

ANGLIA RUSKIN UNIVERSITY

Supply Chain Risk Management:

A Case Study of Maritime Firms in the Kingdom of Saudi Arabia

Basim I Aljabhan

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To my lovely wife, Israa Hakeem

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ABSTRACT

This thesis examined the management of supply chain risks in the maritime transport industry in the Kingdom of Saudi Arabia. Supply Chain Risk Management (SCRM) has quickly become of critical importance to the world economy. Though the transport of oil from this region impacts the economies of countries around the world, it has received too little attention from the academic community. This thesis focused on expanding the field of SCRM by examining how various risk assessment and management concepts and practices are understood, interpreted and implemented throughout the region.

The majority of existing supply chain management and risk management models have been developed and are currently rooted in the US and Europe. Therefore, this thesis is of high significance because its major aim was to explore these concepts and models, namely one focused on the Middle East. This approach allowed the thesis to examine and test certain factors associated with SCRM, such as risk categories, risk assessment and risk strategies, in maritime firms in Saudi Arabia. The thesis thereby offers insights that were not otherwise available in prior research. In achieving these aims, the researcher addressed three key research questions.

The thesis was conducted by relying on the constructivist approach to data collection. The specific qualitative methodology of the case study was employed to collect a wide variety of useful and reliable data, including interviews, focus groups, direct observation and historical records.

The research model included all risks present in the maritime industry in Saudi Arabia. These risks were classified in a meaningful way to be addressed and explained in this thesis. The findings of this study revealed the strategies that could be used in order to deal with potential risks. It also exposed the reality of the situation to professionals involved in risk management decisions in the maritime industry who currently view their companies' risks management processes as efficient. Finally, the research model was found applicable to the maritime firms. The conceptual model for SCRM in this thesis was a combination

of four sections that helped the researcher to discover, identify, evaluate and present techniques to reduce supply chain risk.

This thesis provides insights into the management of maritime firms risks in supply chains. The thesis provides a new classification of risk in terms of the maritime industry. It finds the tools that could help maritime firms to identify risk. And it provides the strategies that are suitable to confront risk in maritime industry.

On the whole, there was no studies found that had researched supply chain risk management in terms of maritime industry at Kingdom of Saudi Arabia. Therefore, the research of supply chain risk management using this revealed methodology is an approach to understand the risks that currently confront maritime industry.

Keywords

Supply chain risk management, Kingdom of Saudi Arabia, Maritime industry.

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Author's Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

SIGNED:

DATE:.....

CHAPTER ONE: INTRODUCTION

1.1 Background of the research

Supply chain management (SCM) has proven to be an important enabler of key business functions in some of the world's most important and lucrative industries. Among these key functions is the realisation of competitive advantages and common benefits such as major cost reductions, reduction in delivery times, improvement in efficiency and profitability, all of which can be obtained through effective governance and a more collaborative chain of activities (Li *et al.*, 2006). The advantages as cited here, however, also constitute sources of potential risk: the sum of all the environmental and external market trends and factors, such as customer demands, increasing competition, increased complexity of products/services and a shorter product life cycle, all push an organisation to seek more flexible, efficient, integrated, innovative and operational mechanisms for launching and managing a supply chain of activities that may, paradoxically, result in unanticipated negative consequences (Roberts, 2001; Agrell *et al.*, 2004; Norrman and Jansson, 2004; Park *et al.*, 2010; Lockamy and McCormack, 2010). As noted by Tang (2006), the increasing use of outsourcing by suppliers and the proliferation of variety in products has greatly increased the risks of supply chain management in recent years.

Supply chain risk management (henceforth SCRM) is a rapidly growing area of research in a number of diverse fields such as engineering, management and logistics. At the same time, there is "growing appreciation for supply chain risk by practitioners and by researchers" (Sodhi, Son and Tang, 2011). In addition, the volatility of consumer markets and business cycles, natural and man-made disasters as well as various kinds of political and health risks all put a degree of strain on supply chain management that can be extremely difficult for companies to master. To understand these risks better, and to identify ways of mitigating them, further empirical research is necessary. Yet, evidence of these risks in empirical research remains relatively rare in the literature, and the coverage of these risks by researchers is still somewhat fragmented.

This thesis confronts this challenge in this nascent and dynamic area of research by presenting not only a sample of the diversity of views on SCM risk in the literature but also – and primarily – the risks as experienced and addressed in an under-researched context: the maritime transport industry in the Kingdom of Saudi Arabia. The industry is clearly of pivotal and global importance for both the country and its trading partners (Savsar, 1998). Drawing upon a qualitative approach, the research aims to elucidate the nature of the risks in SCM faced by maritime transport firms in Saudi Arabia and to analyse critically, through an empirical study drawing upon five maritime firms and fifteen semi-structured interviews with experts in the purchasing, logistics and distribution units, the risks faced by these firms and the methods used to address them. Several key conceptual frameworks are also presented in the thesis as viable ways to analyse and assess data.

1.2 Research aims and objectives

Based on the above discussion, this thesis aims to understand in more depth and detail the SCRM environment and strategies of the maritime sector in Saudi Arabia *as perceived and experienced by managers directly working in these companies*. The thesis aims to establish research links between current SCRM and the maritime industry in Saudi Arabia. It also aims to determine the impact of supply chain risks due to disruptions. The research examines existing theory in SCRM and explores the application of SCRM in Saudi Arabia. Therefore, models are tested and explored for their validity in this context. This analysis identifies the risks Saudi Arabian firms face and the strategies they currently adopt to manage them. The research then identifies whether risk management strategies in this context can be improved and strengthened using the current theories and models. The research encourages supply chain managers, logistics managers, operation manager and distribution managers to take proactive measures for mitigating supply chain risks based on their behavioural understanding.

Three key questions drive this study:

- How do maritime firms in Saudi Arabia face supply chain risk?
- How can managers find and identify supply chain risks?
- How can risk strategies help to minimise or eliminate supply chain risk?

These questions, it must be emphasised, are addressed through the perceptions of respondents working in maritime companies. It is not the aim of this thesis to provide positivistic and factual answers to these questions. Instead, this thesis aims to fill a gap in knowledge in the field by researching how stakeholders in the maritime industry in Saudi Arabia actually feel about supply chain risks as the stakeholders understand these risks through doing their jobs every day in a challenging environment. This kind of research is, therefore, an innovative contribution to the field.

1.3 The research justification

The aim of this thesis, as identified above, is to investigate the matters that enclosing the identification of vulnerabilities throughout maritime industry design and SCRM. The exploration purpose for the business collaborators is to improve an implement in order to enable the vulnerabilities identification in maritime firms in Saudi Arabia and assists in determining interventions to improve supply chain risk environment. The aim is defined above; this section focuses on justification and provides an essential contribution to the academic field of SCRM and to the Saudi Arabian business area. The following reasons clarify why SCRM, Saudi Arabia and the maritime industry are of significance and how this thesis can contribute to areas of study on all three topics:

- Risk management and supply chain studies provide information about the administration and management of different businesses and organisations. Understanding SCRM is very important, as it covers a wide range of fields including accounting, economics, finances, international business, organisational behaviour, marketing, strategy and operations management. By becoming proficient in this one subject it is possible to

gain insight into a wide span of fields. Knowledge of SCRM brings with it awareness of the modern models and methods used to run a successful business.

- Decision-making power is also a benefit of studying SCRM (Xia and Chen, 2011). Developing decision-making power in risk management in the maritime industry in Saudi Arabia is likely to lead to more efficient management of business. With new decision-making skills, businesses would be boosted to an upper level and begin to generate more revenue.
- There is a knowledge gap that needs to be academically fulfilled in SCRM and maritime industry in the kingdom of Saudi Arabia. And that offers knowledge from the different grounds of risk identification, risk assessment, supply chain management and the application of the perspective of the maritime industry in Saudi Arabia.
- The thesis studies each level in maritime firms to identify the risk causes and the effects of the risks. The thesis thereby gives a clear and deep understanding of risk in every aspect of the maritime industry in Saudi Arabia.
- The thesis improves the understanding of the potential risks that maritime firms may face and states how maritime firms can strengthen themselves by applying the applicable strategies.
- The thesis offers information that may be of use to researchers in the same subject. In other words, the study can be applied in other countries, particularly those in the Middle East, that have a similar business environment.
- Saudi Arabia is a country with no further research done in different levels of its market, especially in the maritime industry. Therefore, the paper offers a resource for those who are interested in or who want to invest in the Saudi Arabian market.
- Risk management has been studied in the context of Saudi Arabia, but not

specifically in the area of the maritime industry and its supply chains (Gehani, 2014).

- Saudi Arabia is a unique context for research in SCRM because of the country's international importance as an oil exporter; further, the maritime industry is of crucial significance in the transportation (and all related logistical and strategic distribution) of oil.
- Saudi Arabia is in the process of carrying out a £30 billion renovation of its infrastructure under the government's current 5-year plan. The country is experiencing substantial growth in its ports and shipping sectors, growth which is being supported by the development of mega infrastructural land and sea projects (Saudi Maritime Congress, 2014).
- The Saudi Port Authority heads up the management of one of the most sizable economies in the region; the organisation handles 95% of the imports and exports into the kingdom. This substantial figure represents around 61% of all the cargo handled by the Gulf Cooperation Council (GCC). In total, the GCC manages 210 Berths in 9 ports (GCC states, 2014). This growth is set to continue, as there are already a number of new mega projects underway and more planned. Among the many projects are the Red Sea Gateway Terminal (RSGT) project, which has a 1.8 million twenty-foot equivalent unit capacity; the Jeddah Islamic Port (JIP), which is currently under expansion and set to increase capacity by 45%; the King Abdullah Economic City (KAEC) – Phase 1 – Sea port (£26 billion), which will open in 2020; MARAFIQ's Yanbu Industrial City – Marine Facilities (£210 million); and Saudi Aramco's Dareen Port Expansion Project (£35 million), which was completed in 2015. There are numerous other projects running alongside these, all of which represent a sizable economic investment (Ministry of Economy, 2014).
- According to the UN World Investment Report 2015, the opening up of the Saudi Arabian economy has prompted greater diversity in domestic and export-orientated investment opportunities. As the Saudi Arabian economy has progressively opened up, the variety of domestic and export-

oriented investment opportunities has expanded. According to the UN World Investment Report 2015, Saudi Arabia's FDI inflow in 2014 stood at £18.4 billion, constituting more than half of the £32.3 billion FDI recorded for the entire GCC region (Unctad , 2015).

- In order to realise its ambitious plans, Saudi Arabia will require innovative and equally ambitious solutions. Current projects and investment plans sit at around £45 billion, and over a third of the GCC rail budget is set to upgrade existing lines and develop new rail networks before 2030. Due to the size of the country and to its range of geographical features, Saudi Arabia is set to face a unique set of financing, logistical and engineering challenges (GCC states, 2014).

Further complicating the research picture is the fact that much of the literature on SCRM is dominated by Western models, empirical evidence and frameworks. Yet, as emerging economies such as China, India, Indonesia, Nigeria, Brazil and Turkey continue to grow at much faster rates than Western economies, trade and exports between the North and South have also shifted. As a result, research gaps in how other parts of the world tackle supply chain risks have emerged as a key area of concern for scholars.

1.4 Methodology

The study discusses the methodological approach to the SCRM environment and strategies of the maritime sector in Saudi Arabia. It's a qualitative case study design. It also includes a discussion of the study's data collection strategy and information about the study's confidentiality and anonymity. Interviews and focus groups are used to be the most appropriate method of data collection to gather valid and reliable data. Then, the study discusses the data collection and analysis processes, along with the problems faced during data collection.

1.5 Thesis structure

This section reviews the chapter-by-chapter structure of the thesis, which progresses by identifying the research gap, outlining the development of the research, validating the results and drawing conclusions, as depicted in figure 1.

Chapter One has given a brief background for the research context, defined the aims and objectives of the research, provided a justification for the study and summarized the methodology. Also, It is necessary to cover the research context to gain a better understanding of supply chain risk in order to discuss the main subject: Supply Chain Risk Management (SCRM).

Chapter Two presents facts and information about Saudi Arabia. It delivers the essential knowledge about Saudi Arabia relating to policies, economy and business environment to understanding the thesis. Furthermore, the chapter outlines the Saudi Arabian business environment by detailing some major business policies and regulations in Saudi Arabia.

Chapter Three presents a critical literature review of SCRM to provide insight into the status quo of current research. The focus is on the differences between the types of supply chain risks. Furthermore, the chapter gives insight into the industry factors and evaluations of SCRM. The chapter also critically reviews the central areas of SCRM literature in order to lay the foundations of knowledge on which this thesis is based.

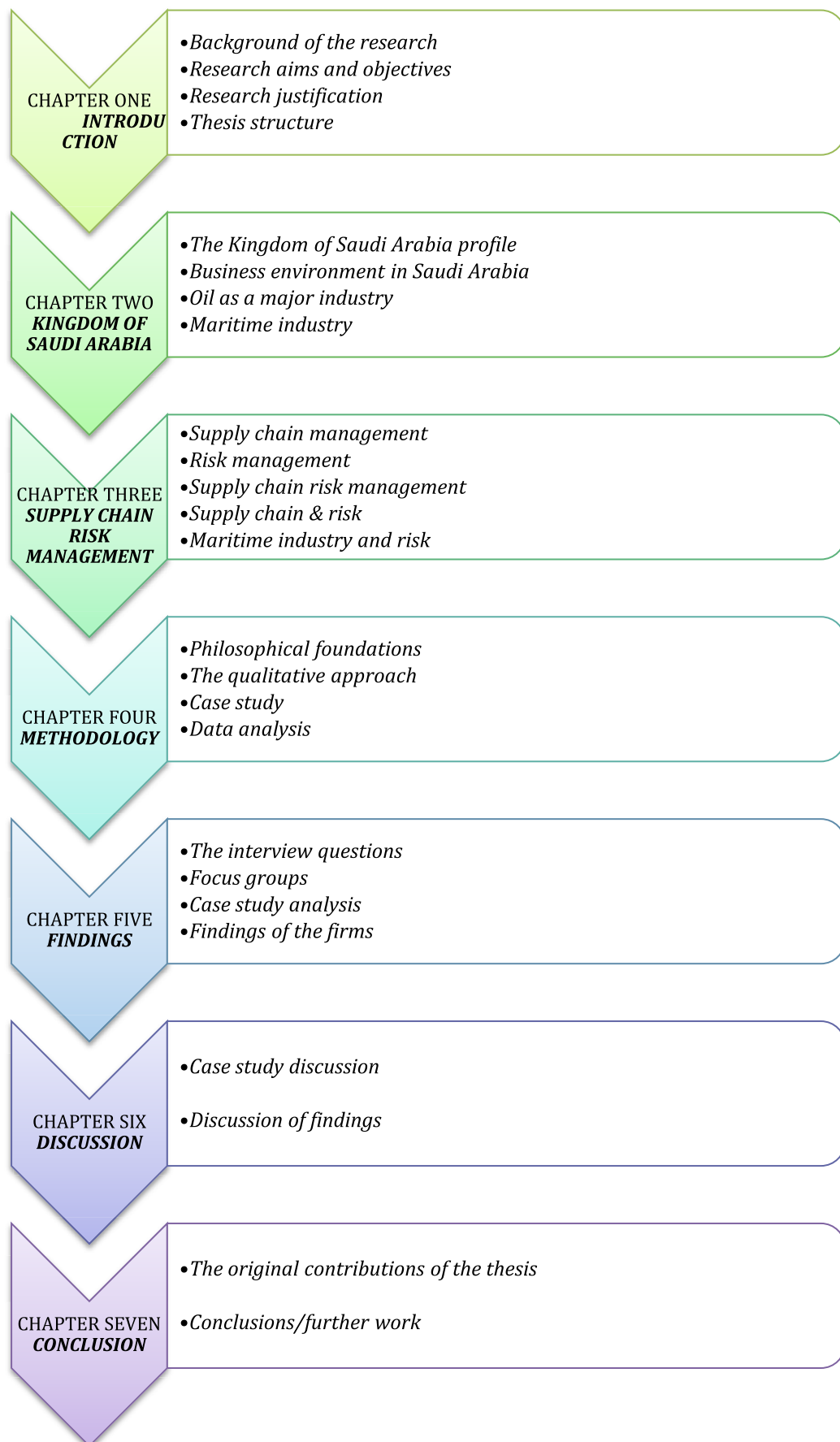
Chapter Four presents the sources and the methodology of this study. The chapter states the philosophical orientation and appropriate methods used to address the study's research questions. In addition, it addresses the frameworks for collecting and analysing the data.

Chapter Five addresses the case study findings from the interviewees and focus groups.

Chapter Six provides the discussion of the findings. This chapter also attempts to answer the research questions using the information and results presented in the above chapters.

Chapter Seven presents the conclusion, summarises the conclusions of the study, and states several points for further research.

Figure 1: Thesis structure



1.6 Chapter summary

This chapter presented an overview of the study, providing the background of the research, the research aims and objectives, an explanation of the research's importance, the methodology and finally the outline of the thesis. The next chapter overviews Saudi Arabia and its business environment.

CHAPTER TWO: THE KINGDOM OF SAUDI ARABIA

2.1 Introduction

This chapter delivers a general overview of the Kingdom of Saudi Arabia. It describes the establishment of Saudi Arabia as well as key facts and knowledge about the country's geography, government and economy. The chapter then describes the Saudi Arabian business environment by defining some of the main business policies and regulations in Saudi Arabia. Finally, the chapter describes the maritime industry in Saudi Arabia.

2.2 Profile of Saudi Arabia

The modern Kingdom of Saudi Arabia was founded by King Abdul-Aziz AL SAUD on September 23, 1932, which is commemorated as the country's National Day.

2.2.1 Facts and knowledge

This section displays some valuable facts and information about Saudi Arabia that could be considered. As a modern-day Saudi Arabia, King Salman bin Abdul-Aziz Al-Saud is the head of government, the Crown Prince is Muhammad bin Nayef Al-Saud and the Deputy Crown Prince is Mohammad bin Salman Al-Saud (The royal embassy of Saudi Arabia, 2015). The Kingdom Saudi Arabia had a population of 4 million people in 1960. In 2015, the most recent census, the population was recorded at 31.5 million people, which is a massive rise in the last 50 years. The majority of the population is young. The capital is Riyadh, however, there are other major cities such as Jeddah and Dammam. Also, there are two holy cities in Saudi Arabia, Makkah and Madinah (CIA Factbook, 2015). There are more valuable information presented as the following:

- **Language:** Arabic
- **Religion:** Islam, Still there are about 1,500,000 Christian in Saudi Arabia. They are allowed to enter the country as foreign workers for temporary work (Elliott House, 2013)

- **Currency:** Saudi Riyal (SR) pegged to British Pound (£1 = SR5.5); bank notes, in Arabic and English, in denominations of 1, 5, 10, 20, 50, 100, 200 and 500 riyals; coins in denominations of 5,10, 25, 50 and 100 halalas (100 halalas = 1Riyal) (Ministry of Finance, 2015).
- **The Gross Domestic Product (GDP):** £571.6 billion (2013)
- **Electricity:** 110v and 220v (60 cycles, 2 pin)
- **Weights and Measures:** Metric
- **Measure of Time:** Hejira Lunar Calendar.
- **Time:** Greenwich Mean Time plus three (GMT+3)
- **Important Dates:** Ramadan (The Holy Month of Fasting), Eid Al-Fitr (End of Ramadan) and Eid Al-Adha (festival of the sacrifice) (The royal embassy of Saudi Arabia, 2014).

2.2.2 The geography of Saudi Arabia

Saudi Arabia, the largest of all the Arabian Peninsula countries, is located in the Arabian Peninsula in South West Asia, which is the so-called Middle East. The Saudi government's estimate of the country's size is at 2,149,690 square kilometres (Stokes, 2009). In the eastern part of Saudi Arabia is a plateau that starts in the North at the Nafud Desert and ends in the South in the RUB AL-KHALI (Empty Quarter), which is considered as the largest sand desert in the world. To the West of this plateau is the Najd area, which is the heart of the country. In the West, a chain of mountains called the AL-Sarawat Range runs parallel to the Red Sea and is separated from it by the Tehama coastline. In the South is Asir Province, which is located at the southern part of the AL-Sarawat Range. Seven countries and three bodies of water bound Saudi Arabia (Saudi geological survey, 2011). The country's boundaries are as follows: Kuwait to the northeast, Iraq and Jordan to the north and the north-west; to the east, the Arabian Gulf, Bahrain, Qatar and the United Arab Emirates; to the south, the

Sultanate of Oman and the Republic of Yemen; and to the west, the Red Sea and the Gulf of Aqaba (SBM, 2006).

The Red Sea basin is considered as one of the youngest oceans in the world. It is created by the tectonic plates of Africa and Arabia and is home to heavy-metal deposits locked up inside hot brines. The Arabian Gulf basin is the richest region of the world in terms of hydrocarbon resources as well. These seas occupy a large space of Saudi Arabia's map and benefit the country's maritime industry (Royal Embassy of Saudi Arabia, 2014).

2.2.3 The government of Saudi Arabia

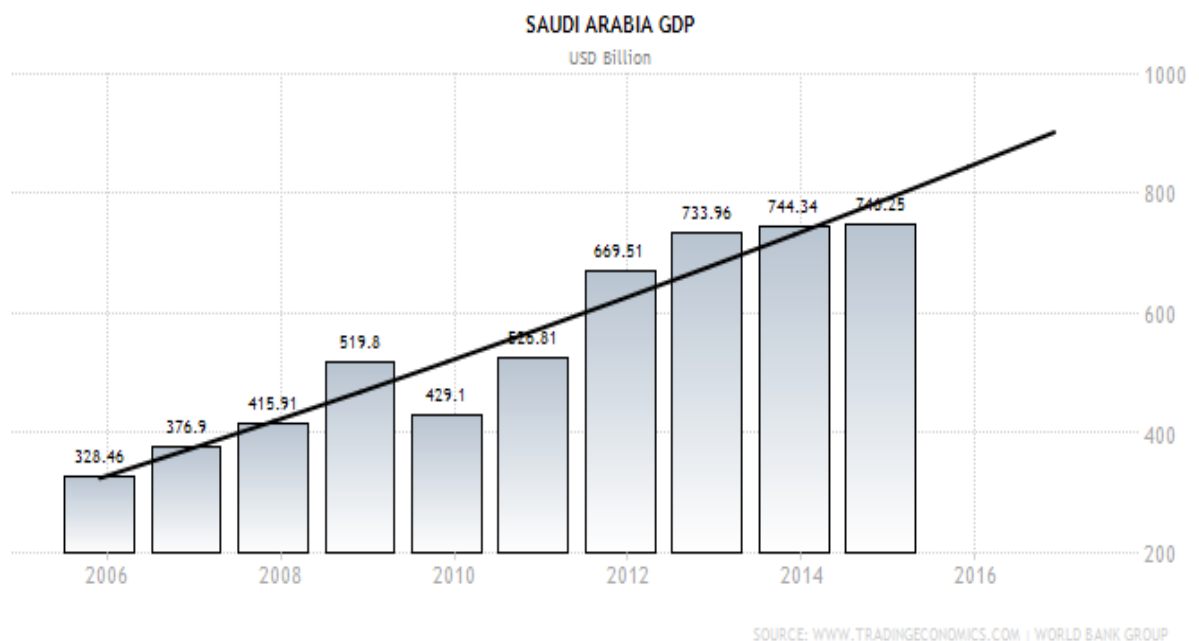
In Saudi Arabia, the King heads the government and is also the commander in chief of the military. The King has the right to select a Crown Prince and Deputy Crown Prince in order to assist him with the country. Saudi Arabia has one source for all laws and regulations in the country: Islamic law (Shari'ah). Islamic law is the pillar of the basic system of government too (Cavendish, 2007). The government of Saudi Arabia is ruled by Islamic law and contains three main divisions: The Council of Ministers (CoM), the Consultative Assembly (CA) (Majlis Al-Shura) and the Provincial System (PS). The CoM is comprised of over 31 ministries, 23 ministers and 7 ministers of state; all members of this council are appointed by royal decree. The separate ministries within it are tasked with different roles such as transport, education, etc. The CA is comprised of 150 members, again appointed by the King, and they have the power to propose laws to the King. The CA has limited powers in government and cannot pass or enforce laws, which is a power reserved for the king. The Assembly is based in the Al Yamamah Palace, Riyadh. Furthermore, Saudi Arabia is divided into 13 provinces. Each province has a governor, a deputy governor, and a provincial council. These councils deliberate on the needs of their province, work on the development budget, consider future development plans and monitor ongoing projects (Royal Embassy, 2007). The Ministry of Transport is responsible for the maritime industry. Saudi Arabia has a well-developed maritime transport network to support the transport of petrochemicals and other cargo. The Saudi Ports

Authority is the port management organisation in the country (Ministry of transport, 2015).

2.2.4 The economy of Saudi Arabia

In a relatively short space of time Saudi Arabia has evolved from a basic agricultural society to a global economic power (Royal Embassy, 2007). Now, the country boasts one of the largest free market economies in the Middle East, accounting for 26% of Arab GDP (Figure 2). This GDP has grown substantially from £4.19 billion (1968) to £530 billion (2014) and represents 1.2% of the world economy (Trading Economics, 2014).

Figure 2: Saudi Arabia's GDP



Source: www.tradingeconomics.com

Saudi's growth is set to remain strong as its domestic market continues to expand (3.8% annual population growth), and its unique access to Europe, Africa and Asia ensures strong international links. On top of this geographical advantage the country enjoys a solid political relationship with the USA and UK, and is in the process of developing strong links further east (Giunipero and Flint, 2001).

Saudi Arabia is proving to be a tempting economy for foreign investors; its political stability, political relations and investment regulation all contribute to the nation's appeal. Whilst the investment environment is largely ruled by the traditions of liberal and open market private enterprise policies, there are no restrictions on the repatriation of capital and profits (CIA Factbook, 2015). The Saudi government allows companies to carry forward losses indefinitely – effectively relieving businesses of their tax burden until they become profitable. The government has also worked hard to adjust the nation in order to make it suitable for World Trade Organization (WTO) membership, which it was granted in 2005. This membership has proved hugely beneficial for the nation, bringing with it access to global markets and more foreign investors (Royal Embassy, 2014). In 2014 the WTO recognised that Saudi Arabia had maintained acceptable standards for the WTO agreement and that the country now operates a free market economy. In an attempt to grow all aspects of the nation, Saudi Arabia has inspired investment in almost all its economic sectors, with priority given to transportation, education, health, information and communications technology, life sciences and energy. On top of this, four “Economic Cities” are in various stages of development; these cities are housed in different regions and focus on particular industries (e.g. Information Technology). In combination with this, Saudi Arabia boasts a sound infrastructure, a well-regulated banking system and a large domestic market of over 31 million people. For all of these reasons the nation is proving to be an attractive investment prospect and a magnet for international money (OECD, 2014).

The Saudi Arabian General Investment Authority (SAGIA) provides information and assistance to foreign investors and fosters investment opportunities. Its duties include formulating government policies regarding investment activities, proposing plans and regulations to enhance the investment climate in the country and evaluating and licensing investment proposals (Ministry of finance, 2014). Foreign investors are no longer required to take local partners in many sectors and may own real estate for company activities. They are allowed to transfer money from their enterprises outside of the country and can sponsor foreign employees. Saudi Arabia's economy continues to expand at a healthy pace, with

real GDP growth of 3.8% for CY20 14, and inflation standing at a moderate 2.7% at the end of 2014 (OECD, 2014).

Oil revenues through Saudi Aramco accounted for 87% of the Saudi Arabian government's total export revenue in 2014. Notwithstanding the downturn in oil prices beginning in mid-2014, the Saudi government is committed to maintaining high levels of government spending and investment, particularly in health care, education, transportation/infrastructure, and housing (Bureau of Economic and Business Affairs, 2001).

Saudi Arabia also offers numerous business opportunities to international firms. Culpan (1985) and Rossides (1994) have mentioned that high power of purchasing (one-fifth of the world's proven oil reserves), the heavy economy and high consumer demand (sizeable and fast-growing population) are considerable goals for international firms. These opportunities have brought many maritime global firms such as Maersk Line, SDV, MOL, Mediterran Shipping Company and more. However, these firms have helped in developing and improving Saudi Arabian industries especially the maritime industry.

2.3 The business environment in Saudi Arabia

Saudi Arabia has been recording trade surpluses since 1968 due to shipments of oil (87% of total exports) (Ministry of trade, 2014). Its main imports are machinery, mechanical appliances, electrical equipment, transport equipment and base metals. Its main trading partners are the United States (14% exports, 12.6% imports), China (12% exports, 13% imports) and Japan (13% exports, 6% imports). The country also boasts strong trade links with South Korea, the UAE, India and Germany. In Saudi Arabia there are 1,805,875 firms registered with the Ministry of Commerce, divided among small (around 1.7 million firms), medium (24297 firms) and large (3780 firms) firms. 85% of these firms operate in the private sector, and 15% operate in the government sector (CDSI, 2015). Saudi Arabia uses oil revenues to help build the country's infrastructure and to increase the import of commodities and general goods (Ministry of trade, 2014).

For the investor, there are compelling reasons to invest in strategic sectors in Saudi Arabia. The comparative advantages are high. It is the hub of oil-extraction and related industries in the heart of the Middle East and North Africa, with a population of nearly 400 million (SAGIA, 2014). Moreover, Saudi Arabia is a member of the G20 (a forum of the world largest national economies), and is the leading economy in the Middle East and North Africa. It is, moreover, the 11th richest out of all 181 countries in the world, ranking very highly in ease of doing business and for its investor-friendly tax and business rates (Business Practice Performance, 2010) issued by the International Finance Corporation (IFC), an affiliate of the World Bank.

Saudi Arabia is considered to be the largest free economic market in the Middle East. Saudi Arabia accounts for 25% of the total GDP of the Arab states, and it has the largest oil reserves in the world (SAGIA, 2014). It is the hub of energy reserves for mega-projects in mining, oil extraction and shipping. Moreover, the Saudi Arabian market boasts high purchasing power. Furthermore, the Saudi Riyal is one of the most stable currencies in the world, with no significant change in its rate of exchange over the last three decades. There are no restrictions on the foreign currency exchanges, or on the capital and profits remittances abroad. Inflation rates in Saudi Arabia are very low, and the government is seeking to sign bilateral agreements with a number of countries to promote and protect capital investments and to prevent double taxation (Ministry of commerce and industry, 2013). As the following sections show, because Saudi Arabia is a key market for most countries in the world, business there can take many different forms.

2.3.1 Local manufacture

Saudi Arabia caters to both local and international markets. Local manufacture and supply is one business approach in Saudi Arabia, where goods and services may be provided directly to local customers. On a more international scale, Saudi Arabia produces goods locally and then distributes them internationally to global markets (Royal Embassy, 2007).

2.3.2 Commercial agents

An area of the economy with noted growth is the number of registered commercial agents, which increased by 30% in 2009–2010. This increase is due to the fact that foreign investors have identified foreign investment as a way to penetrate the market without having to establish a direct presence in the nation. (Ministry of commerce and industry, 2013).

2.3.3 Franchises

In 1992 Saudi Arabia established a franchise law with a substantial amount of inbuilt flexibility. The law is more flexible than commercial agency agreements because the parties are permitted to negotiate their own franchise agreement and do not necessarily have to follow the model provided by the government (Ramady, 2005).

2.3.4 Branch offices

A branch office is a location other than the main office where business is conducted. Most branch offices are comprised of smaller divisions of different aspects of the company such as human resources, marketing, accounting, etc. Branch offices are restricted to an administrative role and do not engage in trading activities. A branch office is useful as a liaison presence (Ministry of commerce and industry, 2013). Saudi Arabia government could help and ease the investors to establish branches.

2.3.5 Government contracting in Saudi Arabia

A great deal of business in Saudi Arabia involves government contracting for both local and foreign companies. Generally, contracts with the Saudi Government are controlled by the Saudi Tender Regulations. To be successful, both local and foreign companies must closely observe the rules for bidding on and fulfilling government contracts (Rice, 2003).

2.3.6 The Saudi society and business corruption

Ali, (2009) shows the society in Saudi Arabia is greatly personalized. Friendship, kinship, regionalism, and communal relationships are substantially effective on actions and behaviour in Saudi Arabia. He also remarks that relationships evolve around the personal-tribal network. Despite the erosion of tribal organisations, individuals take great pride in keeping up their tribal traditions, divisions, and Bedouin heritage. The Muslim faith is of great significance in Saudi Arabians' lives. "Large power distance and uncertainty avoidance are the predominant characteristics for this region. This indicates that it is expected and accepted that leaders separate themselves from the group and issue complete and specific directives." (Hofstede, 2015). Furthermore, the study indicates that Saudi Arabia's society is expressed in a close long-term commitment to the 'group'. Group could be family, extended family or extended relationships and strong friendships. Hence, loyalty in this culture is dominant and overrides most other societal rules. People, in Saudi Arabia, exhibit a huge respect for their traditions, a relatively small propensity to save for the future, and a focus on achieving quick results (Hofstede, 2015). This society influences the way business is conducted in Saudi Arabia. For example, the societal norms manifest in the following characteristics of Saudi Arabian business etiquette:

- Decisions are made slowly.
- The society is extremely bureaucratic. Most decisions require several layers of approval. It takes several visits to accomplish simple tasks.
- Saudis are tough negotiators.
- Business is hierarchical. Decisions are made by the highest-ranking person.
- Decisions are easily overturned.
- When discussing price, Saudis will often make an initial offer that is extremely low when they are buying. Conversely, when they are selling, their initial offer will be extremely high.
- Compromises are sometimes made if someone's dignity is at stake.
- There is a tendency to avoid giving bad news and to give effusive acceptances, which may only mean 'perhaps' (Kwintessentials, 2010).

Corruption is well known as the misuse of an office for private gain. Bribery, extortion, graft, and embezzlement are just some forms of corruption. In some countries, "corruption is so common that it is as expected as a handshake when ordinary people or businesses deal with government officials" (Rigoglioso, 2007). The Saudi Arabian business climate shows a variety of corruption indications. Because Saudi Arabia's culture is based on loyalty to the 'group', these 'group' or tribe members place the group or tribe interests first in business. Furthermore, the society of Saudi Arabia embraces a large number of non-Saudis. Data issued by the Central Department of Statistics and Information (2015) indicate that Saudi Arabia's total current population stands at 30.7 million, of which 20.7 million are Saudis, constituting 60 per cent of the total population.

2.3.7 A quick overview of SABIC

The Saudi Basic Industries Corporation (SABIC) is a Saudi Arabia based public shareholding company representing 70% of the Saudi stock market and one of the five largest petrochemicals manufacturers in the world (Tadawul, 2014). SABIC maintains long-term relationships with quality suppliers. Many of their suppliers from Europe and North America have been working with the company for decades and are supplying major shares of their production to SABIC. Most of the productions are transport by the sea, therefore, SABIC has have a great influence on maritime industry. All suppliers are being managed by the Department of Supply Management, which is part of the Shared Services Organization (creating lasting value, 2013)

2.3.8 Saudi Arabian customs duties

The Ministry of commerce and industry (2013) states that since 2 January 1988, the following customs duties' rates have been in effect in Saudi Arabia;

- Most of the basic consumer products are duty free, e.g., sugar, rice, tea, unroasted coffee, cardamom, barley, corn, livestock and meat (fresh or frozen).
- Customs duties of 20% are imposed on some imported commodities for the purpose of protecting the national infant industries.

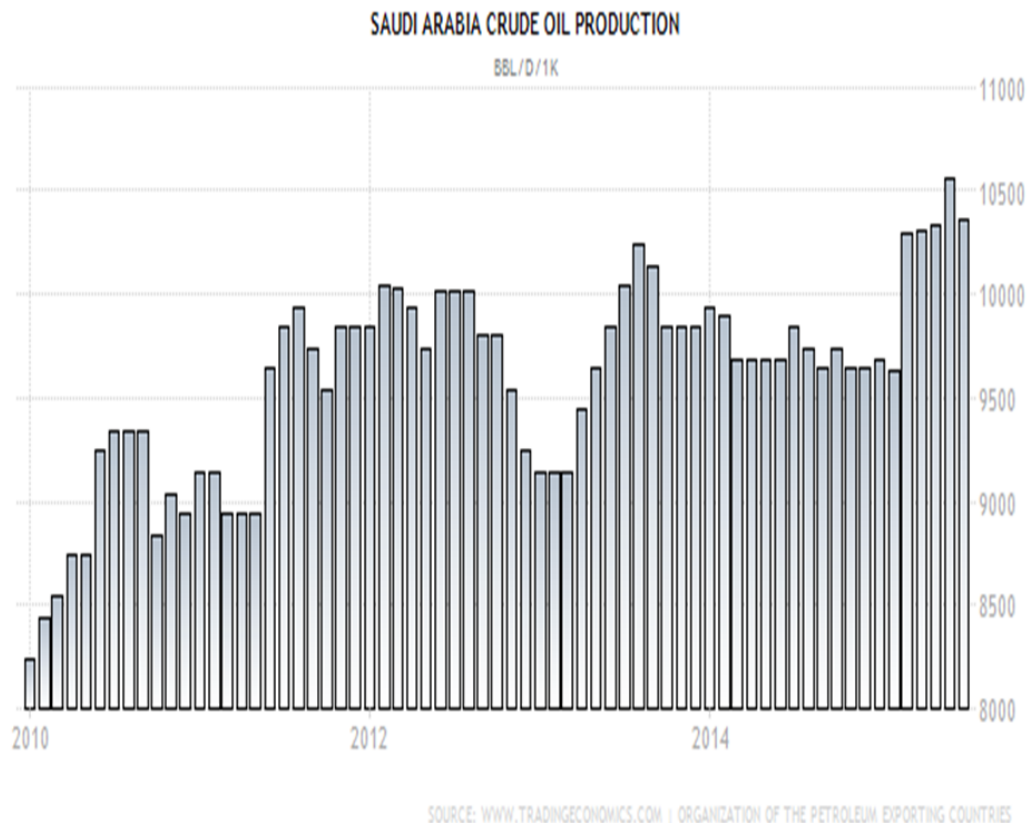
- Import duty on other items is 12% on the c.i.f. (cost, insurance, and freight) value.
- A limited number of items are subject to customs duties calculated on the basis of metric weight or capacity.
- Members of the Arab League who are signatories to the Agreement to Facilitate Trade and Exchange and to Organize Transit between the Arab League States are granted special concessions.
- Imports from the Arab states with which Saudi Arabia has bilateral trade agreements are entitled to further reductions of duty.

Due to these customs duties, international and local firms are greatly considering that Saudi Arabia is a great market with great potential for business. With these customs duties and movement of products, maritime industry is great option for transportation.

2.4 Oil as a major industry

Saudi Arabia has a major impact on energy markets and even on the global economy as a whole, as the country manages the world's largest oil reserves, constituting almost 1/5th of the world's proven oil supply (Nakov and Nun, 2013). The nation's role as the largest producer and exporter of oil in the world gives Saudi Arabia the potential to wield such global economic and political power (Figure 3). In response to this position, Saudi Arabia has pledged to maintain the stability of both the supply and price of oil. Building on this economic position, the country has diversified its economy and today produces and exports industrial goods globally. Furthermore, Saudi Arabia has many other natural resources, such as bauxite, limestone, gypsum, phosphate and iron. The Mining Sector in Saudi Arabia Report (2008) was a valuable resource for companies interested in learning more about Saudi Arabia's growing mining industry; the report found about £1 trillion worth of investment opportunities would be made by 2020 (U.S.-Saudi Arabian Business Council, 2012). Petroleum is an integral part of the Saudi Arabian economy; Saudi Arabia is the world's largest producer and exporter of oil. However, in recent decades the country has increasingly diversified its economy, and today it produces and exports a variety of industrial goods all over the globe (Ministry of Petroleum and Mineral Resources, 2014).

Figure 3: Saudi Arabia's Crude Oil Production



Source: www.tradingeconomics.com

DEAVER (2013) showed that Saudi Arabian economy relies heavily on the enormous oil and gas reserves stumbled upon during a search for fresh water aquifers that took place less than a decade after the country was founded. Saudi Arabia is considered as a relatively young country with a history of only about 80 years. A royal family still governs the country, and a conservative party of Sunni Islam continues to define Saudi Arabian culture.

Although the Saudi Arabian command economy is petroleum based, roughly 75% of budget revenues and 90% of export earnings come from the oil industry (Global Tender, 2014). Saudi Arabia is one of the world's fastest growing countries, with a per capita income of £12,700 (Asefeso, 2012). This income is set to increase in the coming years as investment primes the economy for further growth. The previously mentioned Economic Cities, such as the King Abdullah Economic City and the Prince Abdulaziz bin Musaid Economic City, intended for completion in 2020, are expected to promote economic diversification and, in

turn, increase the income of Saudi's citizens. The cities are spread around Saudi Arabia in order to promote economic diversification for each region. In total, the cities are anticipated to contribute £106.2 billion to the GDP by 2020 (OECD, 2014).

Saudi's largest oil fields are located in the Eastern Province; its largest onshore field is situated in Ghawar, and its largest offshore field is at Safaniya in the Arabian Gulf. In total the nation's refineries produce around 8 million barrels of oil per day, and it plans to increase production to around 12 million. Saudi's policies on the production and export of oil and gas have a major impact on the global energy market. Because of this the nation has committed to ensuring stability of supplies and prices (OPEC, 2012), the Saudi government has been fully responsible for Saudi Aramco (The Saudi Arabian Oil Company) since 1988. Saudi Aramco represents the world's largest oil company and specialises in the exploration, production and distribution of crude oil, petrochemicals and natural gas. The company has longstanding links with suppliers in Europe and, indeed, these suppliers provide up to 75% of their production to Saudi Aramco (Study of ARAMCO Value Chain, 2010).

2.5 Industry sectors related to oil

Both the transport and storage industries have grown up alongside the oil industry in Saudi and are among the most significant sectors in the Saudi economy (General authority for statistics, 2014). Transport has proved key to the country's development plans since equipment related to industry, construction, agriculture and oil all need to be moved throughout the country and internationally. Transportation has also been essential in getting the products from point of production to the consumers. Transport also plays an effective role in the distribution of the population in any given country. The prominence of this industry is clear as it accounts for around 10% of non-oil related revenue and 5% of the labour force (Ministry of transport, 2012).

In relation to transport, maritime transport is undoubtedly the cornerstone of economic development in any country; maritime transport is always considered a main economic development pillar. Because of the low costs and high capacity

associated with shipping, the dependence on maritime transport and, in turn, the revenues of hard currency have increased. Around 80% of the world's trade (£10 trillion) is now transported by sea. Thus this study looks at the positive impacts that maritime transport can have for an economy, including decreasing unemployment and development of cities. As maritime projects such as ports, docks and marine companies develop, so too does the infrastructure that surrounds them; cities emerge in order to house the population employed in these industries. With around £21.2 billion invested in maritime transport, Saudi Arabia is currently experiencing exponential growth in its maritime sector, and a number of mega infrastructural land and sea projects are providing the main catalyst for this growth. This development, coupled with the market of the Saudi Port Authority, which handles 61% of the total cargo handled in the Gulf Cooperation Council (GCC states), indicates that Saudi is set to see substantial growth in its maritime economy (MOT, 2015).

The Ports Report (2014) shows that most of the cargo of the maritime transport in that year was liquid cargo – oil and petroleum products, for example, constituted a significant amount of the 90 million tonnes of liquid cargo. Container ships with 65 million tonnes and Dry-cargo (11 million tonnes) have a smaller share. Specialised vessels such as Oil tankers, Bulk carriers, Container ships, Ro/Ro ships (about 3 million tonnes), General cargo ships and other ships have a large share from the structure of maritime transport. Tankers make up the greater part of half the world's fleet, and they are associated with the development of the world oil market (Ports authority, 2014).

2.6 The maritime industry

The maritime transport industry is a part of the global industry involving the transportation of physical goods, commodities, merchandise goods and cargo from the place of their production to their final consumption (Trade Arabia, 2014). This process of transport takes place on land, sea and air and involves a wide variety of vehicles, vessels and other craft especially suited to the type of cargo and the time requirements of the transport. For example, the transport of time-sensitive documents or highly perishable items would be best achieved

using the superior speed of aircraft shipping. However, aircraft are limited in terms of the weight of cargo they can carry, and their cost to carry per ton is the highest among transport options. When transporting bulk cargo or a large volume of goods over long distances, and especially between continents, an ocean transport vessel is often the most economical approach. Tankers and container ships can carry enormous volumes of cargo at a low cost. In addition, ships are not subject to varying road or track conditions in the way that trucks are. Finally, by using the international space of the sea, the transporter is able to circumvent time-consuming border checks and inspections which may be required by overland transport through different countries. Today, merchant shipping via ocean container ships, bulk cargo vessels, and tankers carries over 90% of international trade, making it an essential element in the global economy (Stopford, 2009).

Saudi Arabia is experiencing exponential growth in its ports and maritime sectors with a number of mega infrastructural land and sea projects planned and currently in progress, totalling £30 billion within the government's current five-year plan. Furthermore, the Saudi Ports Authority serves the largest economy in the region, handling 95% of the exports and imports of the country (excluding crude oil). This represents 61% of the total cargo handled in the GCC states, managing 210 Berths distributed between nine commercial and industrial ports.

As the Saudi economy has been progressively opened so too has the variety of domestic and export-oriented investment opportunities. According to the UN World Investment Report 2015, Saudi Arabia's FDI inflow in 2014 stood at £7 billion, more than 41% of the £17.7 billion FDI recorded for the entire GCC region (Trading Economics, 2014).

While the vast majority of ships and goods arrive at port safely and on time, there are still hazards at sea. From mechanical failure to dangerous weather to piracy, there are risks inherent in maritime transport that both the shipping company and the producer or shipper of the goods have to take into account. The allocation of risk in the shipping process is an ancient issue that has evolved into a highly developed contract and insurance system involving specialised

institutions (Burns, 2014). One of the methods for an exporter to limit their exposure to risks arising from maritime transport is to offer the goods 'Free on Board' or 'FOB'. This means that the exporter is responsible for delivering the goods to the dock, loading them onto the vessel and securing them in the hold. The receiver is responsible for the costs involved in bringing the goods from that point into their possession. Normally, the contract with the shipping company will allocate to the maritime shipping company any damage or loss from this point until acceptance by the receiver.

Because of the inherent dangers of the sea and human dangers stemming from piracy or operator error, maritime shipping companies need to have a robust approach to their risk management in all areas of operation. In addition, because of their critical location within the global supply chain, the maritime shipping company's supply chain risk management (SCRM) influences the business of both their upstream and downstream partners. A disruption upstream of the maritime transport company can have far ranging impacts because a delay to a vessel, waiting for a part to replace a failed system, for example, can have catastrophic downstream impacts as the myriad companies waiting for receipt of the goods can face negative consequences in their own operations due to the delay. This thesis explores the nature of risk in the supply chain of maritime firms operating in Saudi Arabia with the goal of deepening the understanding of how these companies understand and approach risk management. Knowing how the companies in the maritime transport business approach risk is critical for other industries because of the dependence of innumerable industries around the world on maritime transport. The central position of maritime shipping within the global economy makes understanding and management of risk in this industry an area of interest and concern inside as well as outside the boundaries of the industry itself.

2.6 Chapter summary

Saudi Arabia has the largest free-market economy in the Middle East and North Africa and, because of the stability of political, economic and investment law, local and foreign companies are encouraged to invest in Saudi Arabia. The government

has issued a number of policies and regulations to control and arrange the market and its relationship with other parties, taking care of the benefits for all parties. This chapter has set the scene for the research study, emphasising the importance of the Saudi Arabian business environment, especially in perspective of the maritime industry. The following chapter explores the existing theory and practice of SCRM.

CHAPTER THREE: SUPPLY CHAIN RISK MANAGEMENT LITERATURE REVIEW

3.1 Introduction

This chapter outlines the methodology employed to write the literature review and the review itself of the literature key to the main aim of the thesis mentioned earlier. The chapter starts with a review of supply chain management (SCM) and risk management, and then reviews supply chain risk management (SCRM). The chapter outlines some of the key issues in SCRM and establishes some of the key research caveats in the field. This chapter critically reviews the central areas of SCRM literature in order to lay the foundations of knowledge upon which this thesis is based. To keep the literature review tractable, this chapter focuses on studies published between 2000 and 2015.

3.2 Literature review approach

The research process of this thesis began with a literature review undertaken in three stages: research areas identification, key strings selection based on hit rates on search engines and core literature identification.

3.2.1 Identification of relevant areas of research

After choosing research zones that would be applicable to the aims of research noted in Chapter One, the researcher identified the relevant keywords that were found in the research zones. Also, an initial search, via University Library Engine, by the term *supply chain risk* driven to further keywords for the main body of thesis. Too, the researcher has chosen many search engines were found then and could be applied in order to identify the key citation indexes for the thesis. Then, The keywords were collected to establish key strings that would be used in the search engines to cite relevant articles.

3.2.2 Key focus areas in the literature review

- Supply chains;
- Supply chain management;
- Supply chains strategy;
- Risk management;
- Supply chain risk management;
- Transportation industry;
- Maritime industry; and
- Saudi Arabian business environment

The study has gathered comprehensive information about SCRM. As a result, the study has explored materials published between 2000 and 2015; the reasons will be mentioned previously. 488 articles and seven books related to SCRM were identified. A comprehensive search revealed 457 journal articles and 31 magazine articles (Table 1).

3.2.3 Keywords

Examples of keywords are *shipping, reliability, risk, resilience, marine, uncertainty, ports, redundancy, Saudi Arabia, maritime, supply chain, complexity, transportation, logistics, strategy and management.*

Table 1: Reference types of the articles

Reference type	Articles
Journal Articles	457
Books	31
Total	488

3.2.4 Search engines

Many databases in the library have been used, such as Science and Business, in order to explore with key strings drawn from the given keywords. The literature search was performed using a variety of electronic databases, including Business Source Premier, Emerald, Academic Onefile (Gale), ProQuest Business Collection, ScienceDirect, Wiley online library and JSTOR. Too, Google Scholar was applied as an open search engine in order to find scholarly articles that might have been ignored from the engines of search that used above. An example of some of the searches is given and could be seen in appendix 2.

This search revealed 29 articles in ScienceDirect, 108 articles in Business Source Premier, 16 articles in Academic Onefile (Gale), 242 articles in ProQuest Business Collection, 3 articles in Wiley online library, 10 articles in JSTOR and 49 articles in Emerald (Table 2).

3.2.5 Selection of studies

The researcher has chosen the articles selection by reading the abstracts of the articles found via the search engines and then reading the articles themselves and summarising this chapter by theme.

Table 2: Number of articles per electronic database

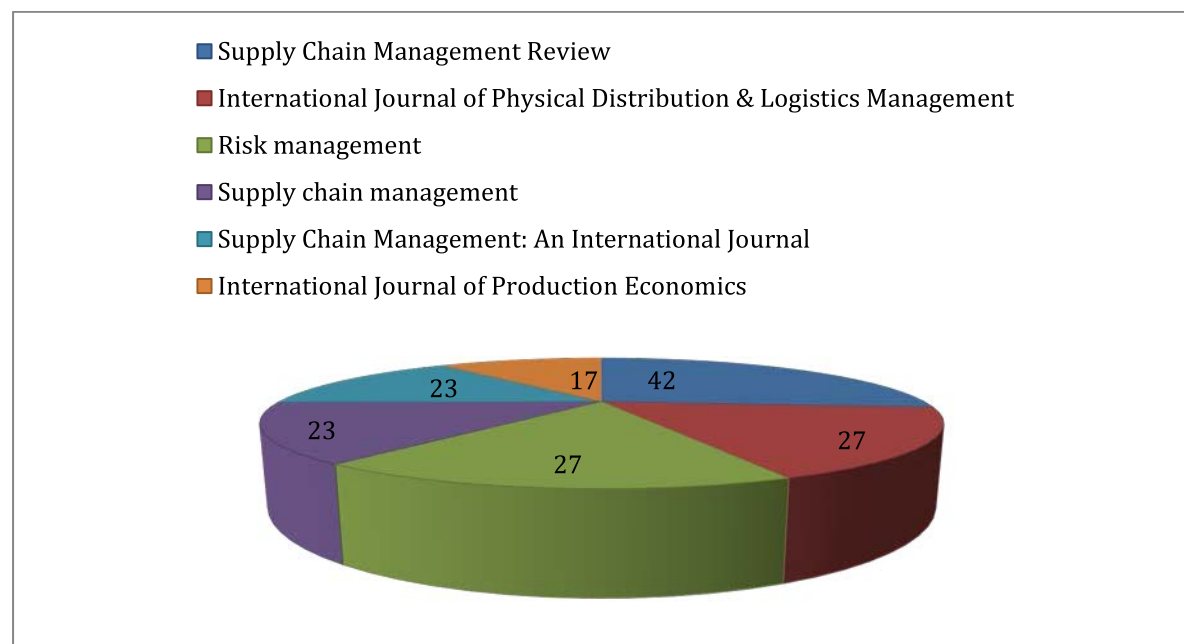
Electronic databases	Articles
Business source premier	108
Academic onefile (Gale)	16
ProQuest Business Collection	242
Sciencedirect	29
JSTOR	10
Wiley online library	3
Emerald	49
Total	457

3.2.6 The classifications

As figure 4 shows, 457 articles identified (from 165 journals across 7 journal databases) were reviewed. Over 34% of the SCRM-related articles were published in the following six journals:

- *Supply Chain Management Review*
- *International Journal of Physical Distribution & Logistics Management*
- *Risk management*
- *Supply chain management*
- *Supply Chain Management: An International Journal*
- *International Journal of Production Economics*

Figure 4: Distribution of articles in journals



Briefly, as shown in figure 5, the number of articles related to SCRM increased steadily over the period 2000–2003 to 20 articles, and then there was a jump in 2004 with more articles published (20 articles). In 2008, there was a huge increase to 45 articles, and in 2012 the number of articles was 45 too, which indicates the high level of interest that many researchers now hold for SCRM. In

2013, the level of interest by researchers was still high with 55 articles. The trend continues in 2014 with another increase at 70 articles, indicating clear continued growth in the interested of researchers regarding the field of SCRM. In 2015, SCRM is still an interesting subject to many researchers with 70 articles.

Figure 5: Number of articles on supply chain risk management from 2000 to 2015

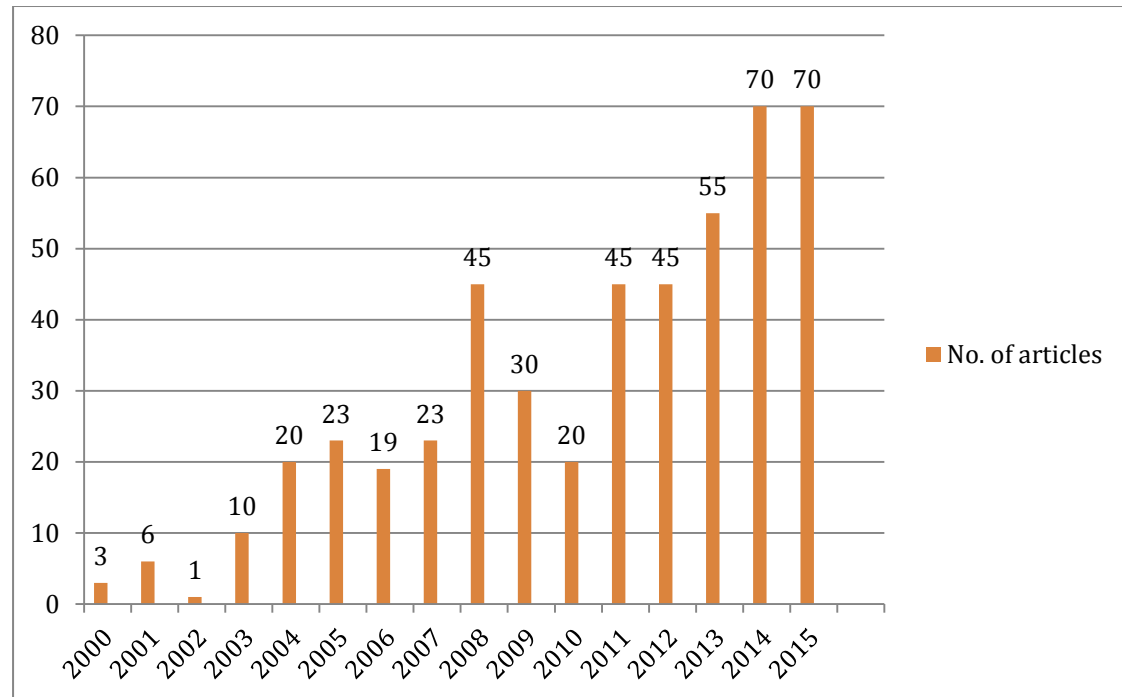
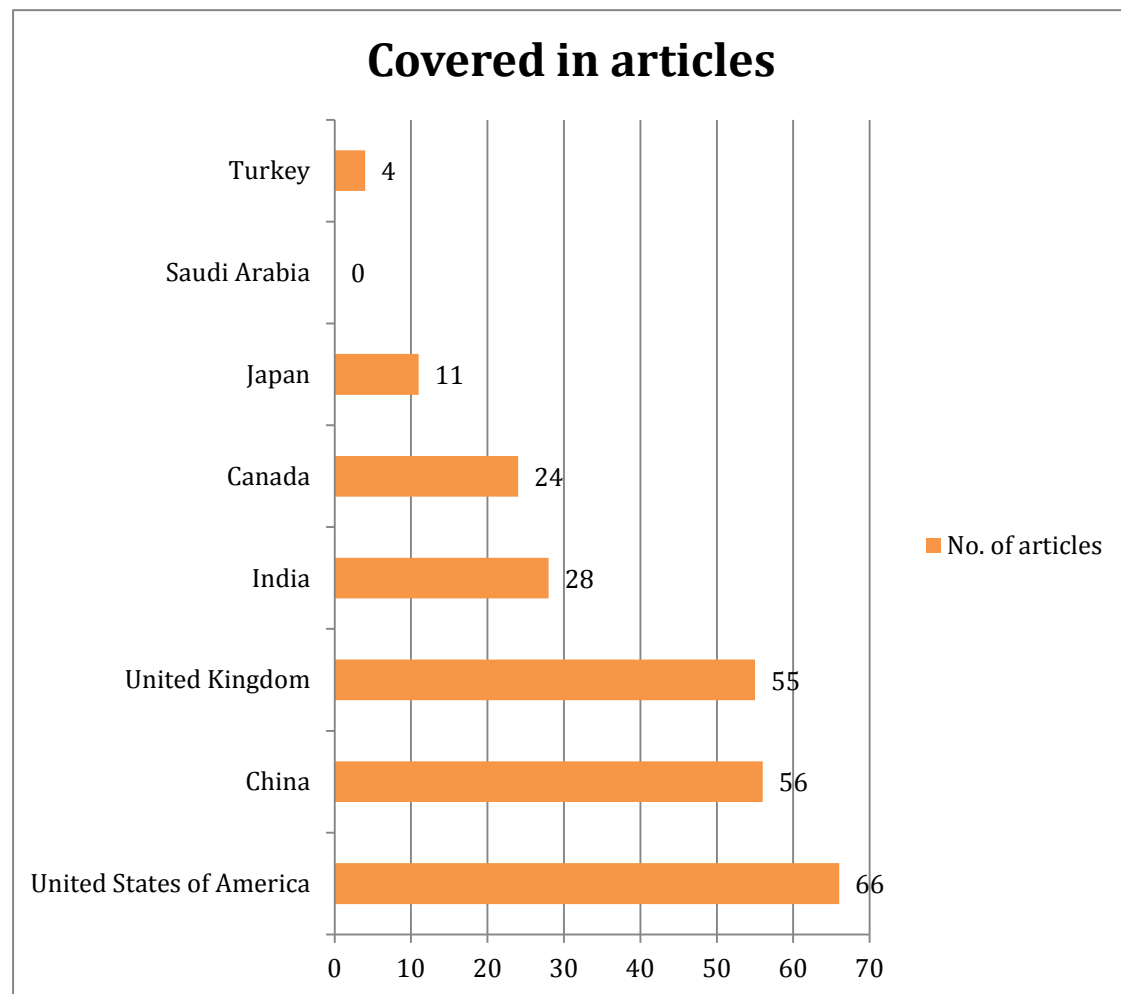


Figure 6: Examples of some countries covered in articles on SCRM



The literature review here shows a broad spread of countries that have been covered in the field of SCRM. However, studies on several major countries dominate the literature: approximately half of all the supply chain risk articles apply to six major countries, namely the USA (66 articles), China (56 articles), India (28), UK (55), Canada (24 articles) and Japan with 11 articles. (see Figure 6).

Notably, very few academic papers have been devoted to the Middle East, including Saudi Arabia. Islamic countries, too, are under-researched in the literature; for example, Turkey is discussed in only four articles (Less than 1% of the entire corpus surveyed here). This detailed study of SCRM in Saudi Arabia thus represents a timely and important opportunity for further empirical research. The research uses existing theory in SCRM and explores its application

in Saudi Arabia. Therefore, models are tested and explored for their validity in this context. This analysis includes identifying the risks Saudi Arabian firms face and the strategies they currently adopt to manage them. The research aims to identify whether risk management strategies can be improved and strengthened using the current theories and models.

As the global economy has become more interconnected, SCRM has become established as a key aspect of strategic planning for firms. This subject impacts almost every part of the product lifecycle, including procurement, the supply of raw and secondary materials, design, manufacturing and distribution. However, despite the fact that production and distribution have been international for decades and that supply chains have long been stretched across continents, a few recent events have sparked a significant upsurge in academic attention in this area. First, there was a major fire in 2000 at a New Mexico company that supplied Ericsson, costing the telecoms company 400 million euros. A year later, the collapse of a major supplier for Land Rover resulted in the loss of 14,000 jobs. Finally, in September of 2001, the attacks on the World Trade Center in New York disrupted supply chains worldwide (Norrman and Jansson, 2004; Paulsson, 2004; Tang, 2006). The confluence of these events spurred an increase in the attention paid to this issue among researchers in the supply chain field.

Despite this increased attention, the literature on risk in the supply chain field is still in the early stages of development. Between 1996 and 2004, the number of articles related to supply chain management and risk increased from one article to 60. While the growth in the field is significant, it is still starting from a fairly small base as recently as ten years ago. This means that there is still a great deal of work to be done both in the theoretical and the applied areas. Although SCRM can draw upon concepts taken from risk management literature in other areas, like finance, economics or organisational behaviour, the particularities of managing supply chains means that these concepts will have to be adapted to this environment. This study is an effort to develop the breadth and depth of the field of SCRM through a focus on an understudied region and on the perceptions of practitioners working in that region of the strategies and concepts that are current in the field.

Within the brief time that researchers have focused on SCRM, the concept of risk has been viewed from a number of different perspectives. While Tomlin (2006) saw supply chain risk in a mathematical sense, other scholars like Giunipero and Eltanway (2004) and Zsidisin and Smith (2005) looked at risk as more of a conceptual construct. Another approach was offered by Gaudenzi and Borghesi (2006), whose concept of supply chain risk was tied to the performance creation process. Despite these works, Neiger *et al.* (2009) argued that risk had yet to be incorporated into an objective business structure within the SCRM field.

This diversity can be viewed as a strength or as a weakness. On the one hand, the myriad concepts show the creativity and energy of the topic of SCRM and offer opportunities for broad exploration. On the other hand, by moving in so many directions at once, the field risks becoming incoherent and losing touch with the practitioners who draw upon these theories to develop their risk management strategies. In order for firms to implement the strategies and concepts developed within the academic realm of SCRM, there needs to be a clear understanding of the definitions of risk in this context. This thesis targets that link between theory and practice by examining the perceptions and understandings of the practitioners of SCRM. In this way, it adds to the field by demonstrating how the theories and strategies that have been developed are understood in a practical setting. With this and other studies, the field can calibrate its focus in terms of theory development.

3.2.7 Geographical focus on USA, China, India, UK and Canada / Lack of attention to Middle East

As mentioned above in the literature review, the number of countries that have been made the subject of studies in SCRM is limited. In fact, about half of the articles that deal with the topic are focused on one of five countries: the USA, China, India, the UK and Canada. These are obviously large and important countries to the world economy, and the companies working in these countries have global reach and draw upon global supply chains. However, this focus on either Anglophone countries or the massive countries of China and India misses others that are both integral to the global economy and culturally distinct from

the countries where the majority of theory creation and strategy development takes place. This leads to an assumption that what works or is understood in one context is applicable generally. This research was designed to test and explore this assumption by looking directly at the perceptions of practitioners involved in maritime industry in a region that is connected to the global economy yet distinct from the countries mentioned above.

The Middle East has received minimal attention from academics in the supply chain risk management field. Islamic countries in general have been largely absent from the literature, despite their large populations and strategic importance. Turkey, despite its historic and present position as a bridge between Europe and the Middle East, has been discussed in only three articles, which is less than 1% of the total number of articles surveyed by this thesis. Saudi Arabia shares a similar fate, despite the fact that it is a key supplier of energy across the world. Saudi Arabian oil has a long and complex supply chain, and the country's position as a major supplier impacts supply chains all over the world, yet it is rarely examined in the context of SCRM.

The geographical and cultural focus of the bulk of the literature on SCRM represents a limitation in the field. While it is probably not a necessity to perform research in every country, it is instructive to explore countries and cultures that are substantial and distinctive because such exploration may offer insights into larger groups. For example, this study of the maritime industry of Saudi Arabia offers insights that can be used to further our understanding of the workings of SCRM in the Middle East generally. In addition, the thesis also allows researchers working in the traditional arenas of the USA, UK, Canada, China or India to check their assumptions and models. By exploring a variety of cultures and regions, the field of SCRM can generate new ideas and cross-pollinate. The goal of this research is not only to question what works in Saudi Arabia, but also to connect with the broader research across the globe as theories and models continue to evolve.

3.3 Supply chain management

The phrase “supply chain management” was first used by Oliver, R. K. and Webber, M. D. in 1982. They offered a study about the difference amongst logistics and SCM from a holistic opinion, and they noted the strategic nature of SCM. Since then, and over the past decade in particular, a considerable body of literature has been established on SCM (Rao and Goldsby, 2009; Jutter, 2005; Khan and Burnes, 2007, Matsuo, 2015). The rapid growth of literature in this area has led to a plethora of definitions, some of which are discussed in detail in a later section of this chapter. A good working definition of SCM must first be established before the risks involved in the process can be authoritatively discussed. Camerinelli (2008, p. 46), the Chief Knowledge Manager and European Director of the Supply Chain Council, defines SCM as follows:

“Supply chain management is a disciplined blend of time-based practices and technologies that supports users in the design, planning, sourcing, manufacture, delivery, service and return of goods, information and funds concerning products and services delivered to end users in the global market.”

This notion of SCM is a productive one to use because it originates from industry, the key arena where risks are played out. Supply chains are formed by linking firms to each other. Therefore, Any unit in the supply chain channel shakes the whole chain would alter. Having a change in supply chain is risk, nonetheless, an unupdated supply chain is also risky (Raj Sinha, Whitman and Malzahn, 2004). Risk in supply chains has arisen as one of the principal research topics in the recent operations and supply chain management (SCM) literature (Narasimhan and Talluri, 2009; Gurnani et al., 2011; Tang et al., 2012). Juttner and Zeigbehnan (2009) noted that the supply chain vulnerability concepts and its managerial counterpart of SCRM still remain investigated. Risks are inherent in SCM and can, therefore, be understood as any factor, or set of factors, that hinder(s), endanger(s) or jeopardise(s) the smooth, sustainable and ethical

delivery of these ‘time-based practices and technologies’ that companies rely on to deliver goods and services to end-users in all corners of the globe.

Businesses today rely upon supply chains that are increasingly diverse and spread out, as businesses now take advantage of differentials in labour costs, tax regimes and proximity to resources and infrastructure. Kozlenkova et al. (2015) noted that Wal-Mart’s Success, which is one of the top companies in the world in terms of sale, is often attributed to its excellent supply chain management. The complexity of modern supply chains necessitates that businesses take an active role in managing all of the elements of the chain to the degree that the businesses are prepared for any issues that may arise with elements that they cannot control. Supply chains are a complex topic and necessarily need to be modelled perfectly (Albores *et al.*, 2007). This process of planning and control is generally referred to as supply chain management (SCM).

SCM is the systematic and strategic coordination of not only the processes inside the individual company, but also the processes across other companies and organisations that influence the supply chain (Simchi-Levi, Kaminsky, and Simchi-Levi, 2007). The goal of SCM is to improve the performance of both the companies involved in the supply chain and the chain itself. SCM goes beyond the oversight and control of supply chain functions to include the design and planning of the chain. These are strategic decisions made at the highest company levels involving the selection of partners, suppliers, transport services and other critical activities. The infrastructure which is put together through the SCM process is designed to maximise the net value of the business process, service or product it supports through efficiency and reliability.

The concept and practice of SCM has received increasing attention amongst business managers, consultants and academicians (Hamister, 2012). While the practice of SCM could, theoretically, be traced back to the trade networks of antiquity, the formal term only came into being very recently. The use of the phrase “supply chain management”, for example, occurred in an interview that Booz Allen Hamilton consultant Keith Oliver gave to the Financial Times (Heckmann, Shorten, and Engel, 2003). The term did not become popular until

the mid-1990s, when it became the subject of numerous books and articles. By the end of the decade, it was becoming a regular feature on resumes and titles. Since then, SCM has continued to be an important part of management literature.

Today, SCM is firmly entrenched as a key component of a business's strategic planning and operational management. Supply chains are seen both as sources of potential disruption and risk as well as opportunities for leveraging certain advantages to increase the value added in upstream and downstream flows of materials, goods and information (Simchi-Levi, Kaminsky, and Simchi-Levi, 2007; Mentzer *et al.*, 2001, Kozlenkova et al. 2015). In contrast to a vision that sees the departments of a company as separate units, SCM requires a total systems view where all the parts of the company integrated, and even the upstream and downstream partners are interrelated parts of a single system (Hines, 2004, p. 76). Every aspect is subject to review with the goal of reducing redundancies and unnecessary costs and improving customer satisfaction at the point of delivery. Some of the elements in a supply chain that are commonly cited as sources of inefficiency include unnecessary handling of materials or products, wait times due to bottlenecks of insufficient throughput at one point in the supply chain and inefficiencies from distances between points on the chain (Simchi-Levi, Kaminsky, and Simchi-Levi, 2007).

The scope of SCM is broader than that of the majority of business activities within a company. Because the supply chain touches on numerous parties outside of the direct control of the company, SCM involves negotiating relationships with numerous stakeholders and partners in addition to managing processes within the company. The Council of Supply Chain Management Professionals, an industry association, describes the scope of their responsibility as encompassing the management and strategic direction of the sourcing and procurement of materials, and the management of logistics including delivery of finished goods (Simchi-Levi, Kaminsky, and Simchi-Levi, 2007; Heckmann, Shorten, and Engel, 2003). SCM is a cooperative and collaborative activity, as many of the players involved are outside of the direct control of the manager. Suppliers, intermediaries, transport and other third-party service providers and customers are all parts of the supply chain operating outside the control of the company.

Because all of the parties involved have an interest in increasing efficiencies along the supply chain, there is generally a spirit of cooperation among the different organisations. In fact, recent developments in supply chain organisation have led to the creation of loose associations of networks of businesses that cooperate along the chain to provide products and services; these associations are referred to as extended enterprises (Heckmann, Shorten and Engel, 2003).

SCM has become more important in recent years as companies have shifted focus away from vertical integration of supply and production and towards a tighter focus on core competencies. This means that the supply is not only raw materials but also many other components are in the hands of other companies. The lack of direct control has the dual impact of increasing the company's efficiency through the supplier firm's focus on that particular function and also of increasing the risk the company faces from a potential delay or interruption on the supply chain (Simchi-Levi, Kaminsky, and Simchi-Levi, 2007). This increased risk necessitates proactive planning and management of the supply chain.

Kozlenkova et al. (2015) noticed that several firms (e.g., Apple, Amazon, Cisco, Coca-Cola, H&M, Intel, Dell, Nike, Proctor & Gamble and Starbucks) attribute at least part of their success to supply chain management. Additionally, the results of a survey conducted in 2013 show that fewer than half of company executives actually recognize SCM as a strategic asset. Those that do will achieve 70 percent higher financial performance on average. In certain industries the results are even more impressive. For example, SCM leaders in the telecom industry achieve 350 percent higher earnings before interest and tax than their lagging peers. SCM leaders in retail and consumer goods companies enjoy inventory turnovers that are over 450 percent higher than those less effective at managing the supply chain (PwC, 2013).

Unlike direct management, SCM involves facilitating communication and collaboration among supply chain partners and creating and sustaining relationships of trust. These relationships and the communication and cooperation among the partners increase the velocity of inventory movement and the efficiency of supply both upstream and downstream.

3.3.1 Supply chain specialisation

The specialisation of the supply chain industry began in the 1980s when transportation brokerages, warehouse management and non-asset-based carriers came into being. Today, specialisation encompasses areas outside of its original field of transportation and logistics, touching parts of supply planning, collaboration, execution and performance management (Lummus and Vokurka, 1999).

Suppliers, logistics providers, locations and customers sometimes force rapid changes as the market shifts and therefore cause disruptions in their capacity as components of supply chain networks. This instability significantly impacts the infrastructure of the global supply chain. The impacts can be felt on all levels of the supply chain, from the most fundamental elements of communication between suppliers, transporters and consumers to the more complicated requirements of managing processes and workflows among the whole network.

In order to improve their overall capacities and abilities, companies often specialise in certain areas of the supply chain. Just like other companies have done in manufacturing and distribution, supply chain specialisation allows companies to focus on specific areas where they can establish competency and increase their efficiency and performance through that focus (Hugos, 2003). In addition, specialisation allows a company to partner with other specialised companies who have improved their own efficiencies, bringing that improved efficiency and expertise on board the supply chain as a whole. These networks of specialised partners can be more efficient than a single vertically integrated system.

The late 1990s saw the advent of outsourced technology hosting for supply chain solutions, since then this process has primarily rooted itself in transportation and collaboration categories. This process has moved through three main models: the 'Application Service Provider' (ASP) model (1998 – 2003), the 'On-Demand'

model (2003 – 2006) and the ‘Software as a Service’ model which is still in focus today (Tomar, 2009).

Building on globalization and specialization, “SCM 2.0” describes both changes within the supply chains themselves and also the development of the processes, methods and tools used to manage them in this new “era”. The ability to connect multiple buyers and suppliers with financial institutions, enabling them to conduct automated supply-chain finance transactions, has been realized through the increasing uptake of collaborative platforms, such as TradeCard’s supply chain collaboration platform (Salecka, 2009).

SCM 2.0 is able to realize continuous flexibility, value and success through its capacity to rapidly deliver results, this inherent agility allows for a diverse and reaction based management of future change. Utilizing competency networks, composed of best-of-breed supply chain expertise, allows for an understanding of which operational and organizational elements deliver results. These results, in turn, can be used, alongside an intimate understanding of how to manage operational and organizational elements, in order to achieve the desired results. Solutions manifest in various forms, including: no-touch via business process outsourcing, mid touch via managed services and software as a service (SaaS), or high-touch in the traditional software deployment model (Tomar, 2009).

In order to implement SCM successfully a shift from managing individual functions to integrating activities into key supply chain processes is required. This technique utilization across departments demonstrates its capacity to revolutionize performance. A purchasing department is able to place orders as its requirements become known and a marketing department is able to communicate with multiple distributors and retailers, in response to their customers demand. It is only through such process integration that an organization can fully leverage the information shared between supply-chain partners (Lambert, 2006).

GUPTA (2011) shows that supply chain business process integration involves collaborative work between buyers and suppliers, joint product development,

common systems, and shared information. How a company operates often has a big impact on their supply chain strategies. Complications for supply chain could be significant as the supply chain is generally spread across multiple geographies and is primarily forecast driven. According to Lambert and Cooper (2000), operating an integrated supply chain requires a continuous information flow. However, in many companies, management has concluded that optimizing product flows cannot be accomplished without implementing a process approach.

3.4 Risk management

The term *risk* carries multiple meanings and a variety of connotations. It takes on slightly different meanings in business than in personal contexts. Business leaders, in particular, understand that risks are a necessary – and sometimes beneficial – part of doing business.

The Royal Society (1992, p. 4) gives a traditional definition of risk as “the chance, in quantitative terms, of a defined hazard occurring. It therefore combines a probabilistic measure of the occurrence of the primary event(s) with a measure of the consequences of that/those event(s).” In contrast, Deloach and Temple (2000) has defined business risk as “the level of exposure to uncertainties that the enterprise must understand and effectively manage as it executes its strategies to achieve its business objectives and create value”.

Risk management is the process-oriented and systematic approach of examining risk and determining how it should be dealt with (Chapman and Ward, 1996, pp. 34-99). Risk management is an approach that allows the individual who is managing the risk to systematically identify any sources of risk and uncertainty in a given project or endeavour, to determine the potential impact of the risk and to develop countermeasures that help mitigate this impact (Juttner, 2005). In other words, it is the method to identify, assess and prioritise risks and followed by the process of coordinating available resources to reduce, monitor and control the likelihood of negative events or outcome. In addition, it is a way to maximise positive outcomes. This process of minimising threats or the possibility of negative events might consist of taking actions that avoid the threat, transferring the threat to a third party and/or accepting the threats as a possibility.

Assessing risk process on a huge business such as a maritime industry, means large number of factors that are involved, could be challenging. Well, process has many phases; identify risks with the greatest likelihood or probability of occurring and entailing the greatest potential loss of resources (Juttner, 2005). These actions or events are addressed first, and those risks with the lowest likelihoods of occurrence and the least associated loss are handled last. Finding potential risks is an essential in risk management; it is only after a risk is identified that it can be addressed.

Research also suggests that risk management is the science of identifying, assessing and prioritising various risks that an individual or an organisation or an industry faces (Hubbard, 2013). Risk management is particularly important because it allows industries, specific companies and entities to approach risk in a structured and organised way in an effort to make managers and other employees aware of the risks that are posed and to make decisions that aim to minimise these risks (Rasmussen, 1997). Many organisations define risks as the effect that uncertainty has on the organisation's objectives and view risk management as the process of identifying, assessing and prioritising the effects of these uncertainties on the organisation's objectives. The way that organisations engage in this process is by coordinating and applying resources at their disposal to control, monitor and/or minimise the impact of negative events on their organisation (Chapman and Ward, 1996). In addition to minimising negative events, risk management might also apply resources in such a way as to maximise the organisations' objectives or deliberately participate in activities with higher risk in an effort to have bigger returns on investment (Hubbard, 2013).

During the process of risk management, all events are classified into two groups: negative events and positive events. Negative events are categorised as risks and positive events are categorised as opportunities for the organisation. In general, there are some strategies that are used to deal with managing the uncertainties associated with negative consequences of a particular action. Common approaches might manage these threats by transferring the threat to a third party (ISO/IEC, 2009). An example of this approach is an organisation purchasing insurance in case something happens to one of their ships while at sea. Another

approach to managing threat might be avoiding the threat altogether by not engaging in the activity that comes with the risk. For example, certain investments might be particularly high risk and the organisation might choose not to invest at all in an effort to avoid the risk. More common approaches to dealing with threats are reducing the negative effect or the likelihood of the threat and accepting the potential negative effects of the threat (Hallikas *et al.*, 2004). For example, there is a likelihood that a ship might be lost at sea due to weather or other natural events. The maritime firm might take every precaution possible to prevent this from happening by putting in additional safety measures, but in the end the firm might accept the fact that all uncertainty cannot be eliminated and accept the threat as a possibility.

Depending on the type of industry and the goals of the organisation, risk management standards and approaches vary. Furthermore, risk management goals and methods also vary depending on the department within the organisation with certain departments such as project management and engineering engaging in very different types of risk taking and risk management. The following section focuses on general aspects of risk management within the maritime industry.

Risk in the maritime industry is a dilemma or a situation that hard to ignored,. Yet, it could be managed as soon as possible. Projects of maritime industry are matter to definite risks that is a outcome of different aspects, and it is up to the maritime' firms managers to interact with those risks. The maritime industry is affected by many different factors, including, but not limited to social, political, economical and environmental factors. These aspects have roles to reduce the risks that various maritime firms face.

The costs associated with not managing risks in the maritime industry properly and effectively are great. Maritime industry projects are expensive and subject to financing issues, and improper risk management causes delays and increases the costs and expenses of a project. In addition to financial issues, improper risk management on a maritime industry site might also result in operational problems and/or employee safety issues. Therefore, it is very important to have

an effective risk assessment and management in order to the success of each individual maritime firm and to the maritime industry as a whole.

Risk is the relationship between the probability of losing something and the probability of gaining something of value. Risk is a concept that relates uncertainty to the result or an outcome of that uncertainty (Chapman and Ward, 1996, pp. 34-99). For instance, risk has been defined as an uncertain event that, if it takes place, has an effect on at least one objective or goal of a project. Risk is associated with uncertainty because all actions, especially those in the maritime industry, have different levels of uncertainty associated with them. The way that various risks associated with different actions can be mitigated or decreased is called risk management.

Another way that risk has been identified is that it is an uncertainty and the potential of losing something that is valuable. Though something of value often refers to something of financial value, risk is not limited to this. Specifically, something that is valuable might refer to any number of things including social status, health and well-being. Whenever an organisation engages in any activity or conducts a particular action, that organisation is subject to risk. Risks are associated with any activity that any person or business entity engages in, because all activities come with certain uncertainties. What is important about engaging in activities and the decision to conduct certain actions, especially for business organisations, is the amount of risk that a particular business venture or activities comes with (Kaplan and Garrick, 1981).

Research indicates that there are no objective measures of risk, only perceptions of risk (Kaplan and Garrick, 1981; Artzner, Delbaen, Eber, and Heath, 1999). Risk perception is the subjective judgment that people make about the probability of a particular risk and the impact that this risk might have on other aspects of the organisation (Weinstein, 1984). Because perception is a subjective process, unique to individuals as well as to departments and organisations, the measurement of risk perceptions is difficult, complex and not entirely straightforward process. For instance, on an individual level, some behaviours such as jumping out of an airplane might be considered very risky by certain

individuals who are afraid of heights or do not have prior experience with airplanes, but are not considered risky by others who engage in other risky behaviour and are not afraid of heights. Similarly, certain businesses might consider certain business activities and endeavours too risky for them, whilst others might consider them to have an appropriate level of risk according to their objectives and goals.

3.5 Supply chain risk management

Unsurprisingly, SCRM has become a key business reality for firms, governing all aspects of procurement, logistics, distribution, supply of raw and secondary materials, design and delivery to end-users (Chopra and Sodhi, 2004). Global corporations such as Nokia and Ericsson, for instance, are well aware of its importance, as noted by Faisal *et al.* (2006) and Tang *et al.* (2013). Many studies for supply chain risk management have been proposed in the recent years (Olson and Wu, 2008 ; Pfohl *et al.*, 2011 ; Giannakis and Louis, 2011; Xia and Chen, 2011 Manuj and Sahin, 2011; Cagliano *et al.*, 2012; Kern *et al.*, 2012 ; Rossi and Pero, 2012; Zegordi and Davarzani, 2012; Klibi and Martel, 2012 ; Chiu and Choi, 2013; Li and Womer, 2012). Thus, supply chain risk management has to become central to organizational survival and prosperity (Wildgoose *et al.*, 2012).

Other studies show how interest in SCRM has increased, especially following two major events: a fire in one of the Ericsson's suppliers in New Mexico in 2000, which cost Ericsson approximately 400 million euros (Norrman and Jansson, 2004), and the collapse in 2001 of one of Land Rover's suppliers which resulted in 14,000 workers being laid off (Lester, 2002). In addition, the terrorist attacks on the World Trade Centre on 11 September 2001 caused major supply chain problems globally (Norrman and Jansson, 2004; Paulsson, 2004; Tang *et al.*, 2013). Therefore, as the management of supply chain risks has risen in conjunction with environmental, political and social events, researchers' interest within the supply chain field has increasingly focused on this strategic issue. Also, risk is becoming critical issues for supply chain managers (Hoffman *et al.*, 2014). Too, Supply chain risk management has become a new zone that emerges from a

growing appreciation for supply chain risk by both practitioners and researchers (Ghadge et al., 2012; Sodhi et al., 2011; Tang et al., 2013).

SCRM has several definitions, some of which are described in the following sections. Table 3 provides a selection of key definitions commonly used by experts.

The literature on 'risk,' however, is still emerging. Paulsson (2004), for instance, notes that in 1995 there was just one article related to risk and SCM. This number increased to 23 in 2002. Seshadri *et al.* (2005) and Kouvelis *et al.* (2006) explain that this increase in articles is due to the concept of risk management having been developed in other disciplines, such as economics and finance, both of which show the effects of SCRM at the inter-organisational level. Tang and Musa (2011), in their investigations into SCRM, also presented that there was a noteworthy expansion of research in SCRM during 2000-2005. The discipline has advanced from passively reacting to general issues to more proactively managing supply chain risk from a systems perspective.

in 2011, Sodhi *et al.* noted there are still three cracks in SCRM research:

- There is no settlement on SCRM definition;
- There is a lack of investigation on response to incidents of supply chain risk;
- The empirical research in the area of SCRM is shortage.

Furthermore, risk is still less carved and developed than other disciplines in the area of SCM (Juttner et al., 2003; Juttner, 2005; Khan and Burnes, 2007; Kleindorfer and Saad, 2005). Khan and Burnes (2007) also advised to use case studies to explore the next:

- How companies manage supply chain risk;
- What processes and techniques companies use to identify and analyse risk in their supply chains.

The definition of SCRM has taken several forms, as mentioned above. However, due to the complexity of SCRM's nature, researchers' views still vary widely.

Kouvelis *et al.* (2006) noted that SCRM is a handling the demand uncertainty, supply and costs. Too, Carter and Rogers (2008) described SCRM as “the ability of a firm to understand and manage its economic, environmental, and social risks in the supply chain” which could be materialised by the adoption of contingency planning and having a resilient and agile supply chain. There are also other notations related to risk management in supply chains. Rice and Caniato (2003) define supply chain resilience as the ability of an organisation “to react to an unexpected disruption and maintain operations after the event”. Resilience can be achieved by employing high flexibility and adequate redundancy in the organisation. A more content-oriented definition of resilience as “the ability of a system to return to its original state or move to a new, more desirable state after being disturbed” is provided by Christopher and Peck (2004). Too, Peck (2006) resilience relates to the concept of an organisation's “ability to absorb or mitigate the impact of the disturbance”. Contingency planning, which is interchangeably referred to as business continuity planning, is an approach to prepare for the possibility of future emergency or disruption. This approach involves continuous supplier assessment, development and maintenance of alternative capacities, mirrored and backup information systems and specific emergency response plans (Rice and Caniato, 2003). In my opinion, Tang (2006) has accurately captured the overall aim of SCRM, which is to manage and make sure that every aspect in supply chain channel is secured and the movement of materials runs smoothly. In short, SCRM aims to sustain high profitability and continuity in firms.

Table 3: Some of the well-known definitions of supply chain risk management

Authors	Definitions
Jüttner	“SCRM is the management of external risks and supply chain risks through a

et al. (2003, p. 202)	coordinated approach among supply chain members to reduce supply chain vulnerability as a whole.”
Giunipero and Eltantawy (2004, p. 703)	“Risk management is a continual process that involves long-term dedication of supply chain members.”
Norrman and Jansson (2004, p. 436)	“Supply chain risk management is to [collaborate] with partners in a supply chain apply risk management process tools to deal with risks and uncertainties caused by, or impacting on, logistics related activities or resources.”
Tang (2006)	“SCRM is the management of supply chain risks through coordination or collaboration amongst the supply chain partners so as to ensure profitability and continuity.”
Goh et al. (2007, pp. 164- 165)	CRM is defined “as the identification and management of risks within the supply network and externally through co-ordinated approach amongst supply chain members to reduce supply chain vulnerability as a whole.”
Manuj and Mentzer (2008)	“[Global] SCRM is the identification and evaluation of risks and consequent losses in the global supply chain and implementation of appropriate strategies through a coordinated approach among supply chain members with the objective of reducing one or more of the following – losses, probability, speed of event, speed of losses, the time for detection of the events, frequency, or exposure – for supply chain outcomes that, in turn, lead to close matching of actual cost savings and profitability with those desired.”
Thun and Hoenig (2011, p. 243)	“Risk management, in general, is described as the identification and analysis of risks as well as their control. A main particularity of Supply Chain Risk Management (SCRM) contrary to traditional risk management is that it is characterized by a cross-company orientation aiming at the identification and reduction of risks not only on the company level but rather focusing on entire supply chains.”
Wieland and Wallenburg (2012, pp. 890-891)	“SCRM is defined as the implementation of strategies to manage both every day and exceptional risks along the supply chain based on continuous risk assessment with the objective of reducing vulnerability and ensuring continuity.”
Lavastre et al. (2012, p. 830)	“SCRM is the management of risk that implies both strategic and operational horizons for long-term and short-term assessment.”
Supply Chain Council	“SCRM is the systematic identification, assessment and mitigation of potential disruptions in logistics networks with the objective to reduce their negative impact on the logistics network’s performance.”

3.6 Supply chain & risk

Risk is always been existing in the reconciling supply process with demand, many factors have lately occurred in and may have increased the risk level (Juttner *et al.* 2003). These factors include the following:

- A focus on efficiency rather than effectiveness;
- The supply chains globalisation;
- Focused factories and centralised distribution;
- The outsourcing; and
- The supplier base reduction.

There are two factors that can help to mitigate risk within a supply chain, visibility and communication Juttner *et al.* (2003) noted that it is possible to reduce the risk to those involved by focusing on joint agreements of the organisations in the supply chain, sharing information and preparing joint business continuity plans, . It is highly important to share information to share information between supplier tiers, thus the notion of sharing information should be understood to identify risk from a supply chain perspective.

3.6.1 Prioritisation of risk

In general, the process of risk analysis begins with the prioritisation process. Prioritisation refers to the ordering of the risks that an organisation faces from the ones posing the greatest loss of resources or the biggest negative impact on the organisation and the ones with the greatest probability of taking place to the ones posing the lowest loss of resources and the ones with the lowest probability of taking place (Ball and Golob, 1999). It is important to identify the risks that will make the greatest impact on the organisation and that have the highest likelihood of occurring first because they pose the greatest risk to preventing the organisation from reaching its strategic objectives.

The process of prioritisation is difficult and complex, involving many different variables. It generally involves avoiding or ignoring risks that are certainties because there is nothing that the organisation can do to mitigate or avoid them. Instead, the process of risk analysis involves focusing on identifying and mitigating risks that can be properly managed. Some common risks that all organisations face including those organisations in the maritime industry include risks that come from ineffective or improper collaboration among individuals and between teams of individuals. These risks often result in decreases in effectiveness of productivity, which, in turn, result in decreases in cost-effectiveness of the product and decreases in the quality of service and profitability. Another important aspect of SCRM which is often difficult to assess is the allocation of resources. Because the process of risk is rather involved and requires a lot of data and a lot of comparisons of data, the resources that a firm within the maritime industry devotes to risk management takes away from resources that could be devoted to other more profitable aspects of running the business (Ball and Golob, 1999). These difficulties in the proper allocation and management of resources are referred to as the opportunity cost. In an ideal environment, one that no business finds itself in, SCRM decreases spending and resources devoted to the process of risk whilst at the same time minimising the negative impact associated with various risks. There are many different ways that risk can be managed by a maritime industry firm; several of these methods are described and analysed below.

However, Previous sections show that Investigation into theory and practice would allow future research to develop reliable SCRM models, And that incorporates the tools of risk management and other methods of research (Khan and Burnes, 2007, Olson and Wu, 2008;Pfohl et al., 2011;Giannakis and Louis, 2011;Xia and Chen, 2011;Manuj and Sahin, 2011;Cagliano et al., 2012;Kern et al., 2012;Rossi and Pero, 2012;Zegordi and Davarzani, 2012;Klibi andMartel, 2012;Chiu and Choi, 2013;Li and Womer, 2012). Therefore, more study can apply other disciplines to develop a tool to identify risk.

3.6.2 Supply chain risk methods

Research shows that one common method of SCRM involves the following steps: identification of threats, assessment of vulnerability, determination of risk, identification of ways to reduce risks and prioritisation of risk reduction (ISO 31000 Risk management, 2007). The first step in this process involves characterising or identifying threats that the organisation faces. After all the common and predictable threats have been identified, the risk management teams proceed to the second step, which involves an assessment of vulnerability or an evaluation of the likelihood that threat may affect critical assets. Once the probabilities of the threats are identified, the risk management team devises a metric that determines the risk that the threats pose to the organisation. During this process, the team determines the expected likelihood and the results of the particular threats. Then the risk management team identifies ways that risks can be reduced or minimised or the steps that the organisation as a whole or the people within the various departments can take to minimise the risks. Finally, the team prioritises the risks in order of which ones pose the greatest impact and which ones are most likely to occur. Each of these metrics allows the team to prepare a strategy for dealing with the various risks, both by preparing to take precautions to minimise the risks' impact and by preparing a way to deal with the risks should the need arise.

In academic literature, nine process based methods were found that could assist to identify and assess the risks of supply chain in a context of supply chain (Juttner, 2005). They are the following;

1. Assessing the importance of the business to the suppliers' business
2. Assessing the importance of the business to the customers' business
3. Supply chain mapping
4. Critical path analysis
5. Process mapping

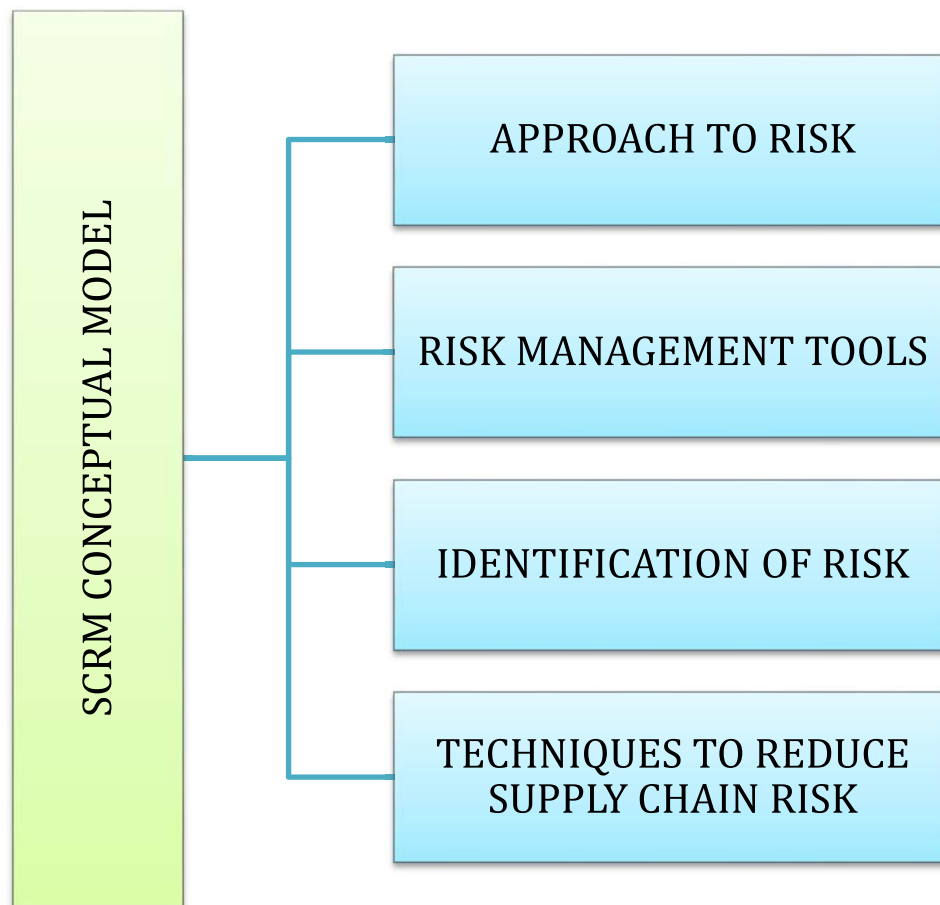
6. Brain storming
7. Risk likelihood or impact analysis
8. Six sigma method
9. Scenario planning

Nowadays, Six Sigma has been widely adopted in a variety of industries in the world and it has become one of the most important subjects of debate in quality management with a lot of successful cases. Six Sigma is a well-structured methodology that can help a company achieve expected goal. Too, it helps the elimination of subjectivity in decision-making, by creating a system where everyone in the organization collects, analyzes, and displays data in a consistent way (Maleyeff & Kaminsky, 2002). Also, one of the aims that the applications of Six Sigma are likely used is the ability to articulate the benefits as reflected in financial returns in originations (Goh, 2002; Kwak & Anbari, 2006). Eventually, the researcher found that the implementation of Six Sigma methodology into supply chain context has become globally popular and will be examined later.

This thesis suggests a conceptual framework that explores several factors that could contribute to the sustainability of a knowledge minimizing risk in maritime supply chains is Saudi Arabia. These factors include: management fit, market related fit, resource fit, shared identity, relational capital, and flexibility. This framework which is similar to Lavastre, Gunasekaran and Spalanzani framework (2012) with adjustments to fit the culture of Saudi Arabia's business.

The conceptual model for SCRM in this study is a combination of four sections: (1) Approach to risk, (2) Risk management tools, (3) Identification of risks and (4) Techniques to reduce supply chain risk (see Figure 7). This conceptual model is used to study the empirical data collected from maritime firms in Saudi Arabia. Details of the model are discussed in chapter 5.

Figure 7: SCRM conceptual model



SCRM processes involve the reduction or elimination of supply chain risks. These processes include such actions as identifying supply chain risk events, analysing the possibilities and the seriousness of influences, selecting and dealing with the risks and developing activities for mitigating risks or planning for backup programmes.

Many researchers have debated about how best to evaluate SCRM. Juttner *et al.* (2003) noted that SCRM contains four main basic management phases:

1. Assessing the risk sources for the supply chain;
2. Defining the supply chain adverse consequences;
3. Identifying the risk drivers; and
4. Mitigating risks for the supply chain.

Other evaluations, such as that of Christopher (2011), suggest that there are seven stages involved in the management of supply chain risk, though these stages are similar to those of Juttner *et al.* (2003), Waters (2009) and Jonsson (2008), with additional stages included to improve supply chain control. The seven stages are the following: (1) Understanding the supply chain; (2) Improving the supply chain; (3) Identifying the critical paths; (4) Managing the critical paths; (5) Improving network visibility; (6) Establishing a supply chain continuity team; (7) Improving the SCRM procedure by working with suppliers and customers.

Waters (2009) and Jonsson (2008) agree that SCRM consists of three core elements: (1) Identifying the risks to the supply chain; (2) Analysing the risks; (3) Designing appropriate responses to the risks. Identifying risks to the supply chain means being aware of the risks and their sources. Techniques and tools have been used to identify various risks that may occur within a supply chain, and brainstorming by a research team or industrial experts is commonly utilised through the stage of identification (Hallikas *et al.*, 2002; Zsidisin, 2003; Norrman and Jansson, 2004; Sinha *et al.*, 2004; Wu *et al.*, 2006). Additionally, the models of Integrated definition (IDEF) and the analytic hierarchy process (AHP) have been used to identify supply chain risks at this phase (Sinha *et al.*, 2004; Wu *et al.*, 2006). IDEF is a function modelling methodology for describing manufacturing function decisions, actions and activities, in order to communicate the functional perspective of a system. The AHP is a structured technique for organising and analysing complex decisions such as choosing leader. Furthermore, AHP is a tool could apply in order to explain multiple criteria issues. AHP is broadly applied for tackling multi-attribute decision-making problems in real situations (Zahedi 1986). Moreover, AHP was used to resolve the relative weights of individual risk factors (Wu *et al.* 2006). Schoenherr *et al.* (2008), on the other hand, mixed AHP with action research in order to evaluate supply chain risk and then deliver decision support for off shoring decisions by a US manufacturing firms.

Other methodologies for assessing risk in supply chains also follow a structure but may be said to be more integrative in their approach. A good example of such an orientation is the Interpretive Structural Modeling (ISM) methodology

(Jharkaria and Shankar, 2004; Ravi and Shankar, 2005), a system that imposes order and direction on the complex elements of a system to produce an “interactive learning process” (Faisal *et al.*, 2006, p. 541). Thus, such a system is aimed at establishing listed variables within a set of contextual relations, a structural self-interacting matrix.

Although attempts have thus been made by researchers to take a more contextual approach to the study of risks in SCRM, the voices of key participants in the process are still neglected in the literature. As a result, the rich, multi-layered and multi-faceted complexities of how actors within a system perceive, negotiate, manage – or, in other words, interact with – systems themselves is missing in current studies. This gap, as the chapter goes on to argue, requires sustained attention.

Chopra and Sodhi (2004) have classified the risks of a supply chain according to the areas from which they develop; internal areas in the organisation such as manufacturing disruptions and delays, forecast, systems, procurement, inventory, receivables and capacity. Fisher (1997) noted that risks could be lessened through developed methods and buffer strategies; organisations have to act against uncertain events. There are four main categories of risk sources that have been acknowledged by Zsidisin and Ellram (2003); the categories are designed to allow for improved risk management within a supply chain. These categories are product related, market related, supplier related and other sources. These categories have been analysed and expanded upon in various texts. For example, Wu *et al.* (2006) expounded upon supplier-orientated risk by generating a wide-ranging group of risk factors and then classify the risks in a hierarchical structure. The supply risk issue has been addressed through developing a risk profile for a given supplier in a supply network using the Bayesian method (Lockamy and McCormack, 2010). Juttner *et al.* (2003) continued to build upon this by identifying supply chain risk sources and suggesting methods to mitigate their effects. Christopher and Lee (2004) described risk in both qualitative and quantitative terms. Finally, Barbara and Borghesi (2006) defined risk as part of an neutral; the authors represented aggregate business performance as a function of a business objective and associated risk with these objectives. This

was driven by the “perfect order index” – the critical service elements which represented the sub objectives of the supply chain.

Noteworthy work has been done in the last ten years in an effort to advance risk quantification. The aim has been to link SCRM with conceptual and mathematical constructs in order to enable better risk assessment. Nagurney *et al.* (2005), Wu *et al.* (2006) and Tomlin (2006) have made significant and notable contributions in risk quantification. They declared that the mathematical modelling approach which they had used established a link between objectives and risks, allowing managers to select quantitative risk indicators. This approach, they argued, could be used for building and assessing risk mitigation strategies.

Risk analysis describes the points where particular attention needs to be paid to the supply chain. Hallikas *et al.* (2004) have illustrated in detail all aspects of the analysis involved in risk management. Zsidisin (2005), in contrast, concentrated on handling risk significantly through early supplier involvement. Faisal *et al.* (2006) applied a graph theory to decrease supply chain risk. Goh *et al.* (2007) proposed a stochastic model of the multi-stage global supply chain network problem, including a set of related risks. In a recent study of the German automotive industry, Thung and Hoeing (2011) studied the impact of SCRM on performance by establishing a probability-impact matrix. Hendricks and Singhal (2005) focused on the risk monitoring issue. They discussed an increased focus on developing tools to avoid or mitigate supply chain risks. Likewise, Giannakis and Louis (2011) developed a multi-agent based decision support system for the mitigation of risk in a manufacturing supply chain. A respectable SCRM would reduce the risk factors probability (Pujawan and Geraldin, 2009).

Amongst other approaches, process mapping and brainstorming are two tools that can provide clear insight into what a business entity does, who is responsible, to what standard a process should be completed and how the success of a business process can be determined. In terms of planning, a method that some organisations option is scenario planning, also called scenario thinking or scenario analysis. This method is utilised in order to generate flexible, long-term plans.

In assessing risk, another popular model that can be utilised is the Failure Mode and Effect Analysis (FMEA). In this model a priority rating is assigned to each risk based on the multiplication of the probability of occurrence and the severity of the impact caused. It is an inductive failure analysis used in product development, systems engineering, reliability engineering and operations management to classify failure modes by the severity and likelihood of the failures. Ireson *et al.* (1995) believed this method is to evaluate, prevent and eliminate potential risks as quick as possible. Sinha *et al.* (2004) have examined and used FMEA in the aerospace industry to analyse and prioritise supplier risk. Additionally, Andre and Miguel (2008) applied FMEA as a tool of risk management in an automotive company.

However, many researchers have developed and tested other models and tools in terms of risk management. Norrman and Jansson (2004) labelled a ERMET model, Ericsson Risk Management Evaluation Tools, whilst Brun *et al.* (2006) presented one more model; SNOpAck (supply network opportunity assessment package). The scales used may differ and can be comprised of numbers 1-4 and 1-5 scales (Hallikas *et al.*, 2002; Norrman and Jansson, 2004; Hallikas *et al.*, 2004), where each number corresponds to a different meaning. For example the values may represent low, medium, high, very high, and catastrophic impacts. On the other hand, Zsidisin (2003) and Sheffi and Rice (2005) used two only levels, high and low.

Thus it is possible to design appropriate responses to analytical risks through various techniques, such as the transfer of risk to another party through outsourcing or subcontracting. In this manner it is possible to eliminate or reduce risk. In 2009, Rao and Goldsby clarified risk sharing in terms of a joint risk collaboration involving two or more parties within a supply chain. Juttner *et al.* (2003) advised that collaboration with the partners of supply chain is one of the mitigating strategies. These efforts can take various forms of joint effort, including sharing information of risk and collectively arranging supply chain continuity plans. Other techniques such as abandoning specific products, markets, customers or suppliers can also be implemented to avoid specific risks.

3.6.3 Process of risk management

Empirical evidence is one of the fundamental bases of case studies. The process of risk management of a business contains risk identification, risk assessment, decision of risk management actions and its implementation and risk monitoring. Several papers discuss on risk identification and assessment methodologies (Chopra and Sodhi, 2004; Lavastre et al., 2012). However, the following sections discuss risk identification and source analysis, an important part of risk identification; different risk identification methods; risk assessment and difficulties with risk assessment; and strategies for dealing with risk.

3.6.3.1 Risk identification

The great aim to identify the risk source is to prevent the events that can go wrong and lead to breaches of safety (Redmill, 2002). Risk identification is a method to discover and identify all potential risks. Too, it is not only to find risk factors, but also to discover the significance of those risk factors (Shen, 1997). The risks are either negative outcomes or positive outcomes. Risk identification is the first and very important phase in risk management because without this step no other part of the process can take place (Chapman and Ward, 1996). This process, however, identifies not all risks associated with a given project, but all relevant risks. For instance, one possible event that can take place on a maritime industry site is that the manager is hurt in a car accident on the way to work and will have to be replaced while he or she is in recovery. This is a risk that will affect the running of the site, but it is not a risk that is identified during the risk identification process. It is up to the managers and whomever else is involved in the risk management process to determine which risks will be considered and identified and which ones will not be addressed due to the fact that they are unforeseeable events. Chapman and Ward (2003) listed that identification of risk is both important and difficult and called for imagination and creativity. They recommended the directed-thinking approach, which includes activities such as the interviewing of individuals or groups, brainstorming,

3.6.3.1.1 Source analyses

Source analysis is an essential in risk identification. Finding the source of risk helps firms to reduce the identified risks. risk sources are in any part in the organization, such as maritime firms' employees, employees of the maritime industry site, management, weather events and stakeholders of the maritime industry project. Sources of risk are either internal or external in the context of the risk management. These sources are the plan to understand the risk whether is directed or will affect business negatively. Robbery by the employees or losing an expensive equipment are examples of internal sources of risk in maritime industry. On the other hand, a hurricane that shakes the business is an external risk source.

3.6.3.1.2 Risk identification methods

Risk identification process has many different methods. There is no a precise approach for risk identification, and an appropriate combination of techniques should be used (Hillson, 2002). However, these approaches are vary, but the following are some of the most common ones: objectives-based risk identification, scenario-based risk identification, taxonomy-based risk identification, the common risk checking method and the risk charting method (Chapman, 1998).

Objectives-based risk identification involves the process of developing objectives for a maritime project. These objectives are typically developed by the maritime industry company and/or its project management team. Prior to beginning work on a maritime project, the project management team develops a set of objectives that allow them to achieve all of the goals of the project. Events which enhance the likelihood of not meeting these objectives are considered risks associated with these objectives.

Scenario-based risk identification is a type of risk identification that involves scenario analysis (Jablonowski, 1999). Scenarios are different situations or setups which may result in achieving an objective. Scenario analysis is also the analysis of the interactions and dynamics that are involved in achieving an objective of the

project. In aspect of scenario-based risk assessment, managers discover the events and are considered risks that result in undesired scenarios.

Taxonomy-based risk identification is the process of breaking down all possible sources of risk. This process involves developing a questionnaire and using taxonomy and different best practices, given the nature of the maritime industry, to get answers to the questionnaire. Common risk checking is another process of identification used when there are a number of known risks associated with different events and these risks can be compiled in a list (Carr *et al.*, 1993) If a list of common risks is available, managers check whether there is a risk associated with certain events. Common risk lists typically also have applications or solutions that are available to mitigate the risks associated with certain events.

Finally, the last common type of risk identification is risk charting. This approach is a combination of all of the previously discussed methods. In particular, it requires the manager to build a matrix which consists of the item and/or objectives which are at risk, the threats to the item and/or objective, factors that increase the likelihood of a negative outcome, factors that decrease the likelihood of the negative outcome and the negative outcome or the consequences that the managers hopes to avoid. This matrix may be devised in any number of ways. For instance, the manager might begin with the threats to a particular part of the project and examine how these threats affect the rest of the project, the people working on the project and the site as a whole. The manager might also begin with the project or a particular item such as a heavy and expensive piece of equipment, which is essential to the operations of the maritime industry site. The manager may then examine the threats that this piece of equipment is exposed to and the possible outcomes of each of the threats. Both of these approaches require the manager to create a type of matrix in order to properly identify the risks that are involved in the project that he or she is working on and is responsible for.

3.6.3.2 Risk assessment

After the relevant risks are identified, maritime industry site managers on a given maritime industry project are then responsible for assessing the potential impact

or severity of the identified risks and the likelihood of them occurring. This method is co-called risk assessment, it is one of the most essential parts of the risk management approach. In the maritime industry, the impact of an identified risk is generally associated with financial loss or damages.

It is an essential to complete the risk assessment process with the best available information, as this will increase the assessment's accuracy and minimise the risk of improper allocation of resources. For instance, consider a manager assessing the risk associated with theft and vandalism in a particular location within a city. If the managers assesses the risk of theft or vandalism to be relatively low and it is in fact much higher then the manager may fail to take certain precautions when it comes to securing the maritime industry site. As a result, the maritime industry site might get vandalised, the loss associated with the vandalism will likely be much greater than anticipated and the project might be jeopardised because the manager did not foresee these consequences. However, if the risk assessment is done correctly, then the manager can deploy extra resources to maintaining security at the site and, as a result, decrease the likelihood of such losses (Soares and Teixeira, 2001).

While it is important that the assessment of risk is as accurate as possible given the best available information, likewise, it is essential to note that all assessments are only best educated guesses on the part of the managers. In reality, there is no way to know for sure how a project will proceed and what unforeseeable events might occur before the project is completed.

The main difficulty associated with risk assessment is the determination of the rate of risk occurrence (Chapman, 1998). The rate of risk occurrence is determined by the statistical information that is available on similar incidents that have occurred in the past. Unfortunately, this rate is often not available because not all incidents that have occurred in the past have statistical information associated with them. Furthermore, this rate might also not be available because not all incidents that might occur have occurred in the past. Thus, it is quite difficult for managers to evaluate the severity of the impact associated with certain risks. Regardless of the difficulties associated with

accurately assessing risks within a project, risk assessment is an essential and extremely valuable part of risk management. The risk assessment process gives maritime industry site managers in charge of overseeing an organisation the primary risks involved with the project and/or a series of projects and allows them to understand how to go about prioritising risk management decisions.

After risk has been assessed, managers have to determine how to quantify the risks to best support decision making about how to mitigate the risks. One of the most popular ways of quantifying risk is to use the Composite Risk Index. The Composite Risk Index, also known as the risk magnitude, is a formula in which the rate of occurrence of a given risk is multiplied by the impact of the event (Turner, 2011). The factors involved in the Composite Risk Index, the risk magnitude, the rate of occurrence and the impact of the event are all measured or assessed using scales ranging from one to five. There are three scales commonly employed in this process: the rate of occurrence scale, the impact of risk assessment scale and the magnitude of risk scale.

The rate of occurrence scale is from one to five, where one represents a relatively low likelihood of the risk event actually taking place and five represents a relatively high likelihood. The scale is non-linear and may be expressed using mathematical or non-mathematical terms, depending on the needs of the company and/or the project manager (Chapman, 1998). When the scale is expressed using mathematical terms, it keeps track of rate of occurrence using time, e.g. an event occurs one time per year, one time per five years, etc. When the scale is expressed using non-mathematical terms, it keeps track of rate of occurrence using much more fluid parameters. For instance, an event has been known to occur, the event has occurred here quite often, etc.

The impact of risk event scale is from one to five, where one represents the smallest amount of impact of an occurrence of risk and five represents the largest. Impact is typically measured in terms of monetary loss. Thus, if a maritime industry site is subject to theft then all of the equipment and materials lost are measured in financial terms, or how much they cost the company to

replace. Like the rate of occurrence scale, the impact of risk event scale is non-linear.

Finally, as both values in the Composite Risk Index are based on scales, the resulting Composite Risk Index, or the magnitude of risk, is also based on values on a range within a scale. Specifically, the Composite Risk Index is a scale with a range from one to 25, which is then subdivided into three sub-ranges: low, medium or high. A low magnitude of risk might then be a Composite Risk Index of one through eight whilst a medium magnitude of risk might be a Composite Risk Index of nine to 16. High magnitude of risk would then be a Composite Risk Index of 17 and above. Due to the fact these are scales which are subject to interpretation, managers have the option of interpreting the scales according to this convention or possibly creating only two sub-scales with the Composite Risk Index. Regardless, whatever decisions managers make they need to be deliberate and methodical in their approach.

Depending on how risk is managed and what steps are taken to mitigate the various risks associated with different aspects of the maritime industry project, both the impact of the risk event and the probability of its occurrence may change (Dorfman, 2007). Thus, it is necessary for maritime industry site managers to re-assess risks on some periodic basis or when certain changes on the site take place. In particular, changes in site technology, schedules and procedures are all factors that influence and affect how risk is assessed and the final magnitude of risk at the site. Other factors that also influence the final magnitude of risk are external conditions such as the political environment where the site is located, the budget with which the managers have to work with and the market conditions. When these factors change, it is typically necessary to re-assess the risks that are associated with the given project.

3.6.3.3 Decision and implementation of risk management actions

The maritime industry presents a plethora of risks that needs to identify, evaluate and assess. Though, these risks are not permanent and change with the conditions. If the conditions in the environment change, so do the probabilities of risk events and the impacts of those risk events. There are a variety of ways to

decrease or deal with risk. For instance, managers might create a new business process to deal with the risk, might transfer the risk to a third party and/or take measures to avoid the risk. In general, there are four approaches for dealing with risk: risk avoidance, risk reduction, risk sharing and risk retention (Juttner *et al.*, 2003).

The first usual method to reduce risk is avoiding certain risks entirely (Adler *et al.*, 1999). This method contains eliminating the risk completely, withdrawing from a method that is associated with the risk and/or not becoming involved in a project where the risk of something happening is relatively high (Adler *et al.*, 1999). The strategy of risk avoidance is normally taken during the process of risk management.

Avoiding certain risks is a risk mitigation strategy (Lavastre *et al.*, 2012), but it not one of the most efficient strategies to dealing with risk during the actual project. Not all risks can be avoided, and the strategy to avoid all risk is one that also forfeits all possible returns. Thus, while risk avoidance is technically the most effective approach to mitigating risk, it is often also inefficient and unrealistic (Adler *et al.*, 1999).

Risk reduction, the second common approach for mitigating risk, is a better and more practical option. This approach aims to optimise and/or mitigate the risks associated with a given venture while optimising the possible potential gains, e.g. financial returns, associated with the venture (Adler *et al.*, 1999; Juttner *et al.*, 2003). Risk reduction is also known as risk optimisation because it consists of reducing the impact of the loss or the likelihood of the loss associated with the risk event. An example of a common risk reduction strategy is to put in sprinklers to reduce the risk associated with a fire. Automatic sprinklers start to put out the fire as soon as there is smoke and/or heat, thus decreasing the risk of loss associated with waiting for the fire trucks to arrive to the location. Another example of a risk reduction strategy is the placement of CCTV and/or security guards at the location of the maritime firms. These security measures aim to prevent theft and vandalism and, if they are seen by the employees at the site, often reduce the amount of theft that is perpetrated by the employees (Juttner,

Peck, and Christopher, 2003). Nevertheless, firms might employ locks and fences to prevent some theft from the site.

Another way that risk may be reduced or optimised is by developing or putting forth a different business process that adequately accounts for the given risk (Juttner, Peck, and Christopher, 2003). For instance, if there is a risk associated with using a particular kind of new equipment or machine, then the managers might develop a policy that only allows access to the new equipment to individuals with prior experience with using the equipment or with proper certification that gives them permission to work with the equipment.

Risk reduction or risk optimisation requires finding the right balance between reducing the adverse effects associated with the risk and the resources required to prevent the adverse effect (Juttner *et al.*, 2003). Risk reduction often requires maritime industry company to take certain measures to prevent the risk or the likelihood of risk. Often, while there are certain measures that can be employed to reduce the risk, these measures are just not an option due to the limitations in the budget.

The third common approach to mitigating risk is to transfer some of the risk to an external company or a third party such as an insurance agency (Gibb and Buchanan, 2006). The purpose of such risk sharing is to distribute both the potential risks and the potential rewards across one or more groups, in order to mitigate severity of loss to one group (Gibb and Buchanan, 2006).

Theft and vandalism are quite common at maritime industry sites because these locations house valuable and easy-to-sell equipment and materials. As a result, risk sharing or transferring is very common, with most maritime industry company owners buying insurance policies on their most valuable pieces of equipment and the site in general (Gibb and Buchanan, 2006). Owners pay monthly premiums in return for the peace of mind that if something does happen to the equipment and/or materials on the site then they will receive monetary payment for whatever losses that they incur. This technique allows the maritime company to share their burden of possible financial loss and possible benefits with the insurance company (Adler *et al.*, 1999). The company pays premiums in

proportion to the kind of risk that they want to share or transfer. Equipment or materials that are considered to have high risk typically have higher insurance premiums associated with them. Insurance companies accept these premiums with the understanding that they will pay out policies if or when something happens to the insured piece of equipment at the site or to the site in general.

In addition to purchasing insurance in an effort to transfer risk to the insurance company, risk sharing might also include outsourcing risk to share it with a third party (Adler *et al.*, 1999; Gibb and Buchanan, 2006). Outsourcing is the process of giving a project or a part of a project to a third party to complete. Outsourcing is very popular in software development, as software firms often outsource some of their work to third party companies located in countries such as India where development costs are cheaper. However, outsourcing is not limited to the software industry. Maritime companies also employ outsourcing as a way to share and mitigate their risks (Adler *et al.*, 1999; Gibb and Buchanan, 2006). The most common process that maritime industry companies outsource is security. Instead of employing security employees directly, many maritime industry companies simply hire outside security firms to handle their security needs. Depending on the needs of the company, these firms might send them a whole team of security staff with a number of security guards, one or two security guards, or simply CCTV equipment that they monitor remotely from their office. Hiring third parties to cover their security needs allows maritime industry companies to mitigate some of the risks associated with running the site. Furthermore, outsourcing is also a way for the company to decrease the number of processes that they are directly responsible for on the site and instead focus more on more pressing matters.

Finally, the fourth common approach is risk retention. This approach or technique involves the company actually accepting the risk as a possibility and budgeting for this possibility (Gibb and Buchanan, 2006). This technique is one that is often used for small risks where the cost of the insurance premiums is too high to justify paying for the risk event (Adler *et al.*, 1999). In particular, most maritime industry companies insure less than half of their total value of materials and equipment on site. The rest of the equipment and materials are not insured

because they are not worth enough to make up for the additional amount that the company would have to pay in premiums. All risk events that are not shared, transferred or reduced are by nature retained. In addition to small risks, companies also retain very large risks, which either cannot be insured or are too expensive to be insured against. For instance, one large risk that companies often cannot insure against is a financial crisis or a political situation that would make it impossible to continue with the project. Maritime companies that deal with projects overseas often contend with and take their chances with possible political instability and/or war, situations that pose such large risks that they are either impossible or too expensive to insure against.

3.6.4 How risk management creates value

In the Western world, risk management is an evolved area of science governed by the International Organization for Standardization. Research indicates that this organisation has put forth certain principles about the overall process of risk management and how it should take place. In particular, the International Organization for Standardization argues that risk management needs to create value for the organisation (Leitch, 2010). In creating value, the process of risk management should spend fewer resources on mitigating and minimising risks than doing nothing would cost the organisation. In other words, it should cost less to manage risks than to put forth no effort in managing the risks.

In order to create value for the maritime industry firm, the risk management process needs to be an integrated and an integral part of the organisation. Research shows that this is the only way that the process can obtain the right amount of information and the necessary access to make important decisions and properly evaluate data. Furthermore, the International Organization for Standardization also argues that the risk management process needs to be an integral part not only of the overall processes within the organisation, but also of the decision-making process within the organisation. Research shows that some decisions that require risk management are financial decisions and investment decisions. Health and safety decisions, which govern how the employees are

treated and the overall safety of the environment, also benefit from risk management (Leitch, 2010).

Other aspects of risk management that allow the process to bring value to maritime industry firms are the challenges that risk management presents to certain assumptions within the organisation. The process of risk management is one of challenging assumptions and looking for gaps where uncertainties might lay. Because the process of mitigating risks involves examining and putting forth proposals of all the things that could go wrong, this process is a kind of prediction science. And in order for the predictions to be somewhat accurate and appropriate, the risk management teams needs to be able to address and challenge assumptions that others make within the organisation and the assumptions that they take for granted (Hallikas *et al.*, 2004).

In addition to these factors, risk management is also a process that brings value to the maritime industry because it is a highly systematic and structured process. Using the best available information, the risk management team follows a particular process and system of approaching the measurement and mitigation of risk, allowing the team to come up with effective ways to save the organisation's resources and time and to prevent catastrophic losses. Furthermore, risk management is also a highly tailorable process, meaning that is a process that can be tailored to specific circumstances and unique situations within the organisation (Sankar and Prabhu, 2001). This approach makes it very complex and dynamic but also accurate and appropriate to the unique circumstances at the particular maritime industry firm. Research shows that throughout this process, the risk management teams need to take into account a number of human factors and other factors that are at play in the final result as well as remain open and transparent to the executive team. It is also very important that the process is not simply ended at a particular time based on the assumption that once all the risks have been identified, the risk management process is complete. Instead, research suggests that what makes risk management effective is that it is an ongoing and continuing process which is based on evaluation and re-evaluation of variables and which aims to continue to improve and enhance the mitigation of risk within the organisation (Ravi Sankar and Prabhu, 2001).

3.6.5 Contextualising risk

An important part of the risk management process is the step in which the manager or the team first establishes the context in which the entire process will take place. This part of the process, referred to as the contextualisation of risk, involves a number of steps. The first step of the process involves identifying the risk in a particular area of focus or interest. As mentioned previously, there are many different areas of risk that an organisation such as a firm within the maritime industry faces. Almost all departments within a maritime industry firm have various risks associated with them, and it is up to the risk management team to focus on specific areas of risk at one time in order to appropriately establish the context of the risks (Godfrey, *et al.*, 2009). For instance, the risk management team might first identify the risks associated with the health and safety on the ships and focus on this area as the specific domain.

Research shows that the second step in the process of contextualising risk is planning the rest of the process by mapping out a number of factors that contribute to uncertainty (Godfrey *et al.*, 2009). For instance, one important factor that has been identified and categorised is comprised of the objectives and identities of the various stakeholders who are affected by the risk or the uncertainty within a particular domain. Another important factor is the evaluation of the basis of how the risks are evaluated and the questioning and the challenges to certain assumptions that form the basis of the risk. Other steps in the contextualisation of the risk process are identifying the parameters of the framework within which the organisation performs various behaviours and activities and developing a process of analysing risks and uncertainties that occur within this framework. The final step in the process is coming up with a list of possible solutions to the various uncertainties (Godfrey *et al.*, 2009). This step involves pre-thinking and strategizing about what the organisation or the department within the organisation would do in case any of the risks turned into eventualities and what actions the team could take to diminish losses associated with the eventualities. Examples of possible solutions include developing additional technological resources or focusing on optimising additional human resources to deal with the problems, if they come up.

3.6.6 Creating a risk management plan

Research indicates that in an effort to diminish the severity of the risk events that are present on a maritime industry site, managers should improve a plan risk management. it should be used to develop countermeasures that allow the firm to work with and reduce various risk events. The plan of risk management should be approved by management and other relevant employees depending on the threat (Leitch, 2010). For instance, a risk event that is associated with security might need to be addressed by a third-party security company and/or by the maritime industry company management while a risk event associated with information technology might need to be addressed by the information technology department.

A worthy plan of risk management should suggest methods to manage risks and improve security processes in order help reducing risks (Leitch, 2010). For example, a maritime industry firm might work with risk by installing appropriate security protocols such as security guards, CCTV cameras and additional lighting. The plan of risk management should cover information about the people who are responsible for implementing this part of the plan and a schedule for when the various steps of the plan are applied.

After the plan of risk management is developed, the plan need to be covered, assessed and evaluated. The implementation should have all requirements that need to in order to mitigate the risks (Leitch, 2010). These methods that might include purchasing relevant insurance policies and hiring security firms, which share and/or transfer some of the risk to a third-party. Too, the plan needs to be revised and evaluated on a continual basis. The evaluation method allows the individuals in charge of the plan of risk management to observe how well all the risks have been accounted for managed and reduced. And then, the firm makes improved decisions about their actions in the future.

3.6.7 The risk management process: stages and cycles

At the heart of risk management is a process or set of processes. At any point, sudden mishaps can occur at any stage of the supply chain and may have either

positive or negative outcomes that were not part of the project plan. Risk management, broadly speaking, focuses on the avoidance of loss from unpredicted occurrences (Williams, 1995). Hubbard (2013) defines risk management as “the identification, assessment, and prioritization of risk followed by coordinated and economical application of resources to minimise, monitor, and control the probability and/or impact of unfortunate events or to maximise the realization of opportunities”. Jeng (2004, p. 139) points out “key supply risk factors that could interrupt company operations, such as geographic, contingency planning, factory, replacement, and supply/demand”.

Risk management of a supply chain has a great influence on the stability of dynamic cooperation among supply chain partners and thus is essential for the performance of the supply chain operations as a whole. The risk management process is to understand the risks, their direct impact and probability, and to decrease their influence.

The stages involved in risk management can vary from risk identification/analysis (or estimation) via risk assessment (or evaluation) to different ways of risk management (labels differ among authors, but the steps are similar) (Norrman and Jansson, 2004). One key question in risk management is how to mitigate the consequences of an accident should it occur. In order to meet this need, strategies require foresight and detailed planning; a prime example of one of these strategies is business continuity management (BCM).

3.6.7.1 Business continuity management

The foundation of BCM is the development of management processes, disciplines and techniques, which aim to maintain the operation of essential functions under all circumstance (Hiles and Barnes, 2001, p. 379). The crux of the strategy is to enable a business to continue to function seamlessly even when its operations are interrupted. Part of the task of ensuring that a business can continue to function when faced with problems is undertaken during BCM and the resulting business continuity plan. The aim of BCM is to identify when an organisation may be exposed to internal or external threats and to assess how to meet these threats using both hard assets (e.g. cash) and soft assets (e.g. personnel). BCM also aims

to provide both prevention and recovery strategies for such threats. At the same time, the business continuity plan aims to ensure that the organisation is able to maintain competitive advantage and the internal integrity of its systems even when dealing with a realised risk.

The business continuity plan is a document drawn up during BCM in order to establish procedures and operations for when a company faces serious disruption to the business. These events can vary greatly both in their quality and their longevity. Examples include severe weather and natural disasters that may affect different aspects of the organisation. The result of such events could be short-term inaccessibility of buildings or a total loss, requiring relocation of the whole operation. The plan contains the relevant steps to take in order to maintain business functionality during this time and also information on how to recover normal functionality after the fact.

A good business continuity plan includes any events which could have a negative impact on the business operations and which can be reasonably predicted. Examples of negative impacts on a business could include interruption of the supply chain, loss or damage to some piece of critical infrastructure like a data centre, or the failure of a critical system. The active management of risk events, including regular oversight of important systems, is a key part of a business continuity plan. After all, it is more effective to prevent a negative event than to respond to it.

One of the tools used in risk management and in business continuity planning is the Business Impact Analysis (BIA). The BIA makes distinctions between critical or urgent functions or activities of the organisation and those that are not critical or urgent. A critical organisational function is one whose disruption would be unacceptable for the organisation. What makes something unacceptable is often a matter of judgment, but it is often rooted either in the severity of the impact in terms of harm to customer relationships or relationships with partners or in terms of the costs associated with recovering from the failure of the function. There are some functions which are deemed critical by law, depending on the country.

At the point where a function is deemed critical, the BIA will assign two values to the function: the Recovery Point Objective (RPO) and the Recovery Time Objective (RTO). These terms refer to the acceptable scope of loss and the amount of time required for recovery, for example a company may deem two days' worth of data loss acceptable, but a greater loss unacceptable. In turn, they may decide a three-day recovery period is acceptable, but longer than that is unacceptable.

The impact analysis yields the recovery requirements for each critical function. Recovery requirements consist of the business requirements of the critical function and/or the technical requirements for recovery of the critical function.

Once applicable threats have been identified, impact scenarios are used to develop the business recovery plan. As part of this, development scenarios for each of the identified threats may be suggested and, even more specifically, localised impact scenarios (e.g. loss of a specific floor in a building) may also be documented. The business continuity plan should equip a business with the information needed to recover from the widest range of possible damage. The risk assessment should focus on developing relevant scenarios that might affect different aspects of the business; for example, it may not be logical to account for a tsunami in the Mideast since the likelihood of such a threat is negligible.

The analysis of possible threats is followed by the technical and recovery requirement phase. Establishing asset inventories allows a business to quickly identify its deployable resources. For an office-based, IT-intensive business, the plan requirements may cover desks, human resources, applications, data, manual workarounds, computers and peripherals. Other business environments, such as production, distribution, warehousing etc., will need to cover these elements, but will likely have additional issues.

The robustness of an emergency management plan is dependent on how much money an organisation or business is able to invest in it. In general, every \$1 invested in an emergency plan will prevent \$7 loss, as a business must balance the realistic feasibility of the plan against the need to properly prepare for a realised risk.

Maintaining a business continuity plan requires either annual or biannual maintenance and consists of three principal activities. The first activity is confirmation of information within the manual; staff must have relevant awareness of the plan and key individuals need adequate training. The second is testing and verification of the technical solutions established for recovery operations. The third is testing and verification of organisation recovery procedures. Any issues uncovered during testing must be reintroduced into the analysis phase.

As an organisation grows and changes, so too must its business continuity plan. Activating the call tree verifies the notification plan's efficiency as well as contact data accuracy. Key changes that should be identified and updated in the plan include important clients, vendors/suppliers, organisation structure changes, staffing, company investment portfolio and mission statement, communication, transportation and infrastructure such as roads and bridges.

In summary, many researchers have noticed that risk can be studied from different perspectives. For example, Tomlin (2006) has developed the view of supply chain risk as a mathematical construct whereas SCRM has been considered as a conceptual construct by Giunipero and Eltanway (2004) and Zsidisin and Smith (2005). Gaudenzi and Borghesi (2006) view supply chain risk as a part of the performance creation process, representing aggregate business performance as a function of business objectives. Furthermore, SCRM has been considered as driven by the perfect order index for the creation of customer value. Finally, Neiger *et al.* (2009) believed that the incorporation of risk into an objective business structure is yet to be implemented in the field of SCRM.

Thus, a clear understanding of SCRM is essential if a more nuanced and effective approach to problems is to be developed and implemented successfully by firms.

3.6.8 Limitations of the risk management process

Though the risk management process is complex and dynamic, it has its limitations. Research shows that risk management is an important part of any organisation. However, research also shows that any organisation such as a

maritime industry firm needs to keep in mind that the risk management process should also be prioritised in order to make sure that it does not take up more resources than necessary. If the organisation focuses on risk management too much then the organisation can distract its directors from meaningful business activities and, as a result, hurt the business and the objectives of their endeavour. Furthermore, at the beginning of any project, if risk management is prioritised too much then the project runs the risk of never getting off the ground and/or never being completed (Tang, 2006). Research indicates that this is particularly true in cases when all other activities are put on hold in lieu of the risk management process being fully completed. In other words, though risk management is an integral part of project management, the project as a whole or the organisation cannot keep from beginning activities and engaging in business behaviour until the risk management process is completed because the risk management process is never fully complete. Risk management is an ongoing and evolving endeavour that requires more input and additional information and, therefore, it has to take place in conjunction with all other business activities, not before them.

Another important limitation of the risk management process is the often-overlooked difference between the notion of uncertainty and the notion of risk. Risk is the measurement of an impact of a particular event or events times the probability of this event or events occurring. The limitation comes into play when the risk management team spends too much time on making improper or inaccurate assessments and prioritisation of various risks (Tang, 2006). In particular, if risk is improperly assessment and prioritised, then the team will likely waste a lot of time worrying and minimising losses that are not likely to take place. Spending time on risks spends resources that would be better spent on other aspects of risk management. Research also suggests that though unlikely events do take place, it is often not wise to spend resources on planning for them because they are so unlikely. Instead, it is better to transfer these risks and worries to third parties such as insurance companies rather than keeping them in-house.

Finally, another important limitation of risk management is that though it is rather scientific in its approach, it is not entirely a science. Instead, risk management depends largely on qualitative data, which is very subjective and often inconsistent (Tang, 2006). Due to these issues, risk management needs to be kept in check in terms of how many resources an organisation such as a firm within the maritime industry devotes to it.

3.7 General overview of types of risks

An important type of risk within the world of business and the maritime industry is financial risk (Frittelli and Gianin, 2002). Financial risk refers to the volatility or unpredictable variability of financial returns on certain investments (Artzner *et al.*, 1999). This volatility can refer to both positive returns, or investments that bring in more than the expected amount of money, and negative returns, or investments that bring in less than the expected amount of money (Artzner *et al.*, 1999). The maritime industry and other business industries are also subject to economic risk in addition to financial risk. Economic risks come from lower revenues and/or unexpectedly high expenditures (Frittelli and Gianin, 2002). Other common economic risks that organisations face are increases in price for raw materials, poor planning and failure to meet deadlines on shipping or development of new facilities, disruptions to the overall shipping process and new competition (Frittelli and Gianin, 2002). Other factors that might impact shipping and the maritime industry include loss of resources due to natural disasters or storms encountered at sea.

Another important area of risk that the maritime industry faces comprises risks associated with health and safety. Health and safety contribute to uncertainty within the maritime industry because the industry is based around heavy shipping; problems with employees as a result of health and safety play an important role in impacting the productivity of the industry as a whole (Holtgrave and Weber, 1993). For instance, many organisations within the industry ship toxic chemicals and other toxic materials, so a problem that results in the release of these materials into the atmosphere affects not only the environment, but also the people on the ship and those in the area where the ship

is located (Weinstein, 1984). The release of these materials not only poses a risk to the safety of the personnel within the organisation, with both short- and long-term consequences, but also threatens an additional loss of monetary resources resulting in additional financial and economic risks (Holtgrave and Weber, 1993). In an effort to deal with all the various risks that an organisation faces, the organisation needs to develop effective risk management processes.

3.7.1 Types of supply chain risks

It has been shown that there are several types of supply chain risks (Juttner *et al.*, 2003). Although classifications of risks may differ between researchers, several commonalities exist. Common risks across virtually all industries and sectors include, for example, fires, truck accidents, machine failures, labour strikes and, increasingly, in the wake of climate change, natural disasters such as earthquakes, tsunamis and floods.

According to scientific research (e.g. Juttner *et al.*, 2003), the concept of SCRM is classified as environmental risks, organisational risks and supply chain-related variables (Figure 8). Environmental risk sources cover all uncertainties that result from the supply chain's interaction with the environment as well as other sources like accidents such as fires, socio-political actions such as terrorist attacks and natural disasters such as earthquakes. Organisational risks cover labour costs such as strikes; production uncertainties like machine failure; and IT system failures. Finally, network-related risks may be the result of ill-conceived or faulty collaborations between organisations in the supply chain.

Other classifications of risks in the literature focus on macro-economic forces. For instance, Johnson (2001) identifies two kinds of supply chain risks: *supply* risks such as capacity limitations, currency fluctuations and supply disruptions and *demand* risks such as seasonal imbalances, volatility of fads and new products. Other researchers take into account operational risks. Zsidisin *et al.* (2000), for instance, categorises supply risks according to design, quality, cost, availability, manufacturability, supplier reliability, legality, environmental factors and health and safety factors. In addition, these authors define supplier uncertainty as the

potential for a detrimental incident to occur within a specific supply source. Zsidisin *et al.* (2004) view supply chain risk mitigation from the perspective of the purchasing organisation.

From an extra-organisational perspective, risk takes on different, but equally potent, dimensions. Zsidisin *et al.* (2000) argue that supply chain risks of this nature require specific mitigation techniques. These techniques include strengthening supplier quality, lessening the chance of supply disruptions and improving the process through which goods and services are supplied by vendors. Managing risk from the supplier's perspective can help companies identify and manage sources of risk to their inbound supply. Wu (2006) has also pointed out the usefulness of considering supplier/supply risks rather than simply considering a product-focused approach.

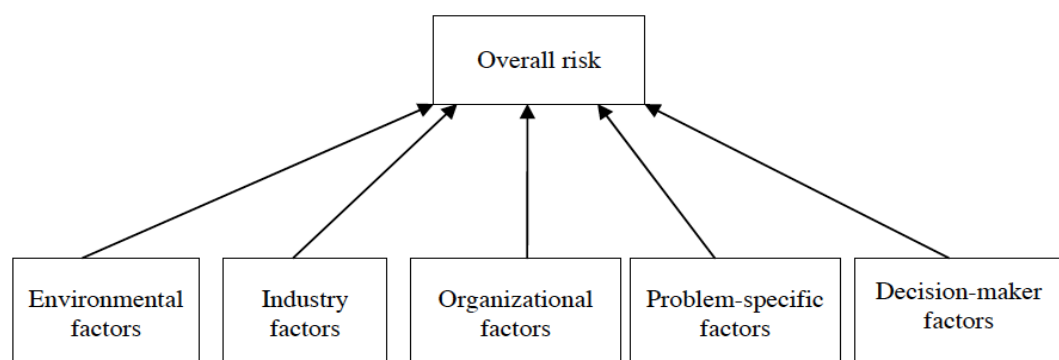
In support of this argument, recent studies have shown that a supplier's failure to deliver inbound goods and services can have detrimental effects throughout the purchasing firm and the supply chain (Zsidisin and Ellram, 2003; Tullous and Munson, 1991). In contrast, Finch (2004) notes that supply chain risks can be classified into three broad classifications: application level, organisational level and inter-organisational level. The risks included at the application level include natural accidents, deliberate acts, disasters, data or information security risks and management issues. At the organisational level, the risks involve the legal and strategic decision-making and any shifts of direction, whereas at the inter-organisational level, the possible uncertainties from outside an organisation could pose a risk.

Other scholars have pointed out that most of the existing research relies on a product-focused, rather than a supplier-focused, approach to SCRM. In practice, the two types of approaches are not easily separated. Norrman and Lindroth (2004), for example, identify supply chain risks as operational accidents, operational catastrophes and strategic uncertainty. All these risks apply equally to products as well as suppliers. Operational accidents are those that affect the operational processes or resources related to logistics/supply chain, such as fires,

truck accidents, machine failures, labour strikes, etc. Although most companies encounter day-to-day operational accidents, the incidence of these risks occurring depends on how these supply chain risks are prepared for in the first place. If these risks are not part of contingency planning, they cannot be assessed, let alone managed effectively. Operational catastrophes are risks that cannot be predicted, but once they happen, they affect many levels within a firm; such risks include natural disasters, socio-political instability, economic disruptions and terrorist attacks. Lastly, strategic uncertainties are risks which are hard to address and affect a firm strategically. These can occur in the form of volatile demand, supplier default/bankruptcy, increasing competition, market constraints and technological change.

Adding more detail to risks encountered by businesses, Rao and Goldsby (2009), citing Ritchie and Marshall (1993) mentioned that business and organisational risks appear from (1) environmental, (2) industry, (3) organisational, (4) problem-specific and (5) decision-maker related factors or some combination thereof. Ritchie and Marshall (1993) place the first three factors (environmental, industry, and organisation) into the broad category of “framework factors”. This category is a “range of circumstances in which the overall situation that the organisation is operating” .

Figure 8: Outline of possible risk factors



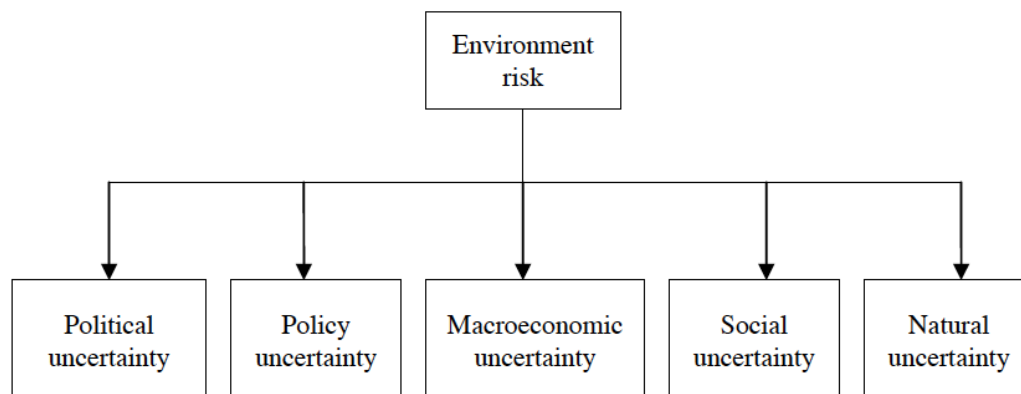
3.7.1.1 Environmental factors

As Figure 9 shows, environmental risks are risks that alter the general firm context throughout industries (Ritchie and Marshall, 1993). Miller (1991)

explained that common environmental risks are the following:

- Political instability, a severe changes in political regimes (Shubik, 1983).
- Shifts in government policy, especially alterations in government policy that effect the business community (Ting, 1988).
- Macroeconomic uncertainties, which incorporate any instabilities in the prices and economic activity (Oxelheim and Wihlborg, 1987).
- Social uncertainties, which exist when government policy or business practices do not reflect the values, beliefs and attitudes of the population (Dunn, 1983).
- Natural uncertainties, which include several phenomena (e.g. earthquakes, fires and floods) could be capable to damage the business and reducing the productive capacity of it's operating in the affected region (Miller, 1991).

Figure 9: Variables constituting environment risk



3.7.1.2 Industry factors

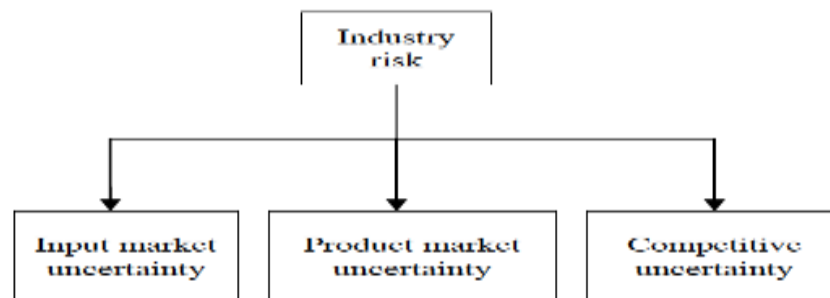
As Figure 10 shows, industry risks are risks that might not have an influence upon all areas of the economy, just on specific industry segments instead (Ritchie and Marshall, 1993). Miller (1991) categorized industry-specific uncertainties to three groups:

- Uncertainties of input market, which reflect the uncertainty surrounding

the acquisition of adequate quantities and qualities of inputs into the production process.

- Uncertainties of product market, which reflect unanticipated changes in the demand for a firm output.
- Competitive uncertainties, which includes all the uncertainties linked with competition among existing and potential applicants into the industry”.

Figure 10: Variables constituting industry risk

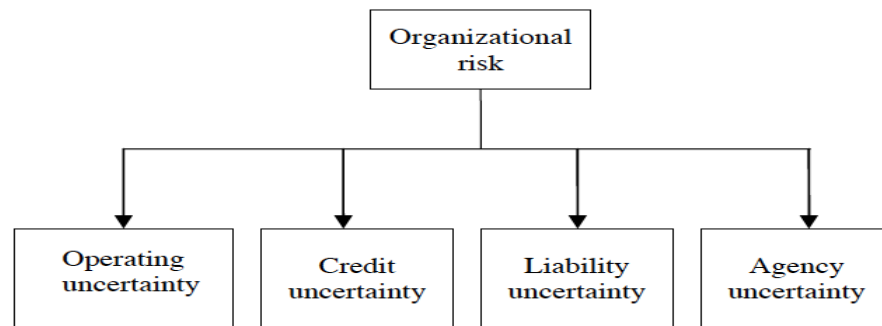


3.7.1.3 Organisational factors

As Figure 11 shows, Ritchie and Marshall (1993) noted that the organisational uncertainty is third group of uncertainties that confront the firm level (i.e.). Miller (1991) and Wu *et al.* (2006) argued that the main risks that could be firm-specific variables yet that also impact the entire supply chain are as follows:

- Operating uncertainties, which include specialised labour or other inputs which are often firm-specific but may still damage the whole supply chain.
- Liability uncertainties, which are unanticipated and negative effects due to the production firm’s product.
- Credit uncertainties, which include troubles with collectibles. Defaults by clients on their debts to a firm can be a direct cause of variation in the firm’s income stream.
- Behavioural uncertainties, which are correlated with the agency relationships within a firm.

Figure 11: Variables constituting organisational risk



3.7.1.4 Problem-specific factors

Risk, to some extent, is endogenous to a firm, and some influence would occur on how they want to manage such risks internally (Bettis and Hall, 1982). There are influence made by several risk decrease behaviours on other organisational processes; these influence, in turn, raise other types of risks. So, it can be argued that problem-specific risk could be influenced by one or more of the following:

- Risk inter-relationships, which relate to the structure of a whole risk and require an understanding of the risk and interrelationships implicated (Ritchie and Marshall, 1993).
- Objectives and constraints, which impact the problem resolution (Bettis and Hall, 1982).
- Task complexity, i.e. the decision task complexity in its several dimensions.

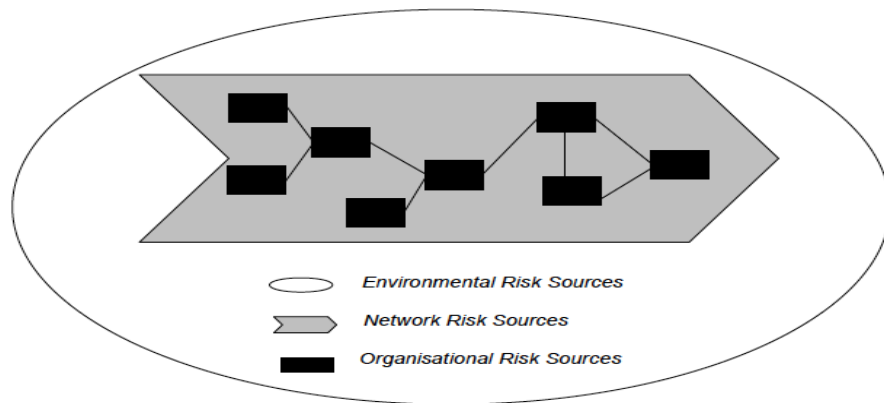
3.7.1.5 Decision-maker related factors

In figure 12, Decision-maker related risks might be correlated to an individual or a decision-making group within an organisation and can include one or more of the following:

- Knowledge/skills/experiences/biases of the decision maker(s) regarding the framework of risk and issues involved (Ritchie and Marshall, 1993).
- Information-seeking behaviour on the part of the decision-maker(s).

- Rules and procedures for taking decisions (Wilson, 1982).
- Bounded rationality of the decision-maker(s).

Figure 12: Sources of supply chain risk



Other classifications of risk can be found in the literature. For instance, Mason-Jones and Towill (1998) and Jonsson (2008) have classified the risk types into the manufacturing process, control systems (from the demand as well as supply side) and environmental factors. Harland *et al.* (2003) has proposed the following categories:

- Strategic risk, which influences the implementation of the business strategy.
- Operations risk, which influences the internal ability to produce and supply goods/services.
- Supply risk, which adversely affects the inward flow of any type of resource to enable operations to take place.
- Customer risk affects the likelihood of customers placing orders; it is grouped with factors such as product obsolescence in product/market risk.
- Asset impairment risk reduces the utilisation of an asset and can arise when the ability of the asset to generate income is reduced.
- Competitive risk affects a firm's ability to differentiate its

products/services from its competitors.

- Reputation risk erodes the value of the whole business due to a loss of confidence.
- Financial risk exposes a firm to potential loss through changes in financial markets; it can also occur when specific debtors default.
- Fiscal risk arises through changes in taxation.
- Regulatory risk exposes a firm due to changes in regulations affecting a firm's business, such as environmental regulation.
- Legal risk exposes a firm to litigation with action arising from customers, suppliers, shareholders or employees.

Table 4: Types of risks

<i>Authors (see references)</i>	<i>Types of risks</i>
Ritchie and Marshall (1993)	Environmental Factors, Industry Factors, Organisational Factors, Problem-Specific Factors and Decision-Maker Related Factors.
Mason-Jones and Towill (1998)	Process, Control, Demand, Supply and Environment Risks.
Juttner et al. (2003)	Environmental, Organisational and Supply Chain-Related Variables.
Harland et al. (2003)	Strategy, Operations, Supply, Customer Relations, Asset Impairment, Competition, Reputation, Financial Markets, Fiscal, Legal and Regulatory Risks.
Chopra and Sodhi (2004)	Disruptions, Delays, Systems, Forecast, Intellectual Property, Procurement, Receivables, Inventory and Capacity Risks.
Finch (2004)	Application Level, Organisational Level and Inter-Organisational Level.
Norrman and Lindroth (2004)	Operational Accidents, Operational Catastrophes and Strategic Uncertainty.
Manuj and Mentzer (2008)	Supply, Demand, Operational, Security, Marco, Policy, Competitive and Resource Risks.
Jansson (2008)	Environmental, Supply, Demand, Process and Control Risks.
Waters (2009)	Strategic, Natural, Political, Economic, Physical, Supply, Market, Transport, Products, Operations, Financial, Information, Organisation, Management, Planning, Human, Technical, Safety, Environment and Local Permits.

As shown in Table 4, a broad range of risks is addressed by Waters (2009). Waters (2009) notes that risks are neither external nor internal; however, he also notes that there are other ways to categorise the types of risks, such as risks related to the flow of material, money and information.

From the above table, one can discern that operational accidents, operational catastrophes and strategic uncertainty are the most commonly cited types of risks in the literature. Strategic uncertainty is discussed in about 24 articles. Operational risks are discussed in about 17 articles, while operational

catastrophes have received relatively less attention. Remarkably, only 7 articles addressed all three types of risks (i.e. Juttner *et al.*, 2003; Zsidisin, 2003; Christopher and Peck, 2004; Norrman and Jansson, 2004; Peck, 2005; Wagner and Bode, 2006; Wu *et al.*, 2006). The following section defines a new classification in order to address all the types of risks that appear in maritime firms in Saudi Arabia.

3.8 Maritime security and risk

Maritime security in supply chain has been engaged in governments and industry organizations. The International Organization for Standardization (ISO) offers outlines for security in supply chain firms. Too, there are in many forms such as Secure Trade in the APEC Region (STAR) Initiatives, Secure and Facilitate Global Trade (SAFE) Framework of Standards, Singapore Customs Secure Trade Partnership (STP), Business Anti-Smuggling Coalition (BASC) Initiatives. However, these programs mainly aim to help on the implementation of voluntary requirements and do not often cover all other applicable security measures.

In academic level, the researcher found that there are several management approaches mentioned such as risk management (Thai and Grewal, 2007; Thai, 2009; Gould, et al., 2010), business continuity management (Gutiérrez, 2007; Thai, 2009; Gould, et al., 2010), quality management (Thai and Grewal, 2007; Thai, 2009; Hints, et al., 2009; Gould, et al., 2010; Urciuoli, et al., 2010), disaster management (Macdonald and Corsi, 2013), crisis management (Gutiérrez, 2007), layered approach (Bichou et al., 2014; Urciuoli et al., 2010), and total security management. Still, there are other frameworks were found in terms of maritime and supply chain security management; the supply chain security management model (SCSMM) which developed by Gutiérrez (2007), the framework for supply chain security management (FSCSM) proposed by Closs et al. (2008), the conceptual models of effective maritime security (CMEMS) introduced by Thai (2009), and the maritime security management system (MSMS) proposed by Thai and Grewal (2007).

Current technological research in the fields of sensors capable of identifying nuclear, chemical and/or biological elements may help to identify at-risk shipments. The capability to understand what is moving when and where, to identify unusual or suspicious elements and concentrate on them and to deal with the rest of the movements through a sampling-based process may be a viable strategy. Efforts such as the Container Security Initiative, the Customs Trade Partnership Against Terrorism (CTPAT), and the overarching Operation Safe Commerce initiative provide directions that in the long term will enhance the security of global commerce (Downey 2004).

There are several strategies that help to minimize risks such as postponement, hedging and control. Bucklin (1965) described that Postponement is an action to defer the actual commitment in order to provide flexibility and delay the incurring of costs. Further, there are some remarkable benefits when postponement is used (Perry, 1991). Postponement has many forms, such as labelling, packaging, assembly and manufacturing. Time postponement refers to the movement of goods from the manufacturing plants only after customer orders are received (Zinn and Bowersox, 1988). The postponement concept relies on demand customisation, component costs, product life cycle and product modularity (Chiou, Wu, and Hsu, 2002).

Duarte (1998) suggested that a hedging strategy is an ideal to minimize and lower downward risks. Too, Chichilnisky and Heal (1998) noted that the statistical and the economic approach are two ways to hedge risks. The statistical approach deals with the law of large numbers. The number, with a large enough population, is likely to be affected with considerable accuracy. The sample mean is highly predictable if the distribution for each person or group is known. On the other hand, the economic approach happens when many people are affected at once. For example, a decline in G.B pound value is the same for everyone in the G.B. economy. Hedge is about to gather the statistical and the economic approaches to accomplish a position such that no financial risk exposes the insurer to risks higher than can be afforded.

In a supply chain context, hedging is undertaken through a globally dispersed portfolio of suppliers, customers, and facilities such that a single event (like currency fluctuations or a natural disaster) does not affect all the entities at the same time and at with the same level. For example, dual sourcing can be used as a hedge against risks of quality, quantity, disruption, price, and opportunism. Similarly, while the underlying cost structures in plant and technology acquisition and operating costs are specific to the industry, production risks can be offset by operating faster, more flexible plants, versus dedicated, efficient plants. Multiple contracting acts as a hedge to reduce variability in performance and a shield against single supplier opportunism (Manuj and Mentzer, 2008).

Several studies revealed that some risks are opportunism and asset specificity by the supplier, capacity constraints and the supplier buyer power balance (Achrol *et al.*, 1983; Ellram and Siferd, 1998; Williamson, 1979; Manuj and Mentzer 2008). Organisations with vertical integration could raise control by decreasing the risks of supply or demand failures in the supply chain, although it alters variable costs into fixed costs. Hence, Carlton (1979) noted that there is a solid incentive for an organisation to provide high probability demand itself and pass on low probability demand to other firms. This is called partial or tapered integration, which leads to full utilisation of the equipment of the firm and allows the supplier to absorb the risks. Designing flexible contracts with clauses that account for possible changes in the environment and associated risks also acts as a control mechanism (Macneil, 1978). Contracting with suppliers based in the host country but having manufacturing facilities in low cost countries provides the benefit of low cost and better access to legal recourse if things go wrong (Manuj and Mentzer, 2008). Is it the same one in the ref or another one?

Overall, the thesis provides the research approach that is used and it would be found in methodology chapter.

However, due in part to the size of maritime operations and the complexity of industry projects, the capacity of the industry to manage risk is severely hampered; indeed, the maritime industry does not manage risk very well. The sheer number of individuals involved with any one maritime project, with all

their varying skill levels and hierarchical positions, makes risk management very difficult. Because of these difficulties, the record of industry is a poor in finishing projects on schedule and on budget (Kristiansen, 2013, pp. 23-87). In addition to time and budget issues, poor quality and low standards also afflict many maritime industry projects, with some not being completed at all due to financial issues and/or environmental problems.

Despite the complexity of the maritime industry and the projects that they undertake, it is possible to predict and mitigate the risk associated with their projects (Kristiansen, 2013, pp. 23-87). With some foresight and planning, the project manager should be able to neutralise some of the potential risks that face projects. One of the major obstacles, finance, can be overcome with an accurate budget and funding secured before the project begins. Much of the financing that is needed to complete a maritime industry project can be set up ahead of time with proper planning and initiative on the part of the project manager. Likewise, project managers can meet the necessity for suitable operational management by hiring and organising all sub-contractors prior to starting the project, thereby mitigating some risks that would result from rushing to hire additional sub-contractors in the middle of the project.

3.8.1 Management in the maritime industry

The responsibility for the upkeep of quality throughout the maritime industry falls upon the heads of managers. management is the process of applying skills, tools and approaches to fulfil certain activities and goals. managers' role is to ensure that, at all levels, individuals are carrying out their assigned task to the specification of the plan. In other words, managers are individuals who oversee certain activities and/or projects and make sure that everyone who is working on a given site is doing what they are supposed to be doing when they are supposed to it. This is a very important position because this individual or team of individuals works to ensure that quality is assured and maintained throughout the maritime industry process.

Because of this position, and the fact that they are tasked with overseeing various teams across sites, managers have a critical role in the management of risks in the maritime industry. the management has the capacity to identify and manage the potential and ongoing risks within their projects. Managers mitigate and manage risks by maximising the consequences of positive events and minimising the effects of negative instances or events. This proses plays an integral role in managing risk because they are the individuals who oversee various teams of individuals who are working together on different sites. Thus, they play an essential role in identifying potential problems and/or risks associated with different areas of the maritime industry project. Furthermore, managers are also the individuals responsible not only for identifying potential and ongoing risks but also for responding to and managing those risks. Research views the concept of risk as something that is an option or a choice instead of something that is a predetermined outcome. Risk affects outcomes of projects by playing a role in the remaining choices that individuals and/or managers make. However, an activity being highly risky does not necessarily mean that a negative outcome is guaranteed. Risk is unavoidable and plays a role in all the decisions and activities that occur within the maritime industry and on site at all projects. The success and efficiency of a manager is determined by their capacity to manage the risks that present themselves to their projects and to maximise the positive outcomes of those projects.

Table 5: Number of existing articles per industry

<i>Industry Sectors</i>	<i>Articles</i>
Electronics	35
Automotive Industry	32
Aerospace	19
Telecommunications	11
Semiconductor	12
Metal Industry	14
Textile and Garment Industry	12
Third Party Logistics (3PL) Providers	14
Construction Industry	12
Medical and Dental Devices	10
Agricultural Industry	10
Toys Industry	8
Chemicals and Pharmaceutical Industry	13
Other Industries (Leather, Packaging, Tobacco, Marine Transport, Cosmetic, etc.)	16
Total	218*
* Some articles have no application to any sector	

3.8.2 Types of risk in the maritime industry

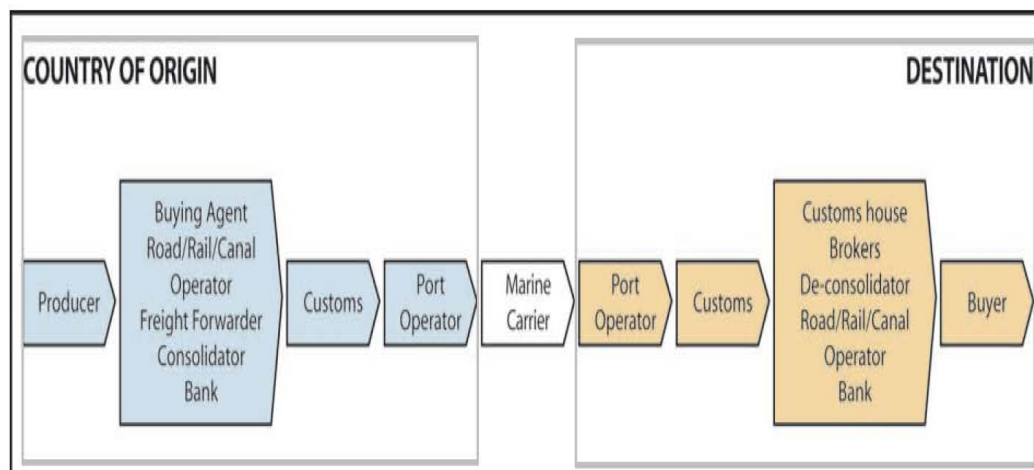
Certainly further development of risk analysis, and the understanding of risk, will only continue to prove beneficial to the projects that it affects. A reasonable next step is to identify which different types of risk are associated with different industry sectors. Vanany *et al.* (2009) declared that strategic uncertainty could be a concern for the innovative industries, as product life cycles are becoming shorter in the wake of rapid technology development. Operational accidents could also be correlated with the minor awareness of internal risks that is often attributable to weak management systems. Future studies should focus attention on the fine details of risks within particular industry sectors.

The maritime industry is an interesting site for further study and application of risk management strategies. The extensive literature review undertaken so far has considerable relevance for this sector. However, the maritime industry also

poses challenges to existing literature. This section considers some of the issues in more detail.

To begin with, a maritime supply chain consists of two distinct elements: pre-customs (origin) and post-customs (destination). Besides these elements, the complexity of the maritime supply chain purely from a transactional perspective is, itself, noteworthy. Interactions include buying agents, road/rail transport operators, freight forwarders and consolidators – all have some degree of contact with commodities being shipped. At the destination, similar participants engage in disposal of goods (see figure 13).

Figure 13: Flowchart of maritime supply chains



Source: International Maritime Organization (IMO)

The maritime industry thus calls forth a wide-ranging classification of risk. Such a classification must, firstly, confront any element involved in a complex maritime supply chain and, secondly, be underpinned by a clear and well-defined vision that can be simply and flexibly adapted to the maritime supply chain.

Although it must be acknowledged that a number of risk classifications may apply to the context under consideration, the researcher concluded, after a careful review of the literature, that a three-fold classification is appropriate for the study of the Saudi Arabian context. The elements of this classification are operational risk, strategic risk and financial risk. These risks are not disparate nor can they be studied in isolation from one another.

The importance of maritime transport in Saudi Arabia with its worth of £323 million in trade lies in the country's long coast, which extends for more than 1500 miles, and in the fact that 90-95% of the country's imports and exports are transported through the sea. In 2012, Saudi Arabia reached a volume of goods totalling 188 million tons. Saudi Arabia has since paid great attention to the maritime sector, constructing modern ports and shipyards, starting marine companies and institutions and modernising the commercial marine fleet. The commercial marine fleet supports the military fleet at times of peace and war (Ports authority, 2014). However, the maritime transport industry faces many risks such as strategic, natural, political, economic, physical, supply, market, transport, products, operations, financial, information, organisation, management, planning, human, technical, safety, environment and more. Thus, it is a substantial opportunity to study the sector of maritime transport in Saudi Arabia and to identify the benefits of SCRM in reducing the risks that might face the relevant firms in order to enhance profitability.

3.9 Aspects of effective supply chain risk management

The process of SCRM is invaluable to all organisations, but especially to the maritime industry because SCRM helps decrease delays, saves financial resources and allows projects to be completed on time. Research indicates that ideally risk management should create value and be an integral part of all the operational and organisational processes related to a project (Juttner, 2005). SCRM builds value, fewer resources are applied to reduce risk than to cover the consequences of failing to mitigate risks. For instance, risk management makes decisions regarding what kind of security a maritime industry firm should have. These decisions and the costs associated with the security services are there to ensure that the site is made safer against possible vandalism and/or theft of equipment and materials.

Because SCRM is such an important part of any project, it should be incorporated into the organisational process of the entire project, including but not limited to the decision-making process. Effective SCRM should also explicitly address any uncertainties that various parts and actions of the project entail, and this process

of addressing these uncertainties should be structured and systematic (Juttner, 2005). SCRM must have current updated information about conditions that may affect business. Furthermore, it should also take into account factors that are hard to evaluate quantifiably such as human error.

Another factor that contributes to effective SCRM is the ability to be clear and transparent and dynamic (Juttner, 2005). In other words, good SCRM is responsive to change rather than static and one-dimensional. Because it is a process rather than a solution or a one-time calculation, SCRM is tweaked and changed according to new conditions that arise on the maritime industry site, as changes in the conditions affect the likelihood of certain risks. Because SCRM is a dynamic process, it is also one that is involved in continuous re-assessments or re-assessments over periods of time and one that can be improved over time.

3.10 Evaluation of supply chain risk management

This literature review revealed multiple techniques available to decrease risk levels. Some of these techniques were listed by Lavastre, Gunasekaran and Spalanzani (2012); such as employing safety stocks (vendor owned inventory [VOI]); ensuring effective communication and exchange of information (forecasting, operations); establishing emergency scenarios; centralising operations (stocks, production and/or distribution); performing activity planning using Advanced Planning Systems (APS); appointing a risk manager who convenes an SCRM group. Others like, establishing long-term continuity in partnerships; centralising decisions; establishing a focal firm which coordinates the supply chain; assisting providers/suppliers in improving their performance; reducing the number of suppliers; introducing rewards for an absence of misconduct and faults; improving forecast accuracy; establishing cultural proximity with partners; encouraging responsiveness and reactivity via Supply Chain Event Management (SCEM); establishing external safety stocks which are co-owned by the partners; performing dual sourcing (or dual manufacturing); and building friendly personal relationships with partners. These techniques are discussed later in the interviews.

The literature review has addressed several types of supply chain risks from different perspectives, including the strategic, political, economic, financial, organisational, managerial, logistical, planning, human, technical and environmental aspects of SCM. The evaluation of SCRM has shown that there are many ways in which risk management processes can assess risk sources in a supply chain, for example defining supply chain adverse consequences, identifying risk drivers and mitigating risks for a supply chain. This review of SCRM-related articles has considered the risks in diverse sectors, including the electronics, automotive, aerospace, telecommunications and third-party logistics providers. In particular, the conceptual models used or referred to by researchers tend to be heavily quantitative in their approach. Among others, the AHP and IDEF models have been discussed in this chapter, respectively showing the managerialist and technical slant of current SCRM thinking in this area. For all their advantages, such models leave unexplored empirical terrain that merits a more fine-grained, qualitative approach that can capture the perceptions of actors directly involved in SCRM.

3.11 Chapter summary

This chapter has discussed the method with which the literature review was conducted. The review started with supply chain management (SCM) and risk management, and then supply chain risk management (SCRM) was explored. The chapter outlined some of the key issues in SCRM and established some of the key research caveats in the field. The classifications used within SCRM articles published between 2000 and 2015 have shown that SCRM is a rapidly growing area. This literature review also highlighted key gaps in current scholarship on SCRM in the maritime industry. The following chapter states the methodological strategy used in this thesis to address these gaps and then justifies the subsequent methodological orientation.

CHAPTER FOUR: METHODOLOGY

4.1 Introduction

This chapter presents the methodology for the thesis and explains how the theoretical proposals can be improved and verified. This study examined the supply chain risk management (SCRM) environment and strategies of the shipping sector in the Kingdom of Saudi Arabia. In particular, the researcher was interested in investigating this environment as it is perceived and experienced by managers who are directly working in companies within the shipping sector. This chapter starts by describing the philosophical background to the research themes. It then gives an argument to justify the importance of the research approach. Then, the methods for analysis are investigated with an exploratory case study research. In an effort to carry out this case study, the researcher tests and explores the models currently governing SCRM to determine their validity and to see what risks they identify for Saudi Arabian firms and what strategies they recommend for managing these risks. One of the aims of the research was to identify whether risk management strategies can be improved and strengthened using the current theories and models.

Firstly, the researcher elected the method by having an investigation in literature review, explored in chapter three. The aim was to find the key issues in terms of mitigating risk in the supply chain at maritime firms. Too, this investigation helped the researcher to develop the research questions.

Lavastre, Gunasekaran and Spalanzani (2012) revealed that the number of articles with suitable empirical research that study ways to reduce and manage supply chain risk is few. Additionally, few studies attempt to witness supply chain manager attitudes regarding to risk. Also, several studies examined SCRM in Australian companies (Singh *et al.*, 2005), Chinese companies (Jiang, Baker and Frazier, 2009) and German companies (Thun and Hoenig, 2011), French companies Lavastre, Gunasekaran and Spalanzani (2012) but none have been undertaken using maritime firms. To fill this gap, this thesis addressed the subject of supply chain risk management in maritime firms at Saudi Arabia.

This thesis studies maritime firms in Kingdom of Saudi Arabia. The thesis selected firms that met the researcher requirements; they are large and medium sized companies and in relatively competitive markets. Those firms also have similar structural of elements. However, these firms perform many services, including general cargo services, shipping of chemicals, marine services and ship management and many more. The study decided to focus on only a few companies (five firms), rather than on a wider sample, in order to have a more comprehensive examination of top management teams' responses to changes in the business environment (Tarziján, 2013).

The general structure of this thesis contains of two stage methodology. Stage one is about an exploratory case study, fifteen interviews with managers at maritime firms. In respect of a retrospective case study, secondary data from firms' records is also collected. The one of the purposes of this stage was to discover at the different opinions of risk between the firms. The second stage was a focus group investigation that would cover and validate the theoretical findings from the first research stage.

The researcher selected an exploratory case study research as a method for analysis in relation to the initial research issues regarding if risks can be eliminated or reduced in supply chain at maritime firms. Exploratory research was conducted because no empirical research found in the literature review on identifying and reduce risk in the supply chain across maritime firms. In general, the researcher noticed that a case study methodology was a good approach and well be suitable to this exploratory research phase. The design of the case study will be explained later in this chapter.

Pilot test was done to suit the needs and purposes of this study. Several maritime firms were contacted to help with the pilot test to this study. The respondents were asked to complete the questionnaire. As a result, several alternations were made.

4.2 Philosophical foundations: positivist versus constructivist approaches

Two key approaches to research are dominant in the literature: positivism and constructivism. This thesis adopts a constructivist approach. Constructivists tend not to start with a theory and work outwards from that; rather they tend to rely upon the "participants' views of the situation being studied", recognising the impact on the research of their own background and experiences. From the qualitative data they gather, constructivists tend to generate a theory or pattern of meanings through their own interpretation of this data. They rely mostly upon qualitative data collection methods and analysis, or a combination of both qualitative and quantitative methods (mixed methods). Utilising quantitative data, it is possible to support and expand upon the qualitative data, deepening the description generated.

It is worthy to outline the differences between the two philosophies in the first instance.

Positivist approaches can be an important research method within the information systems discipline. The positivist paradigm has the following positions with regard to the three dimensions:

1. The ontological position, in which an objective reality is assumed. That reality can be systematically and rationally investigated through empirical investigation, and it is driven by general causal laws that apply to social behaviour (Guba and Lincoln, 1994).
2. The epistemological position, in which the researcher and the phenomena being investigated are assumed to be independent, and the researcher remains detached, neutral and objective. Any reduction in independence is a threat to the validity of the study, and should be reduced by following prescribed procedures.
3. The methodological position, in which general theories are used to generate propositions that are operationalized as hypotheses and subjected to empirical testing that is replicable (Shanks, 2002).

Hypotheses should be testable and provide the opportunity for confirmation and falsification. This is the essence of the scientific method.

Yin (2013) and Pare (2004) argued that the validity of a positivist case study can be judged using the four following criteria: construct validity, internal validity, external validity and reliability. In constructing validity, issues arise as to whether empirical data in multiple situations leads to the same conclusions. There are also concerns about whether data is improved by using multiple sources of evidence (to essentially provide multiple data points for the same phenomenon), whether key informants review the case study report (to improve the accuracy of case study data) and how to establish a chain of evidence (so a reader can trace the chain of evidence) (Yin 2013).

Internal validity relates to the issue of whether empirical data provides information about the theoretical concept, and is achieved by using pattern matching to ensure that case study data cannot be explained by rival theories with different independent variables in the hypotheses (Yin 2013). Reliability relates to the stability and consistency of the study over time and is ensured by creating and maintaining a case study database and developing a clear case study protocol (Yin 2013). External validity relates to the generalisability of the findings of the study and is ensured by selecting a “typical” case (a single case that is representative of a large number of other cases) and selecting a case that is likely to confirm the hypotheses, so that disconfirming evidence can be considered decisive (Markus 1989). Research validity will be ensured by creating and maintaining a case study database and by using a protocol for the case study. The external validity of the case study could be improved by testing the model in other case studies.

Constructivist approaches are based upon the understanding that ‘reality’ is socially constructed. The perceptions of key actors in the process or system(s) used in SCRM in a particular context thus become interesting and, therefore, important.

4.2.1 Philosophical perspectives: deductive and inductive

This section outlines the overall approach and study design of the investigation in an effort to provide a rationale for the type of choices in terms of methodology that are described and used in this chapter. In general, academic research can be placed into categories: deductive and inductive. Deductive research tends to focus and operate from a fixed hypothesis, and this type of reasoning often begins with a fixed hypothesis and then tests the hypothesis using experimentation. Deductive research tends to be ‘top-down’ in that it focuses on proving or discarding certain hypotheses and theories which originate from an existing body of research and literature on the subject (Ritchie and Lewis, 2010).

Unlike deductive research, inductive research tends to focus on developing hypotheses through the course of the research study and on representing the research in a more open-ended and exploratory form. Inductive research uses approaches that seek to identify patterns within the data and to develop hypotheses and theories from this process. Typically, it also focuses on collecting data that is subjective, or in other words, data that yields to the particular world view that the participants have (Ritchie and Lewis, 2010). Given the focus of this research study and its research questions, the researcher decided that the inductive perspective is the best fit for this examination.

There are several necessary reasons to select the accurate research approach, Easterby-Smith *et al.* (2002) noted the following reasons:

- Initially, it assists the researcher to have a right decision about the research design.
- Then, it enables the researcher to elect the accurate strategies for the research. Understanding why something is happening versus what is happening indicates use of the inductive approach.
- Lastly, knowing different approaches of research helps one to adapt the research design to cater to constraints. Constraints may include limited

access to data or lack of prior knowledge of a subject to allow hypothesis building for deductive approaches.

However, The inductive approach, which seems to be suitable to the aims of this thesis, was preferred to improve theory as to why and how risk is identified in the supply chain of maritime firms in Saudi Arabia.

4.3 Research methods: qualitative versus quantitative

Healy and Perry (2000) perceived that realist and interpretivist research emphasises on the qualitative research aspects. Given the choice to utilise the inductive philosophical perspective in approaching research, a qualitative research design was also developed in order to collect qualitative data. Qualitative methods rely on deductive approaches and revolve around collecting and analysing numerical data (Creswell *et al.*, 2003). Because these approaches are positivist in nature, their aim is to develop standardised data by observing phenomena independent of their context (Creswell *et al.*, 2003). Quantitative data is mainly preferred by researchers who are aiming to develop reliable and generalisable outcomes compatible with statistical analysis and capable of yielding efficient and quickly derived results (Creswell *et al.*, 2003). Unlike quantitative research, qualitative research tends to examine phenomena in their entirety. Qualitative research relies on inductive approaches and revolves around collecting and analysing non-numerical data (Creswell *et al.*, 2003). Examples of non-numerical data might be answers to interviews and results of a documentary search; words, sentences, and paragraphs represent the data. Instead of aiming to develop standardised data by observing certain phenomena, qualitative research aims to develop more comprehensive results and understanding of the phenomena. This process of developing a more thorough understanding of what is going on is often time consuming (Creswell *et al.*, 2003). However, this process is also often more holistic and inclusive than the results and the findings of quantitative research. Because qualitative research methods take into account the phenomena in their entirety, the researcher decided that these methods are more appropriate to use than quantitative methods in collecting data for this research study.

For the purposes of this thesis, a qualitative – constructivist – approach was deemed most appropriate for several reasons. Generally, qualitative research methods are especially useful in discovering an in-depth understanding of human behaviour and the reasons that govern such behaviour (Bogdan and Biklen, 2003; Denzin and Lincoln, 2000). Additionally, a qualitative study helps researchers to investigate phenomena that are challenging to extract or learn about through conventional research methods (Strauss and Corbin, 1998). Moreover, qualitative research methods are considered as a best approach to study phenomena in their natural settings (Denzin and Lincoln, 2000) and when striving to understand social processes in context (Esterberg, 2002). Qualitative research methods also help researchers to be active participants in the study (Creswell, 2005). Furthermore, Sachan and Datta (2005) and Reichhart and Holweg (2006) note that the case study is one of the most commonly employed qualitative research methods in field of operation management. Voss *et al.* (2002, pp. 195) echo this sentiment, stating that “case research has consistently been one of the most powerful research methods in operations management”. Healy and Perry (2000) detected that case studies have criteria different to the realist criteria since only ontological issues are included in the definition of a case, but does not include them as the criteria of quality research. Saunders *et al.* (2007) noted that a thesis could apply multiple case studies. In order to assess if it is possible to generalise specific findings, multiple cases must be observed and examined. Qualitative research is frequently shown as a research strategy that focuses on a relatively open-ended approach to the research process; a strategy that frequently produces surprises, changes of direction and provides new insights (Bryman, 2006). McCutcheon and Meredith (1993) believed that the richness of case study research could be further strengthened to assure maximum measurement reliability and theory validity through a number of steps. If those steps done correctly, then case study research would be a truly scientific research approach (Meredith, 1998).

The quantitative approach is normally chosen to discover information of a numerical, statistical or objectively verifiable nature. The most common methods used in the social sciences are surveys, modelling and questionnaires. These data

are rarely rich on information; however, although data of this kind allows useful comparisons to be made across cohorts, for instance, or helps track longitudinal changes using large datasets, detailed information at the individual level can be difficult to obtain.

Boyer and Swink (2008) noted the limitations of quantitative research involve time, cost, incapability to generalise and prescribe and potential for bias in the perceptions of the researchers. In quantitative data analysis, new understanding can often spring from an imaginative application of techniques. When this is used in parallel with qualitative techniques, the unanticipated outcomes potentially become multiplied.

Consequently, the qualitative and quantitative methods can form part of a case study. Still, the qualitative research is well-defined in terms of interviews types conducted. Therefore, The thesis adapted exploratory semi-structured interviews then followed by focus groups to improve the accuracy from an examination using focus groups and interviews.

4.4 Developing appropriate research design: case study design

The research questions focused on descriptive issues in supply chain management and risk and served as a focus for gaining insight into perceptions of risk that people who work in the maritime industry have and what strategies can be improved. Using these research questions, the researcher conducted research using appropriate qualitative methods that might answer these questions. The researcher decided on the case study design as the appropriate design. An exploratory case study is an appreciated means to find out “what is happening; to seek new insights; to ask questions and to assess phenomena in a new light” (Robson, 2002).

4.4.1 Detailed case study design

The research design approach is a case study which explores in-depth the relationships of various participants with a number of variables. It is particularly salient for examining the depth of issues in managing supply chain risks in Saudi

Arabia. Case studies are analysed to further address the research questions, which are restated below.

- How do maritime firms in Saudi Arabia face supply chain risks?
- How can managers find and identify supply chain risks?
- How can risk strategies help to minimise or eliminate supply chain risk?

Yin (2013) states that the case study strategy has a distinct advantage when “a ‘how’ and ‘why’ question is being asked about a contemporary set of events, over which the investigator has little or no control”.

The case studies approach has been recognised as an important and effective research method within operations management (Voss *et al.*, 2002) and logistics (Ellram, 1996). Case studies are highly essential to address those how and why questions (Benbasat *et al.*, 1987; Yin, 2013). Yin (2013, p. 18) defines a case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident.”

Case studies can be grouped into two categories: intrinsic and instrumental. Intrinsic case studies focus on the superior understanding of one particular case (Stake, 1995). Instrumental case studies aim to deliver insight into an issue or refinement of theory (Stake, 1995). This study problem focused on instrumental cases, as it is designed to play a fundamental role.

What makes case studies so effective is that this approach is used for describing phenomena (Stake, 1995; Yin, 2013), developing theory (Eisenhardt, 1989) and testing theory (Sarker and Lee, 2002). Benbasat (1987) identifies the characteristics of case study research, by reviewing a number of other studies (i.e., Benbasat, 1984; Bonoma, 1983; Kaplan, 1985; Stone, 1978; Yin, 2013). In this review, the following attributes of the case study are developed:

1. The phenomenon is examined in a natural setting;
2. Data is collected by a multitude of means;

3. One or few entities (person, group, or organisation) are examined;
4. The complexity of the unit is studied intensively;
5. Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge-building process; the investigator should have a receptive attitude towards exploration;
6. No experimental controls or manipulation are involved;
7. The investigator may not specify the set of independent and dependent variables in advance;
8. The results derived depend heavily on the integrative powers of the investigator;
9. Changes in site selection and data collection methods could take place as the investigator develops new hypotheses;
10. Case research is useful in the study of “why” and “how” questions because these deal with operational links to be traced over time rather than frequency or incidence;
11. The focus is on contemporary events.

These characteristics are helpful for the case study method to investigate how the supply chain risks for maritime transport firms in Saudi Arabia are managed. Because it is not possible to evaluate all settings of supply system risk selection, the researcher then focused on particular organisations in order to allow for detailed investigation of each. Specifically, when investigating supply chain risk, it is essential to recognise the complexity of the setting without manipulation; doing so is supported by examination of the natural setting and collection of multiple means of data.

The multiple sources of data in this study help include a wide diversity of evidence such as documentation, archival records, physical artefacts, interviews, direct observation and participant observation (Yin, 2013). Yin (2013) explained

that by collecting a large diversity of evidence, the researcher is able to group the characteristics holistically and meaningfully and generate a better understanding of complex social phenomena.

A case study offers flexibility and depth of analysis as well, and that has made the case study the most popular qualitative research method in the field of supply management. Furthermore, Sachan and Datta (2005) and Reichhart and Holweg (2006) note that case study is the most commonly employed qualitative research method, with 16.1% and 15% of papers studied employing the case study method respectively. Voss *et al.* (2002, p. 195) stated that “Case research has consistently been one of the most powerful research methods in operations management”.

Case studies do have certain limitations. Case studies can be very time consuming, and researchers often encounter difficulties in accessing organisations for their case study research. The selection of cases to provide phenomenon explanations can also be difficult. Nevertheless, these problems of the case study approach are common due to the contextually rich exploration that it provides. A highly essential strength of the case study is that a wealth of evidence is generated surrounding the subject.

4.4.2 Data collection

The evidence in case study research is labelled into six sources, they are the following; interviews, documentation, archival records, direct observation, participant observation and physical artefacts (Yin, 2013). Each source has strengths and weaknesses, and no source has a widespread advantage over all the others. Different sources of evidence were collected and used to describe and define the SCRM for maritime transport firms in Saudi Arabia to enable the fullest application in this research.

The data collection focused on supply chains risks and their management; there was no data collected that was not relevant to these areas. The following sections discusses the process of performing documentation search in more detail.

4.4.2.1 Data collection: documentation search

Yin (2013) classifies the evidence in case study research into six sources: interviews; documentation; archival records; direct observation; participant observation; and physical artefacts. Documentation and archival records are classified under documentary search. This is an important aspect of qualitative research design, as data is typically collected from various databases in order to providing researchers with valuable secondary data. The documentary search in this thesis was conducted entirely on the web using a number of different databases. Examples of databases used in the search are Google, Google Scholar and academic databases such as Emerald Insight and DeepDyve. The data that was generated by this search gave the researcher greater understanding of various issues in supply chain management and risk.

Research suggests that this approach to collecting documentary data is appropriate to use in accordance with the objectives and the research questions which are the focus of this study (Patton, 2005). The following sections discuss various aspects of the documentary search in more detail.

4.4.2.1.1 Documentation

Documentation encompasses any documentary information that is relevant to the research. Yin (2013) noted that many forms of documentary information are available for this type of research:

1. Letters, memoranda, email correspondence and other personal documents such as diaries, calendars and notes
2. Agendas, announcements and minutes of meetings and other written reports of events
3. Administrative documents—proposals, progress reports and other internal records
4. Formal studies or evaluations of the same case that you are studying
5. News clippings and other articles appearing in the mass media or in community newspapers.

Documents are increasingly easy to access through Internet searches, which is convenient because it is important to corroborate evidence using other sources.

Documents are helpful for making inferences about events. Still, some documents can lead to incorrect indications in the hands of inexperienced investigators, which has been a criticism of case study research. Documents are links amongst different parties in a study, and documents show a clear character in any data collection in doing case studies (Yin, 2013).

4.4.2.1.2 Archival records

Yin (2013) provide the following examples of archival records:

- “Public use files” such as statistical data by local library, universities, governments;
- Service records, such as those showing the number of clients served over a given period of time;
- Organisational records, such as personnel records or budget;
- Maps and charts of the geographical characteristics of a place; and
- Survey data, such as data previously collected about a site’s employees, residents or participants.

Archival records have been used in this research in the form of computer files and records. However, not every record is accurate; it is very important that the researcher be accurate in assessing the correctness of the records before using them (Yin, 2013).

4.4.2.1.3 Interviews

Interviews are a highly important source of case study information. Additionally, they are an essential element of case study because interviews are guided conversations rather than structured enquiries (Rubin and Rubin 1995). There are several types of interviews that are possible: in-depth, focused, structured or survey interview (Tellis, 1997; Yin, 2013; Adams and Cox, 2008; Simons, 2009).

In in-depth interview, key respondents are asked to remark on certain events. They might also advise a solution or provide insight into events. Key respondents may also verify evidence obtained from other sources. Nonetheless, the researcher must seek the same data from other sources to verify the interview’s

authenticity and avoid becoming dependent on a single informant (Tellis, 1997, Yin, 2013).

The focused interview is used in a place that the respondent would be interviewed for a short period of time, usually with set questions. This type of interview is frequently used to verify data that has already been collected from another source (Yin, 2013).

The structured interview is similar to a formal survey, and is used to collect data in cases such as neighbourhood studies. However, the questions are more detailed and developed in advance, much as they are in a survey (Yin, 2013). Generally, interviews are a crucial source of case study evidence regarding to human affairs or behavioural event that provide important insights that are relevant to the researcher's objectives.

Interviews were an important part of this thesis. It was one of the most power tools for data collection.

4.4.2.1.4 Direct observation

Direct observation arises when the researcher is creating an opportunity during the case study. Direct observation has two types: casual data collection activities and formal collection with protocols to measure and record behaviours. Additional information is the most important element in this source; it is useful for providing extra information about the topic being studied. The reliability is improved when more than one observer is involved in the study. Glesne and Peshkin (1992) suggested that researchers should be as unobtrusive as the wallpaper (Tellis, 1997).

4.4.2.1.5 Participant observation

When the researcher actively participates in the process of observing, taking notes and entering into events, participant observation takes place. Yin (2013) shows that "This happens in studies of neighborhoods and organisations". This source delivers unusual opportunities for collecting data, but it is also possible

that the researcher may become part of the group, and that may not be beneficial to the study (Yin, 2013).

4.4.2.1.6 Physical artefacts

Physical artefacts may be collected during the study as part of a field visit. They can be instruments, tools, works of art or some other physical evidence. The orientation of the researcher in this case is to develop a broader perspective on the data that will prove useful in the process of discovery (Tellis, 1997; Yin, 2013).

It is noted that all sources are relevant for all case studies (Yin, 2013). The researcher would need to be qualified to implement all of them, but every case shows a range of opportunities for data collection.

Table 6: Six sources of evidence: strengths and weaknesses

Source of Evidence	Strengths	Weaknesses
Documentation	<ul style="list-style-type: none"> ➤ Stable - repeated review ➤ Unobtrusive - exist prior to case study ➤ Exact - names etc. ➤ Broad coverage - extended time span 	<ul style="list-style-type: none"> ➤ Retrievability - difficult ➤ Biased selectivity ➤ Reporting bias - reflects author bias ➤ Access - may be blocked
Archival Records	<ul style="list-style-type: none"> ➤ Same as above ➤ Precise and quantitative 	<ul style="list-style-type: none"> ➤ Same as above ➤ Privacy might inhibit access
Interviews	<ul style="list-style-type: none"> ➤ Targeted - focuses on case study topic ➤ Insightful - provides perceived causal inferences 	<ul style="list-style-type: none"> ➤ Bias due to poor questions ➤ Response bias ➤ Incomplete recollection ➤ Reflexivity - interviewee expresses what interviewer wants to hear
Direct Observation	<ul style="list-style-type: none"> ➤ Reality - covers events in real time ➤ Contextual - covers event context 	<ul style="list-style-type: none"> ➤ Time-consuming ➤ Selectivity - might miss facts ➤ Reflexivity - observer's presence might cause change ➤ Cost - observers need time
Participant Observation	<ul style="list-style-type: none"> ➤ Same as above ➤ Insightful into interpersonal behavior 	<ul style="list-style-type: none"> ➤ Same as above ➤ Bias due to investigator's actions
Physical Artifacts	<ul style="list-style-type: none"> ➤ Insightful into cultural features ➤ Insightful into technical operations 	<ul style="list-style-type: none"> ➤ Selectivity ➤ Availability

Source: Yin, 2013

Yin (2013) showed that the study's questions must be defined and finalised before a case researcher starts data collection. Furthermore, rival hypotheses and

theories or frameworks should be considered in order to give the study added quality and depth.

Yin (2013) suggested three principles of data collection for case studies; these principles are related to all six sources of evidence and aim to address the problems of establishing the construct validity and reliability of the case study evidence. They are as follows:

1. Use multiple sources of data.

Triangulation of evidence, which entails using multiple sources of data, enhances the validity of data collected from other sources and thereby increases the reliability of a study. Potential drawbacks are the time and resource requirements involved in using multiple sources and the high skill level demanded of the investigator.

2. Create a case study database.

Databases should be accessible even to new researchers, with clear descriptions for all documentation. There are two types of databases for sorting data during gathered during a case study: the data and the report of the researcher.

3. Maintain a chain of evidence.

To ensure reliability, it should always be possible to trace evidence back to its origins, both in terms of source and in terms of its relation to the research questions. The case study report must have appropriate citations and provide access to a database of the original evidence.

The following sections discuss the study's participants and other relevant details about the research methodology in more detail.

4.4.2.2 Identifying the case study's participants

The focus was on maritime industry professionals' perceptions of risk management in Saudi Arabia. Participants contained Purchasing managers, logistic/transport managers, distribution managers, operational manager and supply chain risk managers. These participants were involved in various aspects of risk management and assessment in the maritime industry. Participants had several levels of experience and worked for companies of different sizes: medium and large. All participation was voluntary, and none of the participants received any compensation in return for their responses.

The study was initially targeted at only people at certain firms, but the pool of participants was expanded after the researcher encountered difficulties finding enough participants. The pool was also expanded to include all possible individuals at any firm who had experience with risk management and supply chain management.

4.4.2.3 Data collection procedure for identifying case study's participants

Potential participants were found through connections at maritime firms in Saudi Arabia. After the researcher developed an initial list of 40 possible case study participants, he then contacted all people on the list of potential participants via email. Individuals who expressed an interest in participating were invited to participate, and the researcher set up a meeting where the interviews could be administered.

4.4.2.4 Primary data collection procedure: justification for interview portion

In order to augment the data that was collected from the procedure, the researcher also conducted a series of interviews. During the interview portion of the study, the researcher asked in-depth questions about supply chain management and risk management. The researcher also asked the participants about additional rewards that might be effective, as indicated by the literature review. In particular, participants were asked about their thoughts on risk

management and different risks faced within the maritime industry. The researcher developed the questions for the interviews after completing the literature review.

The interviews were semi-structured, open-ended interviews. Research suggests that semi-structured interviews are “excellent for gathering a deeper level of information than questionnaires” because they allow researchers and participants in the study to discuss the topic at hand in more detail (Drever, 1995, pp. 34-55). The researcher also chose this approach because the semi-structured interviews provided the study with a way to compare the interview responses, such as reasoning and explanations, with the findings of the other portion of the study (Drever, 1995, pp. 34-55).

The use of open-ended questions allowed participants to discuss various aspects of the question rather than just the parts that they considered the most important. The researcher ensured all participants that their answers would remain anonymous and that they should feel comfortable expressing their real opinions as they would not be identified and their answers would not be revealed to anyone and used only for the purpose of the study. The researcher attempted to ask the questions in the same order to all participants in order to diminish interviewer bias and increase the validity and reliability of the results. Different individuals spent different amounts of time answering the questions, and all interviews were recorded and interview transcripts were typed up from the recordings.

The researcher utilised the interview approach to collect qualitative data about the participants in order to get a better understanding of participants’ perceptions and attitudes about rewards and how they did or did not motivate them on the job. Prior research suggests that the mixed-method approach to collecting both qualitative and quantitative data would be useful given the objectives and the research questions of this study (Patton, 2005, pp. 64-86).

4.4.3 Interview methods

The study used an approach to investigate SCRM via the use of semi-structured interviews. Kvale (1996) explained that there are seven stages of analysis as follows:

- Thematizing: “Formulate the purpose of an investigation and describe the concept of the topic to be investigated before the interview starts. This was done at the outset of the investigation. The *why* and *what* of the investigation should be clarified before the question of the *how* – method – is posed”.
- Designing: “Plan the design of the study, before the interviewing starts”.
- Interviewing: “Conduct the interviews based on an interview guide and with a reflective approach to the knowledge sought and the interpersonal relation of the interview situation”.
- Transcribing: “Prepare the interview material for analysis, which commonly includes a transcription from oral speech to written text. This was done in handwritten format first, and then typed”.
- Analyzing: “Decide, on the basis of the purpose and topic of the investigation, and on the nature of interview material, which methods of analysis are appropriate for the interviews”.
- Verifying: “Ascertain the generalizability, reliability, and validity of the interview findings. Reliability refers to how consistent the results are, and validity means whether an interview study investigates what is intended to be investigated”.
- Reporting: “Communicate the findings of the study and the methods applied in a form that lives up to scientific criteria”.

With these seven stages proposed, the case study interview process would be a decent framework for the methodology. The researcher has coded the transcripts using a software application named QSR Nvivo which the researcher attended a course on Nvivo at Anglia Ruskin University for this purpose. Though, the data analysing process and verification are discussed later. The the interview process design would begin with selecting a proper sample for interview; this is reviewed in the next sections:

4.4.3.1 Key informants

As mentioned earlier, this research took place at the maritime transport companies in Saudi Arabia. Therefore, the interview participants for this research were selected from the operation, purchasing, logistics/ transport, supply chain and distribution units of the relevant companies. These functions are all heavily involved in the supply chain within this company; further information on participants is given later.

4.4.3.2 Interview composition

The interview composition consisted of two parts. First, the key informants for this research were purchasing managers, logistics/ transport managers, supply chain managers and distribution centre managers. Second, ten experts, each with experience of more than 20 years in the marine industry and academic field, were gathered from a faculty of maritime studies in a Saudi Arabian university for the two focus groups. The participants were asked a set of questions related to SCRM in the company. The questions were composed of two sections. The first section attempted to determine the importance of supply chain risks in terms of risk frequency and risk severity. The second section requested the respondents' demographic data, including type of business, job title and working experience.

4.4.3.3 Types of interview questions

The researcher used Kvale (1996) style for designing the exploratory interview questions, the style was the following:

1. Introducing questions.
2. Follow up questions.
3. Probing questions.
4. Specifying questions.
5. Direct questions.

6. Indirect questions.
7. Structuring questions.
8. Silence;
9. Interpreting questions.

However, samples of Introducing and probing questions can be seen in appendix 3. To answer these questions, the researcher relied upon perceptions of respondents within the maritime industry. Furthermore, instead of simply providing positivist answers to the research questions, the researcher aimed to fill the gap in knowledge in the field by exploring how stakeholders within the maritime industry in Saudi Arabia understand and feel about supply chain risk; further information on participants is given in next section.

4.4.3.4 The interview questions

The interview questions were focused on 15 participants in five different firms in Saudi Arabia. Purchasing managers, logistic/transport managers, distribution managers, operational manager and supply chain risk managers were requested to respond to 28 questions. The interviews were held in their offices. The questions were divided into five topics: structure of the firm and SCRM, risk perception, attitude and risk management tools, risk minimisation techniques and finally general questions. In the interviews, the researcher was interested in manager perceptions and representations concerning risk management in their firms. As mentioned above, the interviewed population consisted of managers, and at least two sessions of face-to-face interviews were held with every participant; each interview session was conducted following an interview guide and a qualitative methodology. These interviews offered an in-depth view of supply chain risk management (SCRM) in each of these firms and allowed the researcher to define managerial practices.

Each interview first sought the company's background information. This information was obtained via four questions related to background information on the firm. The following questions were posed:

- What do you think is the nature of the company's business?
- What do you think is the product range?
- How long have you worked for the company?
- Can you explain your main responsibilities in your job role?

The reason for these questions was to identify the nature of each firm. Moreover, all that information could build a solid base of every key variable in the maritime industry. In this sense, the maritime industry is no different from any other because information such as the type of firm, registration, partners, turnover and objectives all form part of the background information for any researcher. For example, the objectives of Company X are to engage in the operation and maintenance of container terminals; dredging and filling works; container handling, loading and unloading works; shipping and cargo works; marine and support services; bunkering services and waste water treatment. That information is highly important because it helps the researcher to recognise and understand the value of the firm in the field.

Furthermore, the responsibilities in job role are significant in order to help the researcher comprehend and understand the advantages of supply chain management. For example, purchasing managers' responsibilities are essential to ensuring that high quality goods and services are procured at competitive prices and delivered in a timely manner to meet the needs of end users (internal customers). Purchasing managers are also encouraged to share ideas on innovations with internal and external customers for better growth opportunities. Therefore, each firm had to be asked these kinds of questions, and all data needed to develop superior valuation had to be duly gathered.

The second part of the interviews related to the company's supply chain. This part was divided into four questions related to the supply chain concept of the firm:

- How do you search or source for a supplier?

- Why do choose a certain supplier instead of another one?
- How successful do you think your company is in managing its supply chain in general? Why?
- What do you think your company needs to do in order to manage its supply chain better? Why?

This part of the interview aimed to comprehend the mechanisms involved in finding a supplier and what the principles are for choosing one supplier over another. It is essential to select suppliers that suit the firm. The process of supply chain management would be greatly enhanced if such mechanisms were more widely understood because they would help in choosing the proper supplier.

The third part of the interview related to SCRM ideas and concerns. This part was divided into four questions related to the supply chain risk concept of the firm:

- Are you familiar with the concept of risk management in supply chain?
- Is your organisation/business unit concerned about supply chain risks? Why?
- What does the phrase SCRM mean to you?
- Why is supply chain risk management so important today to you?

This part evaluated how the concept of supply chain risk is viewed in maritime firms; risks encountered in the supply chain process are known and, if possible, minimised at most. Firms are concerned about their supply chain, as operations depend on the availability of necessary goods and services.

The fourth part of the interview related to the risks that firms face and the standards used to address those risks. This part was divided into several questions related to risks in the supply chain process:

- Have you had preliminary discussions with the supply chain management department about supply chain risk management?

- Does your company have any corporate standards or practices for risk management?
- In your opinion, which of these three categories of risks affect your supply chain the most: operational risk, strategic risk or financial risk? Why is this category the most problematic?
- What risks are occurring? How do they affect the supply chain?
- Where does risk occur?
- Can you explain any other significant risks that affect your supply chain? How do these risks affect your supply chain?

These questions aimed to understand and identify the risks the firms face. It was essential to realise the risks and the influence those risks exert on firms.

The last part of the interview related to the supply chain risk approach. This part was divided into several questions related to models that may be applied to reduce risks:

- Which activities are currently carried out in your company to minimise supply chain risks?
- What actions does your company take to mitigate the potential impact of supply chain risks that may occur in the future?
- Have you developed a supply chain risk mitigation strategy?
- Do you periodically collect risk information from your critical suppliers?
- Are the critical suppliers willing to collaborate with you to mitigate the risk?
- Do you have other strategies to deal with suppliers who are not willing to collaborate with you?

- Do you have anything else you would like to add about your company's risk management approach or supply chain risk in general?

This part tried to discover the method to reduce risks and produce an appropriate supply chain process. Many strategies were discussed to prevent and address the damage that may happen in firms. This part also enhanced the researcher's understanding of risk management at a general level.

This thesis used secondary data collected from each firm's historical data. The secondary data involves the sales volume, company's annual report, suppliers' performances, production volume, multiple other facts about the social, political, economic and environmental situation in Saudi Arabia such as the state of the Saudi Stock Exchange and details from the Central Department of Statistics and Information and the Ministry of Transport. To supplement data collection (as advised by Yin, 2013), supporting information was also collected. The information included company reports, memos and notes taken at the interviews.

4.4.3.5 Six steps of analysis

The following six steps of analysis was detailed by Kvale (1996); they were applied to analyse the feedback from the interviews:

- "A first step is when subjects describe the lived world during the interview. They spontaneously tell what they experience, feel and do in relation to a topic. [...]"
- A second step would be that the subjects themselves discover new relationships during the interview [...].
- In a third step, the interviewer, during the interview, condenses and interprets the meaning of what the interviewee describes and sends the meaning back. [...]
- In a fourth step, the transcribed interview is analysed by the interviewer alone, or with co-researchers. The interview is usually structured for analysis by transcription and with computer programs for textual analysis. The analysis proper involves developing the meanings of the interviews [...]

- A fifth step would be a re-interview. In a continuation of a 'self-correcting' interview, the subjects then get an opportunity to comment on the interviewer's interpretations as well as to elaborate on their own original statements [...].
- A possible sixth would be to extend the continuum of description and interpretation to include action, by subjects beginning to act on new insights they have gained during their interview".

The researcher needs to mention that the fifth step is a chance to cleanse the original interview as well as comment on the interviewer's interpretations of the interview. In the case of this thesis, a focus groups was used to conduct this step.

4.4.3.6 Coding

Ritchie and Spencer (1994), described framework analysis as 'an analytical process which involves a number of distinct though highly interconnected stages'. Therefore, there are five key phases adopted and they are the following:

- Familiarization;
- Identifying a thematic framework;
- Indexing;
- Charting;
- Mapping and interpretation.

The other distinctive aspect of framework analysis is that although it uses a thematic approach it allows themes to develop both from the research questions and from the narratives of research participants.

Data analysis process starts while the data is collected, by skilfully facilitating the discussion and generating rich data from the interview, complementing them with the observational notes and typing the recorded information. This phase is trailed by familiarisation with the data, which can be reached by listening to recordings, reading the transcripts in their entirety several times and reading the observational notes taken during interview and summary notes written

immediately after the interview. The purpose here is to submerge in the details and get a sense of the interview as a whole before breaking it into parts.

During this process the major themes begin to emerge. The next phase includes finding a thematic framework, by writing memos in the margin of the text in the form of short phrases, ideas or concepts arising from the texts and beginning to develop categories. At this stage descriptive statements are formed and an analysis is carried out on the data under the questioning route.

The third phase, indexing, comprises sifting the data, highlighting and sorting out quotes and making comparisons both within and between cases. The fourth phase, charting, involves lifting the quotes from their original context and re-arranging them under the newly-developed themes. Indexing and charting could also be viewed as managing the data.

One of the most important aspects of this task is data reduction, which is achieved by comparing and contrasting data and cutting and pasting similar quotes together.

The data is now ready for mapping and interpreting, the final phase. It is not only to make sense of the individual quotes, but also to be imaginative and analytical enough to see the relationship between the quotes, and the links between the data as a whole.

The analysis of the interviews and focus groups thus allowed themes to develop from the research questions and narratives of the interviewees or participants of focus groups.

Period One, the transcripts were analysed on paper first, and a code or themes were put next to each section of narrative.

Period Two, each of these narratives were then coded into Nvivo until all of the transcripts and narratives had been analysed. The narratives within themes were then read and analysed to see if the codes could be broken down into further codes.

However since the initial codes were detailed and distinct this was not deemed as necessary.

Period Three, reports were then generated by theme, so that all conversations relating to a theme were under one heading.

4.4.4 Focus groups

Gibbs (1997) offered the following a review of focus group methodology:

- Focus group research involves organised discussion with a selected group of individuals to gain information about their views and experiences of a topic.
- Focus group interviewing is particularly suited for obtaining several perspectives about the same topic.
- The benefits of focus group research include gaining insights into people's shared understandings of everyday life and the ways in which individuals are influenced by others in a group situation.
- Problems arise when attempting to identify the individual view from the group view, as well as in the practical arrangements for conducting focus groups.
- The role of the moderator is very significant. Good levels of group leadership and interpersonal skill are required to moderate a group successfully.

Several articles have noticed that focus groups are not being used often in social research, even though focus groups have extensive contributions in market research (Morgan, 1998; Krueger and Casey, 2000), and lately focus groups have become well-liked in medical research (Powell and Single, 1996). Nonetheless, Gibbs (1997) observed that focus groups have significant value as a tool for social researchers.

4.4.4.1 What are focus groups?

The thesis has found several definitions of focus group in the literature, but there are other features such as organised discussion (Krueger and Casey, 2000), interaction (Kitzinger, 1994) and group interview (Morgan, 1997) identify the contribution that focus groups make to social research. A focus group cloud

defined as a special type of group in terms of purpose, size, composition and procedures. Krueger and Casey (2000) shows that focus groups is methodology, which is understood as “a way of collecting qualitative data, which – essentially – involves engaging a small number of people in informal group discussions, ‘focused’ around a particular topic or set of issues” (Wilkinson, 2004). A focus group is normally consisted of 7 to 10 members who been nominated as they have common characteristics that relate to the topic.

4.4.4.2 Focus groups in comparison to other methods

Focus groups are an informal nature of the method, where instead of asking questions to each participant, the moderator(s) actively encourages interaction between group members (Wilkinson, 2004). One of the most important aim of a focus group research is to understand and infer participant’s attitudes, beliefs, feelings, reactions and experiences which that would not be possible if used other methods, such as questionnaire surveys, observation and one-to-one interviewing (Krueger and Casey, 2000 ; Gibbs, 1997). This builds a trust among the participants with more a freedom to encourage them to be more forthcoming (Hammersley and Atkinson, 2007) and to investigate issues they perceive as important (Kontos and Naglie, 2009). Therefore, it is befecial to use focus groups in order to test the theoretical propositions developed from the initial exploratory case study. In individual interviews, the researcher would receive individual attitudes, beliefs and feelings, on the other hand, focus groups obtain a multiplicity of views and emotional processes within a group context. While an individual interview could be greatly held easier than a focus group in which participants may take the initiative. In a focus group, the researcher achieves a larger amount of information in a shorter period of time compared to observation (Gibbs, 1997). Too, Kitzinger and Barbour (1999) reviewed that is important to incorporate focus groups with individual interviews. As result, the informal nature of the methodology, and the group context, helps to provide interactive discussion and reflection that is tough to realize by applying other methods.

4.4.4.3 The role of focus groups

The propositions of this thesis will be further tested by the means of focus groups within the data collection and an academic setting. The researcher wanted expert opinion on the findings of the research so the academics of King Abdulaziz University were the members of the focus groups conducted in an academic setting. Those academics have had a highly respected experience in maritime industry. This meant that the basis of the testing of the propositions was not only practitioner based but also academically based.

The researcher conducted focus group discussions to generate additional practitioner input. Kreuger (2000) noted that focus groups are helpful to be employed at the preliminary or exploratory research stages.; during a study, possibly to assess or improve a particular programme of activities (Race *et al.*, 1994); or even after a programme is finished, to evaluate its influence or to produce further avenues of research, as was the case in this thesis. Also, Morgan (1998) and Kreuger (2000) noted that focus groups could be used as a method in their own right or as a complement to other methods, especially for triangulation and validity checking. Too, focus groups can be used in multi-method types of research in order to add the data collected over other qualitative methods just as participant observation and individual interviews. Too, the validating focus groups would confirm both, the importance of identifying risk and strategies of supply chain risk. This approach is used in the thesis.

4.4.4.4 Potential and limitations of focus groups

Qualitative approaches like focus groups provide a method by which researchers can gain reliable insight into the perception of the individuals within it. Focus groups could apply alone and they can prove useful when perception, insight and explanation are more valuable than just numbers. The format of the groups permits the moderator to probe and interview in order to gain a deeper insight into the perceptions held by the participants; they enable the researcher to get in tune with the respondent and discover how the person sees reality (Kreuger 2000). The groups offer other advantages too. On top of the type and quality of data that they provide, they would not cost high and can quickly deliver workable

results. They allow researchers to increase the sample size of qualitative studies, and both the technique and results can be easily understood and utilised. Furthermore focus groups could become a forum for change (Race *et al.*, 1994), both during the focus group meeting itself and afterwards.

4.4.4.5 Focus groups summary

The previous section presented the significant features of focus group research and understanding the benefits of interaction and group dynamics which only this method can offer. Focus group research is a cooperative process, however, focus group is also an inspiring process for participants and a thrilling experiment for researchers who need to have a different perspective on their interest field.

Two focus groups were placed and guided; ten invited academics were attending in each one. The aim is to deliver a reliable answer to the question of research due to the limitations and costs involved in conducting more groups (Morgan, 1998). On the other hand, Burgess (1996) clarified that numbers of groups are vary; some studies might apply only one meeting with each of several focus groups. Hence, the focus groups results provide sufficient support for the aim of the thesis.

4.4.5 Unit of analysis

The unit of analysis for this case study research can be considered as “maritime transport firms in Saudi Arabia”. Depending on the research paradigm, case study research can be based on a single case, providing it can be justified based on one of five rationales: that the case is critical; extreme/unique; representative/typical; revelatory; or longitudinal (Yin, 2013). However, in this instance these rationales did not apply and hence, an embedded multiple-case study design (Yin, 2013) was used. Eisenhardt (1989) states between 4 and 10 cases usually work well, with fewer than 4 cases having limited complexity.

The units of analysis in this research are maritime transport firms in Saudi Arabia focusing on interviewing purchasing managers, logistics/transport managers, supply chain managers, factory/manufacturing managers and distribution centre managers. The minimum number of participants was three. At the maximum there would be a total of 15 participants. The sample size of more than three participants was necessary to ensure that different perspectives across the supply chain would be considered, e.g. the risks in the purchasing area are different to those in the factory and those in the transportation area.

4.5 Data analysis

This thesis has used transcript-based analysis. It does take much time to finish, but the accuracy is high and the error is low. This is what this thesis used. The interviews and focus groups were transcribed into Microsoft Word. Kitzinger and Barbour (1999) noted that focus groups could offer great numbers of very rich and dynamic data. Rabiee (2004) noted that this is the case for focus groups analysis in particular.

After the researcher had collected the data from interviews and focus groups, the researcher began to analyse the data personally. Transcribing all the data was the first phase, which took approximately 3 months. The second phase was translating the transcribed data to English, as most of the interviews had taken place completely in Arabic. This took nearly 2 months, as no decent translation program exists. After the all data had been translated into English, the data was categorised in order to identify any meaningful relationships between the categories.

The interviews and focus groups analysis allowed themes to develop from the research questions and from the narratives of the interviewees or participants of focus groups. The analysis steps were as follows:

- Using printouts of the transcribed data, the researcher placed themes next to each section of narrative.

- Each of these narratives was then coded into Nvivo until all of the transcripts and narratives had been analysed.
- The narratives within themes were then read and analysed.

Examples of the themes established during the analysis mentioned above are risk in supply chain, maritime industry and risk, process of risk, knowledge of supply chain, types of risk, risk & strategies and current risk.

4.6 Confidentiality and anonymity of participants

It was important to take certain precautions and measures to make sure that participants' confidentiality and anonymity were preserved (Boruch, 1971). This was particularly relevant in the interview section, as it was important to encourage participants to respond truthfully to all the questions without being concerned about what their colleagues and managers might think about their responses. As a result, the researcher did not collect any personal identification data, which would connect the participants to their responses (Patton, 2005, pp. 64-86).

4.7 Ethical considerations with the research study

The researcher examined the study for potential risks that it might pose to participants and did not identify any risks (Patton, 2005, pp. 64-86). The participants who participated in the study did so voluntarily. Participants were given full and accurate information about the study so that they could decide on their own whether they wanted to participate. The participants who participated in the study signed all the necessary consent forms. All information was given to them before the interviews, and all participants agreed to it and gave their consent prior to proceeding.

The researcher did not ask any participants to provide any identifying information. All information collected by the study was stored behind a password-protected computer in order to protect and ensure participants' confidentiality and anonymity. The sources and citations used in the paper report

of this study were identified using the Harvard Referencing System, an academically acceptable system for referencing.

4.8 Reliability and validity of the data

To make sure that the data and the results were reliable and valid, the researcher took certain precautions and followed certain processes. In particular, the researcher used the rewards and the interview sections of the study to decrease interviewer bias, researcher bias and central tendency bias of the data (Jacob, Tennenbaum, and Krahn, 1987, pp. 297-328). The researcher took careful measure in order to ensure the anonymity and confidentiality of participants' responses, and the process improved the reliability and validity of the results because the participants were assured that their responses would be kept secret (Jacob, Tennenbaum, and Krahn, 1987, pp. 297-328). The following chapter discusses the findings of the study.

4.9 Practical difficulties with data collection

The researcher encountered some practical difficulties when collecting data. The participant pool was initially too small, and he had difficulty finding enough participants who were willing to participate in the study. Expanding the pool, alleviated this problem somewhat but not by much. Finding enough participants continued to be a problem. The researcher contacted many people at many different institutions about participating in the study through email. Each email stated that the study was not long and that it would not take much of the participants' time. After encountering the initial difficulties in finding enough participants, the researcher also simplified the questions. The initial draft of the study had fifty questions, but these were shortened to encourage more participants to answer all of the questions. Nevertheless, there were some individuals who started the interview and, after answering only a few questions, stopped and did not proceed with the rest of the questions. These replies were excluded from the study and not included in the data analysis.

4.10 Time and money constraints

The researcher encountered many time and money constraints. The study would have benefited from having some budget to pay the participants. Monetary compensation would have served as an incentive to enrol even more participants than the study already enrolled. Monetary compensation would also have made the process of recruiting these participants much easier and simpler. Due to the limitations of the budget, the researcher did not have any funds to pay any of the participants for their time. Thus, their participation was entirely voluntary.

The researcher was also somewhat limited in time. Recruitment of study participants took a considerable amount of time, especially given how difficult it was to find all of the participants. As a result, the researcher was somewhat limited in time in terms of performing analysis of the data. If the researcher had more time to recruit study participants then the study may also have had more participants. Due to the time constraints, the researcher also did not have time to develop an alternative approach to encouraging potential participants to participate in the study. Given extra time, the researcher also could have developed alternative incentive options.

4.11 Chapter summary

The methodological approach for this research on the SCRM environment and strategies of the maritime sector in Saudi Arabia was a qualitative case study design. The chapter started by outlining the philosophical background of the research themes. Interviews and focus groups were found to be the most appropriate method of data collection to gather valid and reliable data. This chapter then discussed the data collection and analysis processes, along with the problems faced during data collection. Finally, the ethics, the reliability and validity of the data, the time and money constraints and the confidentiality issues were discussed; all these factors were given a high level of consideration during the process of collecting the data.

CHAPTER FIVE: FINDINGS

5.1 Introduction

In this study, the researcher conducted a case study in the field of maritime firms in the Kingdom of Saudi Arabia by using the semi-structured interviews and focus groups. The participants were asked questions related to SCRM during the semi-structured interviews. The participants were asked about what sorts of risks they noticed presently, the significance of SCRM with regards to disruption risks, the causes that the participants have experienced for risk and their views of SCRM in general. Participants were also asked to critically describe the steps firms can take to address a wide variety of risks. This chapter presents the findings of the thesis.

5.2 Overview of the focus groups

This thesis has grouped two academic and practical focus groups at King Abdulaziz University, Saudi Arabia. The groups were composed of academics who were asked about their perceptions, opinions, beliefs and attitudes towards the concepts or ideas of SCRM. Questions are asked in an interactive group setting where participants were free to talk with other group members.

5.2.1 Focus groups' goals

The academic focus groups discussed the risk and methods of the SCRM process. The aims of the focus groups were the following:

- Discuss the outcome of the interviews;
- Analyse the risk that was found in maritime firms;
- Discuss and analyse the approach of risk identification;
- Discuss how to improve risk management in the supply chain;
- Discuss the techniques of reducing supply chain risk.

The focus groups in this thesis have replicated the findings from the case study to show how essential SCRM is to maritime firms. Replication of the findings also made the findings more understandable for further discussion and analysis.

5.3 Case study analysis

5.3.1 General information to the participants and firms

The study examined five large firms related to the maritime industry in Saudi Arabia. The firms chose to stay anonymous. These firms have had a respectable experience in maritime transportation. Three participants were chosen in each firm. Eighty per cent of the participants work in firms with more than 500 employees. All of the firms have international partners. The study was dedicated to large maritime firms. All participants are men. The average age is 46. The working average in the current firm is 6.5 years.

The firms examined have used logistics on average of more than 15 years. The median creation date for these divisions is the year 2000. The participants all have good experience and knowledge in the logistics field.

There are several activities in maritime transport in Saudi Arabia, including the following:

- Container companies
- Maritime transport companies
- Multimodal transport companies
- Logistic companies
- Maritime transport companies operating within the ports
- Maritime supply
- Maritime insurance companies
- Container construction, maintenance and repair companies
- Maritime security companies for the implementation of ISPS code
- Charting and owning containers
- Maritime dredging companies
- Operating specialised ports companies (gas - fishing)
- Navigational maintenance, repair and purchase
- Ports and quays construction companies
- Transit
- Specialised ports
- Maritime training (training institute)
- Warehouses, silo and storage companies
- Containerising and wrapping companies
- Companies for cleaning containers
- Feeding terminals

- Shipping agents

The firms that participated perform most of these activities. These firms are shipping service providers, providing the full range of canvassing, commercial, documentation and operational supervision services required by regular liner operators to ensure profitable calls at ports throughout the Middle East. Furthermore, they provide smooth and efficient handling of all the owner's or charterer's husbandry and operational requirements on vessels calling at ports throughout the Middle East. They have a range of global contacts amongst ship owners and operators to arrange shipping for a wide range of non-containerised cargo, e.g. projects, heavy lifts, vehicles, bulk parcels. They provide a full range of husbandry and operational support to vessels engaged in installation, survey and other offshore work including securing work permits and vessel clearances, arranging crew and spares movement, organising local supplies and technical support and attending to medical and other emergencies.

The study shows that managers in all firms have strong and similar attitudes in the direction of risk. Therefore, SCRM can be effective to use in these firms when it is secured and managed across multiple organisations.

5.3.2 Concept of supply chain management in Saudi Arabian firms

The researcher found that the firms have a good understanding of the concept of supply chain management. This was because of their logistics experience. Logistics shows that every product that reaches an end user does so only with the cumulative effort of multiple organisations. These organisations are referred to collectively as the supply chain. Supply chain management, then, is the active management of supply chain activities to maximise customer value and achieve a sustainable competitive advantage. The researcher also found that there are many methodologies firms use in order to fulfil their supplier's requirements. Some of the methodologies or channels mentioned are trade magazine, Internet search, references and existing references.

Nonetheless, the researcher noted that it is extremely important that suppliers are chosen based on their degree of reliability for continued delivery of high quality goods/services in a timely manner and at competitive prices and considering innovation. Hence, firms are not just looking for suppliers; they are considering and looking for partnerships.

5.3.3 Concept of supply chain risk management in Saudi Arabian firms

The interviews revealed that SCRM is not purely academic well known in Saudi Arabia. It is a new term to Saudi Arabian organisations. It is understood that there are goods/parts that are not sourced from international markets today. SCRM is viewed as a strategy to manage both everyday and exceptional risks along the supply chain based on continuous risk assessment with the objective of reducing vulnerability and ensuring continuity.

“We have not heard about SCRM, It’s a new term. However, SCM is known matter”

(Purchasing Manager, Firm C)

Further, this study found that this trend raises the possibility that firms cannot adequately control and manage the risk of running out of key goods/parts.

SCRM would work with each department of the company to identify risk and embed risk management procedures within the business process of firms. Therefore, SCRM has to ensure that all risks that could prevent the firm from having sufficient resources (goods and services) necessary to carry out the operations of firm in an uninterrupted manner are mitigated and managed. These risks, if not identified and managed on a long-term basis, could significantly affect the operations of firm and thereby affect the clearance/movement of goods.

On the other hand, the researcher noticed that the firms do understand the term *risk management*, which facilitates the application of risk identification and risk assessment. Risks are communal in maritime firms in Saudi Arabia, as explained in the next section.

5.3.4 Types of risk

Many classifications of risks have already been discussed extensively in the previous chapter. Those categories help firms to recognise risks across different levels of the firm. For example, some risks are operational and internal in nature; these risks are well managed by embedding sufficient risk mitigating procedures within the business process. Thus, it is highly recommended to identify the nature and classifications of risks in order to address and minimise the influence of risks.

This study has found, among the many risks that firms face, many researchers have agreed on three common types of risks (Juttner *et al.*, 2003; Zsidisin, 2003; Christopher and Peck, 2004; Norrman and Jansson, 2004; Peck, 2005; Wagner and Bode, 2006; Wu *et al.*, 2006). These three risks are operational accidents, operational catastrophes and strategic uncertainty.

Though, the literature has revealed that perspectives on disruption risks in each industry are unique, and these perspectives are different from firm to firm. Therefore, this thesis has provided a new classification for risk in terms of the maritime industry. Most of the types of risk that were given by participants are communal. However, the researcher has classified risk upon to connection and similarity between risks. The three types of risk, as detailed in the following sections, are financial risk, operational risk and strategical risk.

5.3.4.1 Financial risk

Financial risk is a term for multiple types of risk associated with financing, including financial transactions that include company loans in risk of default. Risks related to finance include credit risk, foreign exchange risk, liquidity, bunker price and interest rate risk.

Making a profit is one of the objectives of any company. To do that, the cash flow is however the accurate pat that should be managed properly. Managing financials for firms is the biggest challenge and risk of financial mismanagement can lead to downfall of the firm. In many business sectors, an industry or an organization delivers the goods or service to its customer on credit. Debtors default (Meulbrook, 2000) affects the cash flow severely thereby increasing the financial risk of the organization. Mitigating financial risk leads to smooth flow of cash and keep organizations profitable (Kleindorfer and Saad, 2005; Hendricks and Singhal, 2005 ; Arcelus et al., 2012).

5.3.4.2 Operational risk

Operational risk is defined as the risk of loss resulting from inadequate or failed processes, people and systems or from external events. Risks related to operation, which are the most numerous type of risk, include production and productivity losses; health and safety; lack of education, practices and training; ship accidents or oil spills; piracy and maritime robbery; personnel injury; transportation incidents and denial of access; and vessel operation.

5.3.4.3 Strategical risk

Strategical risk can be defined as the uncertainties and untapped opportunities embedded in strategic intent and how well they are executed. Risks related to strategy include competition, reputation loss & negative campaign; political risk; economic risk; lack of security; natural disaster events; and oil.

5.4 Analysing risk

The study noted that Saudi firms are somewhat familiar with the methods to reduce risks and to produce an appropriate supply chain process:

“There is a bit of knowledge about reducing risks that might be facing our company”

(Firm A)

“We know several methods that can possibly reduce risks”

(Firm B)

"We are aware of methods that might help us to minimise risks"

(Firm C)

"Reducing risk is a job that must done in our company"

(Firm D)

"Knowing risk technique is important"

(Firm E)

However, many strategies have been discussed to prevent and address the damage that may happen in firms. Risk and risk management are inherently uncertain issues that require careful projection and estimation in order to reach a reliable result. Because it is impossible to know, at the same time, the efficacy of mitigation and the severity of an unmitigated risk event, the valuation of the mitigation strategy will always be an exercise in judgment and estimation. However, despite the uncertainty, there are strategies that have been developed to analyse risk techniques that are highly effective at getting close to certainty. These approaches use similar past events to benchmark certain costs and impacts stemming from a certain kind of risk event to forecast the costs that can be expected from a similar event in the future. These are combined with expert opinion on the efficacy and cost of mitigation strategies to gain a fuller understanding of the risk environment.

Analysing risk involves identifying the risks facing an organisation, assessing those risks according to the degree of harm or disruption they would cause if they were to occur, the likelihood of their occurring and the ability of the organisation to prevent or mitigate their occurrence. This analytical methodology follows a three-phase process to identify and assess risk events, grouping them according to their severity and likelihood of occurrence and then prioritising their mitigation. The thesis was seeking to define the level of agreement or disagreement respondents by operating a seven point Likert scale ("strongly disagree", "disagree" "somewhat disagree", "no opinion", "somewhat agree", "agree" and "strongly agree") with respective notes from 1 to 7. Else, neutral response is a 4 on the scale.

The research has revealed a process to identify and assess risk that is divided into four sections: approach to risk, risk management tools, identification of risks and techniques to decrease supply chain risk.

This model was studied with empirical data collected from maritime firms in Saudi Arabia to complete the conceptual framework.

5.4.1 Approach to risks

The study on supply chain risks and mitigating strategies has increasingly become popular (Wei and Choi, 2010). Many studies on several different models have tried to find risk minimising strategies in SCRM. However, the literature review shows that a simple four-step system is a common means to manage risk. These stages are identifying risks, assessing risks, implementing solutions and controlling risks. As a result of excessive risk level that come from all types of operational risk, strategic risk and financial risk, the strategy of reduction has to cover an entire supply chain worth of risk. Every single type of risk has its own mitigation strategy. The enablers of risk mitigation have been identified by previous research. Faisal *et al.* (2006) found that information sharing, agility in the supply chain, trust among supply chain counterparts, collaborative partnerships, risk sharing and transfer, increased knowledge of supply chain risk and continuous risk analysis and assessment are the enablers of risk mitigation in the supply chain. Moreover, increasing some factors such as inventory level, capacity, responsiveness, number of suppliers and the number of customer accounts can be mitigation strategies to reduce the impact of supply chain risk (Chopra and Sodhi, 2004). Previous research from Manuj and Mentzer (2008) which focuses on developing global SCRM strategies noted that strategic level of risk management has an attention on identifying and assessing the risks possibilities and consequences, also on choosing applicable strategy to decrease the probability of risks and it's adverse events. Risk mitigation in this case should thus focus on decreasing that consequences (Norrman and Jansson, 2004).

In 1990, Amit and Wernerfelt advised that there are three purposes in order to manage risk in business, they are the following;

- Low-risk firms have low firm value, this is called a agency motive. Managers care about market risk and business risk, on the other hand, shareholders consider about market risk since they can diversify their portfolios to account for business risk.
- Higher cash flows are correlated with lower business risk, this is called Cash flow motive. In a steady environment, operations are efficient and earnings instability is low.
- There is an existing positive relationship among 'rate of return' motive and business risk. However, due to transaction costs such as time costs and brokerage fees, shareholders are keen to receive stocks with lower risks.

Moreover, Tomlin (2006) mentioned that there are five strategies that could deal with supply chain risks; they are the following;

- Passive acceptance (A),
- Inventory mitigation (IM),
- Contingent rerouting (CR),
- Inventory mitigation and contingent rerouting (IMCR),
- And Sourcing mitigation (SM)

Furthermore, many researchers have classified risk management strategies into seven classifications: postponement, avoidance, security , control, hedging, sharing/transferring and speculation (Jüttner, Peck, and Christopher, 2003; Miller, 1991; Manuj and Mentzer, 2008). Still, those strategies are closely narrated to each other. Too, the firm may use more than one strategy in order to reduce risks (e.g., a hedging strategy entails avoiding some risks).

Table 7 shows the basic strategies suitable to confront risk (Lavastre *et al.*, 2012). However, these strategies were apparent during the initial exploratory study, in which interviewing of the managers was the first phase, and during the literature review.

Table 7: Supply chain risk strategies

LABEL	SUPPLY CHAIN RISK STRATEGIES
A1	Elimination risk by internal actions
B1	Security
C1	Transferring risk to another partner
D1	Sharing risk to another partner
E1	Ignore the risk

5.4.1.1 Avoiding risk and reducing risks as a strategy

The study found that a large number of participants used risk avoidance as a risk management strategy:

“Sometimes, avoidance strategy is really a comfort option to reduce risks”

(Transport Manager, Firm B)

Soares and Teixeira (2001) revealed that avoiding risk is a simple and efficient way of protecting the firm from unnecessary harm and/or loss of financial resources. Risk can be avoided by dropping specific products/geographical markets/supplier and/or customer organizations, shutdown a site in bad weather to avoid risk of staff would hurt. The thesis findings are supported by prior research on risk management strategies, which suggest that risk avoidance is one of the most common ways that organisations mitigate risk.

In addition to avoiding risks whenever it is possible and efficient, managers also reported risk reduction as a common strategy for mitigating risks:

“It’s highly recommended that firm plan to eliminate possible risks”

(Logistics Manager, Firm E)

As several risks can be effectively avoided, maritime industry also applies techniques that allow them to reduce risks such as security measures (Soares and Teixeira, 2001). One example of a risk reduction strategy is the use of security measures. These findings are supported by the previous studies findings, which indicate that risk reduction is a common strategy used to manage risk.

5.4.1.2 Risk transfer and sharing as a strategy

The study found that risk transfer and/or risk sharing was a common strategy used by maritime industry professionals in managing their risk. Risk transfer and/or sharing is the strategy of employing a third party in helping the organisation to take on some of the risks associated with a given event in the project. A common example, and the one brought up in the study, is the use of insurance companies:

“Insurance companies lately help a lot reducing risks”

(Operation Manager, Firm A)

The findings of this study are supported by prior research on risk management strategies and their use in maritime industry projects. Maritime industry companies buy policies to insure certain aspects of the project, such as a piece or a collection of equipment used on the project, in case something happens. That way, in case of a theft or an act of vandalism, the company receives monetary compensation for the loss that they encounter.

5.4.2 Risk management tools

These tools can be used in many stages of SCRM, in risk identification and analysis, risk assessment, decision and implementation of risk management actions and risk monitoring (Hallikas et al., 2004; Zsidisin *et al.*, 2005; Wu *et al.*, 2007; Lavastre *et al.*, 2012). However, risk identification and risk assessment stages are usually used. Sinha *et al.* (2004) noted that there is a developed prescriptive method to decrease risk in an aerospace supply chain and propose the following five activities: identifying risks, assessing risks, planning and implementing solutions, conducting failure modes and effects analysis (FMEA) and continuously improving.

The relationship between quality management and supply chain management practices were examined by Flynn and Flynn (2005). They ended with a result of there is a strong relationship between quality management and supply management that affects business performance. There were seven classic quality

management tools identified in the literature. They are commonly used to identify, understand and solve supply chain risks and are presented in Table 8.

Table 8: Quality management tools

LABEL	QUALITY MANAGEMENT TOOLS TO IDENTIFY RISK
A2	Failure mode, effects and critical analysis
B2	Internal and external processes mapping
C2	Question positioning approach
D2	Score method
E2	Pareto diagram, ABC ranking
F2	Ishikawa diagram, brainstorm
G2	PDCA cycle, Deming cycle, Six Sigma, permanent improvement

5.4.3 Techniques to reduce supply chain risk

Many techniques exist for minimising risk in the supply chain:

“There are some effective methods that need to be applied in order to reduce risks facing maritime firms in the Kingdom of Saudi Arabia such as scenarios for emergency, applying maritime security, quality management, Information exchange and more”

(Focus group member)

As a result of the literature review, the interviews and focus groups, the thesis has identified 24 techniques to minimise risk levels (see Table 9).

Table 9: Techniques to minimise supply chain risk

LABEL	TECHNIQUE TO MINIMISE SUPPLY CHAIN RISK
A3	Dual sourcing
B3	Information exchange
C3	Safety stocks (VOI or in-house)
D3	Activity planning using advanced planning system (APS)
E3	Operations centralisation (production, stocks and distribution)
F3	Reduce the number of suppliers
G3	Scenarios for emergency
H3	Forecast accuracy
I3	Solid relations with suppliers
J3	Improving performance to suppliers/providers
K3	Distribution centralisation
L3	Third party to coordinates supply chain
M3	External safety stocks
N3	Strict and formal procedures
O3	Responsiveness to supply chain event management
P3	Implementing quality management
Q3	Acquiring business disruption insurance
R3	Product postponement
S3	Initial and periodic training
T3	Applying maritime security
U3	Voluntary logistics security programs
V3	Using alert levels
W3	Communicating terrorism information to employees
X3	Marine constructions

5.5 Six Sigma approach

Applying the Six Sigma approach provides leverage in achieving higher supply chain security and reduction of disruptive risks faced while reducing operating costs. Recently there has been much interest in the Six Sigma methodology as a way of reducing variability in processes (George, 2002). Six Sigma tools such as control charts and failure modes and effects analysis (FMEA) can be very helpful in identifying the opportunities for reducing process variability in supply chains.

However, these tools and methodologies are primarily of benefit within the business for the control of repetitive activities. Roth *et al.* (2008) proposed a Six Sigma based framework of food supply chain control, relying on traceability, transparency, testability, time, trust and training. To improve internal quality and capabilities, firms have invested heavily over the past decade in programmes such as Total Quality Management (TQM), Lean Manufacturing and Six Sigma. Six Sigma tools can help companies identify the source of a problem and, more importantly, the sources of variation before the source turns into a problem. Using total quality management (TQM) factors such as Six Sigma approach could reduce risks

As result, one of the most common tools of supply chain management is a continuous improvement such as Six Sigma and PDCA. This thises confirmed that Six Sigma method is widely popular. Too, tools of risk management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma case, and they provide important safeguards in management of risk.

The study shows that firms who used Six Sigma approach indicated it could provide substantial benefits such as the following:

- Reduction in process variability in supply chains
- Higher supply chain security
- Higher reliability
- Disruptive risks reduction
- Control over repetitive activities
- Continuous improvement in process design
- Identification of the source of potential problems
- Higher quality and capabilities

- Reduction in operating costs.

However, measuring the effectiveness of any risk reduction process by using standard supply chain performance measures (cost, quality) does not directly assess the relative success of the risk mitigation effort. It can only be inferred that the Six Sigma mitigated risks and thus supported better supply performance.

5.6 The findings on the firms

5.6.1 Firm A

Firm A performs many services, including general cargo services, shipping of chemicals, marine services and ship management. It has many branches in different locations around Saudi Arabia. The paid capital of this firm is about £700 million. The participants were managers in three different levels of the firm, an operational manager, a logistic manager and a distribution manager. All three have a good understanding of logistics and risk management. However, SCRM is a new term to them. Semi-structured questions were asked in order to discuss and analyse the supply chain risk process. The questions were divided into four sections, and the findings are presented accordingly.

5.6.1.1 Approach to risks

This study found that there are six basic strategies to confront risk:

- Financing risk
- Eliminating risk by internal actions
- Implementing security
- Transferring risk to another partner
- Sharing risk with another partner
- Ignoring the risk

“These strategies are more likely essential for approaching risks that possibly face our company”

(Logistics Manager, Firm A)

These strategies were marked through the initial exploratory study with interviews of the managers and the focus groups. They arise from the literature review as well. The researcher asked the participants to evaluate these strategies in order to learn more about how to approach risk in Firm A.

The study shows that clearly Firm A primarily and principally employs the security strategy ($M= 5.8$, $SD= 0.74$) and sharing solutions to manage and reduce or eliminate supply chain risks with their partners ($M=5.6$, $SD=0.91$). The financing risk strategy is also a popular approach ($M=5.2$, $SD=1.0$) to have an operative SCRM (see Table 10). All managers adopt proactive and practical attitudes toward risk. The response to this position produced a low average (1.5) and a very low standard deviation (0.51), reflecting a strong agreement of responses. Managers agree that it is essential to act and to take risk into account in supply chain management decisions.

Table 10: Ranking of risk strategies for Firm A

	N	Mean	Std. Deviation
Securing the supply chain channel	3	5.8667	.74322
Sharing the risk with another partner	3	5.6000	.91026
Financing the risk	3	5.2667	1.03280
Transferring the risk to another partner	3	4.9333	.70373
Reducing or eliminating the risk by internal actions	3	3.9333	.88372
Ignoring the risk	3	1.5333	.51640
Valid N (listwise)	3		

5.6.1.2 Risk management tools

The study noted that there are tools which can be used in many different phases of SCRM, including risk identification and analysis, risk assessment, decision and

implementation of risk management actions and risk monitoring. These tools are used most commonly in the risk identification and risk assessment phases.

The relationship between quality management and supply chain management practices were examined by Flynn and Flynn (2005). They ended with a result of there is a strong relationship between quality management and supply management that affects business performance. There were seven classic quality management tools identified in the literature and were discussed through the interviews and the focus groups. The participants agreed that the following tools are regularly used to identify, understand and solve risks:

-
- Internal and external processes mapping
- Question positioning approach
- Score method
- Pareto diagram, ABC ranking
- Ishikawa diagram, brainstorm
- PDCA cycle, Deming cycle, Six Sigma, permanent improvement

As mentioned previously, the researcher also asked the participants to evaluate these tools in order to learn more about how to identify and assess risk in Firm A.

The PDCA cycle, Deming cycle, Six Sigma, permanent improvement ($M=5.4$, $SD=.91$) are the most popular supply chain management tools; these tools all relate to continuous improvement. This confirms that Six Sigma methodology is still very fashionable. Internal and external mapping ($M=5.3$, $SD=.72$) is well known and widely used to manage supply chain risk. Actually, tools of risk management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma case, and they provide important safeguards in management of risk. Score method ($M=4$, $SD=1.1$) is the tool least often used (see Table 11).

Table 11: Ranking of risk management tools for Firm A

	N	Sum	Mean	Std. Deviation
PDCA cycle, Deming cycle, Six Sigma, permanent improvement	3	82.00	5.4667	.91548
Internal and external processes mapping	3	80.00	5.3333	.72375
Ishikawa diagram, brainstorm	3	78.00	5.2000	.94112
Question positioning approach	3	75.00	5.0000	.84515
Pareto diagram, ABC ranking	3	67.00	4.4667	.99043
Score method	3	60.00	4.0000	1.13389
Valid N (listwise)	3			

5.6.1.3 Identifying risks

The study identified the risks in the supply chain of maritime firms. Risk has been found in the firms as follows:

✓ Financial risk

- Credit risk
- Foreign exchange risk
- Interest rate risk

✓ Operational risk

- Production and productivity losses
- Health and safety
- Lack of education, practices and training
- Personnel injury
- Transportation incidents and denial of access
- Vessel operation

✓ Strategical risk

- Economic risk

- Lack of security
- Natural disaster events
- Oil

However, the researcher requested the participants to evaluate these risks in order to identify which risk is more common in Firm A:

“Those categories – financial risk, operational risk and strategic risk – could be respectable to identify risks in our firm”

(Purchasing Manager, Firm A)

It also shows that financial risk (credit and interest rate are the top) (M=6.6, SD=.5) is considered the highest risk for Firm A. Strategic risk (Lack of security is the top) is (M=6.3, SD=.5) is the second highest risk. However, the risks least likely to occur to supply chain channel are transportation incidents and denial of access in operational risk (M=4.0, SD=1.1) see Table 12.

Table 12: Ranking of risk in Firm A

	N	Mean	Std. Deviation
Financial risk	3	6.6000	0.50712
Strategic risk	3	6.3757	.50043
Operational risk	3	4.0000	1.13389
Valid N (listwise)	3		

5.6.1.4 Techniques to reduce supply chain risk

The researcher noted that many techniques exist for minimising risk in maritime firms. The techniques found in Firm A are listed as follows:

- Initial and periodic training
- Information exchange
- Scenarios for emergency
- Forecast accuracy

- Distribution centralisation
- Responsiveness to supply chain event management
- Implementing quality management
- Applying maritime security
- Voluntary logistics security programmes
- Using alert levels
- Communicating terrorism information to employees
- Advanced planning system (APS)
- Safety stocks (VOI or in-house)
- Fewer suppliers
- Third party to coordinates supply chain
- External safety stocks by partner
- Product postponement

“These techniques have shown to us that they are the most likely operatives to reduce potential risks in the firm”

(Operation Manager, Firm A)

However, the researcher requested the participants to evaluate these techniques in order to minimise risk in Firm A.

Information exchange & communication with partner (M=6.5, SD=.51) is the finest approach to manage risk. Forecasting accuracy (M=6.1, SD=.63), initial and periodic training (M=5.9, SD=.70), voluntary logistics security programs (M=5.7, SD=.59) and applying maritime security (M=5.7, SD= .79) follow closely as the most frequently chosen alternatives. The least popular means is responsiveness to supply chain event management (M=3.1, SD=.83), as shown in Table 13.

Table 13: Ranking of techniques used to reduce supply chain risk in Firm A

	N	Mean	Std. Deviation
Information exchange & communication	3	6.5333	.51640
Forecast accuracy	3	6.1333	.63994
Initial and Periodic Training	3	5.9333	.70373
Applying maritime security	3	5.7333	.79881
Voluntary logistics security programs	3	5.7333	.59362
Distribution centralisation	3	5.2667	.70373
Acquiring business disruption insurance	3	5.2667	.70373
Implementing Quality Management	3	5.2667	.59362
Using Alert Levels	3	5.1333	.51640
Advanced planning system (APS)	3	4.8000	.77460
Safety stocks (VOI or in-house)	3	4.4667	.74322
Less suppliers	3	4.3333	.81650
Third party to coordinates supply chain	3	4.2000	.94112
External safety stocks by partner	3	4.0000	.84515
Product Postponement	3	3.4667	.63994
Responsiveness to supply chain event management	3	3.1333	.83381
Valid N (listwise)	3		

5.6.2 Firm B

Firm B also performs many services in Saudi Arabia. It is an offshore & marine services provider in the Middle East. Firm B performs activities such as offshore marine services, ship chandelling, ship chartering, offshore hook-up projects, Engineering and Construction Services Contractors, offshore shipbuilding, ship & rig repair and sea port operation and management. It is a large firm in Saudi Arabia. The paid capital of this firm is about £104 million. The participants were managers in three different levels of the firms, operational manager, logistic manager and ship manager. All three have a good understanding of logistics and risk management. However, SCRM is a new term to them. Semi-structured questions were asked in order to discuss and analyse the supply chain risk

process. The questions were divided into four sections, and the findings are presented accordingly.

5.6.2.1 Approach to risks

This study found that there are six basic strategies to confront risk:

- Financing risk
- Eliminating risk by internal actions
- Implementing security
- Transferring risk to another partner
- Sharing risk with another partner
- Ignoring the risk

“Approaching risks is an important way to identify them, but these approaches tend to be fairly necessary”

(Purchasing Manager, Firm B)

These strategies were evident during the initial exploratory study with interviews of the managers and the focus groups. They derive from the literature review too. The researcher asked the participants to evaluate these strategies in order to learn more about how to approach risk in Firm B.

Firm B principally seeks to transfer risk strategy ($M= 5.6$, $SD= 0.91$) and share solutions to manage and reduce or eliminate supply chain risks with their partners ($M=5.2$, $SD=1.03$). Security strategy is also a popular approach ($M=4.9$, $SD=.7$) to have an operative SCRM (see Table 14). It also shows that all managers adopt proactive and practical attitudes toward risk. The response to this position produced a low average (1.4) and a very low standard deviation (0.7), reflecting a strong agreement of responses. Managers agree that it is essential to act and to take risk into account in supply chain management decisions.

Table 14: Ranking of risk strategies for Firm B

	N	Mean	Std. Deviation
Transferring the risk to another partner	3	5.6567	.91322
Sharing the risk with another partner	3	5.2000	1.03026
Securing the supply chain channel	3	4.9667	0.73280
Financing the risk	3	4.4333	.70373
Reducing or eliminating the risk by internal actions	3	3.9333	.88372
Ignoring the risk	3	1.4333	.71640
Valid N (listwise)	3		

5.6.2.2 Risk management tools

This study found the following basic tools to confront risk:

- Internal and external processes mapping
- Score method
- Pareto diagram, ABC ranking
- Ishikawa diagram, brainstorm
- PDCA cycle, Deming cycle, Six Sigma, permanent improvement

As mentioned previously, the researcher also asked the participants to evaluate these tools in order to learn more about how to identify and assess risk in Firm B.

PDCA cycle, Deming cycle, Six Sigma, permanent improvement (M=5.3, SD=.81) are the most popular supply chain management tools; these tools all relate to continuous improvement. This confirms that Six Sigma methodology is still very fashionable. Internal and external mapping (M=5.0, SD= .72) is well known and widely used to manage supply chain risk. Actually, tools of risk management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma case, and they provide

important safeguards in management of risk. Pareto diagram, ABC ranking (M=3.9, SD=.91) are tools least often used (see Table 15).

Table 15: Ranking of risk management tools for Firm B

	N	Mean	Std. Deviation
PDCA cycle, Deming cycle, Six Sigma, permanent improvement	3	5.3743	.81612
Internal and external processes mapping	3	5.2650	.76880
Ishikawa diagram, brainstorm	3	4.6544	.94112
Score method	3	4.4667	.99043
Pareto diagram, ABC ranking	3	3.9344	.91389
Valid N (listwise)	3		

5.6.2.3 Identifying risks

The study identified the risks in the supply chain of maritime firms. Risk has been found in the firms as follows:

✓ Financial risk

- Credit risk
- Foreign exchange risk
- Liquidity
- Interest rate risk

✓ Operational risk

- Health and safety
- Lack of education, practices and training
- Ship accident or oil spill
- Piracy and maritime robbery
- Personnel injury
- Transportation incidents and denial of access
- Vessel operation

Strategical risk

- Economic risk
- Lack of security
- Natural disaster events
- Oil

“Financial risk, operational risk and strategic risk, are acceptable-to-identify risks in our firm”

(Logistics Manager, Firm B)

However, the researcher requested the participants to evaluate these risks in order to identify which risk is more common in Firm B.

Operational risk (with health and safety reported the most) (M=5.8, SD=.5) is considered the highest risk for Firm B. Financial risk (with credit risk at the top) (M=5.6, SD=.7) is the second risk. The risk considered least likely to occur in the supply chain channel is natural disaster events in strategic risk (M=3.0, SD=1.1), as shown in Table 16.

Table 16: Ranking of risk in Firm B

	N	Mean	Std. Deviation
Operational risk	3	5.8000	0.50712
Financial risk	3	5.6323	.70043
Strategic risk	3	3.0000	1.13389
Valid N (listwise)	3		

5.6.2.4 Techniques to reduce supply chain risk

The researcher noted that many techniques exist for minimising risk in maritime firms. The techniques found in Firm B are listed as follows:

- Initial and periodic training
- Information exchange
- Scenarios for emergency

- Improving performance for every factor
- Strict and formal procedures
- Responsiveness to supply chain event management
- Marine constructions
- Acquiring business disruption insurance
- Applying maritime security
- Strict and formal procedures
- Solid relations with suppliers
- Third party to coordinates supply chain
- External safety stocks by partner
- Dual sourcing or manufacturing
- Communicating terrorism information to employees

“We totally agree about these techniques, which could be very helpful to identify risks”

(Operation Manager, Firm B)

However, the researcher requested the participants to evaluate these techniques in order to minimise risk in Firm B.

Information exchange & communication with partner (M=6.3, SD=.71) is considered the best way to manage risk. Acquiring business disruption insurance (M=6.1, SD=.63), improving performance for every factor (M=5.8, SD=.90), marine constructions (M=5.7, SD=.89) and applying maritime security (M=5.7, SD= .75) follow closely as the most frequently chosen alternatives. The least popular means are dual sourcing or manufacturing (M=3.1, SD=.83), as shown in Table 17.

Table 17: Ranking of techniques used to reduce supply chain risk in Firm B

	N	Mean	Std. Deviation
Information exchange & communication	3	6.3333	.63640
Improving performance for every factors	3	5.8333	.90362
Marine constructions	3	5.7342	.89679
Applying maritime security	3	5.7211	.75881
Communicating terrorism information to partner	3	5.2667	.70373
Acquiring business disruption insurance	3	5.2667	.70373
Strict and formal procedures	3	5.2000	.77460
Solid relations with suppliers	3	4.9333	.88372
Less suppliers	3	4.3333	.81650
Third party to coordinates supply chain	3	4.2000	.94112
External safety stocks by partner	3	4.0000	.84515
Dual sourcing or manufacturing	3	3.1000	.419
Valid N (listwise)	3		

5.6.3 Firm C

This firm provides many services in Saudi Arabia. It is a shipping agency with regionally centralised operations, and it is a finance and communications provider in the Middle East. Firm C performs activities such as port agency, liner representation, cargo booking, crew care and marine services and offshore logistics. It is a large firm located in many locations around the Middle East. The paid capital of this firm is about £1 billion. The participants were managers in three different levels of the firms, an operational manager, a logistic manager and a branch manager.

All three have a good understanding of logistics and risk management. However, SCRM is a new term to them. Semi-structured questions were asked in order to discuss and analyse the supply chain risk process. The questions were divided into four sections, and the findings are presented accordingly.

5.6.3.1 Approach to risks

This study found that there are six basic strategies to confront risk:

- Financing risk
- Eliminating risk by internal actions
- Implementing security
- Transferring risk to another partner
- Sharing risk with another partner
- Ignoring the risk

“The above strategies are most likely necessary to approach risks that perhaps face our company”

(Distribution Manager, Firm C)

These strategies were evident during the initial exploratory study with interviews of the managers and the focus groups. They derive from the literature review as well. The researcher asked the participants to evaluate these strategies in order to learn more about how to approach risk in Firm C.

Firm C primarily and principally seeks the financing strategy ($M= 6.4$, $SD= 0.76$) and sharing solutions to manage and reduce or eliminate supply chain risks with their partners ($M=6.0$, $SD=0.90$). The security risk strategy was also a popular approach ($M=5.8$, $SD=.93$) to have an operative SCRM. This shows that all managers adopt proactive and practical attitudes toward risk. The response to this position produced a low average (1.5) and a very low standard deviation (0.51), reflecting a strong agreement of responses. Managers agree that it is essential to act and to take risk into account in supply chain management decisions.

Table 18: Ranking of risk strategies for Firm C

	N	Mean	Std. Deviation
Financing the risk	3	6.4323	.75322
Sharing the risk with another partner	3	6.000	0.9026
Securing the supply chain channel	3	5.8667	0.9380
Transferring the risk to another partner	3	4.4333	.70373
Reducing or eliminating the risk by internal actions	3	3.9333	.88372
Ignoring the risk	3	1.5333	.51640
Valid N (listwise)	3		

5.6.3.2 Risk management tools

This study found that there are several basic strategies to confront risk:

- Internal and external processes mapping
- Question positioning approach
- Score method
- Pareto diagram, ABC ranking
- Ishikawa diagram, brainstorm
- PDCA cycle, Deming cycle, Six Sigma, permanent improvement

As mentioned previously, the researcher also asked the participants to evaluate these tools in order to learn more about how to identify and assess risk in Firm C.

The PDCA cycle, Deming cycle, Six Sigma, permanent improvement (M=5.4, SD=.91) are the most popular supply chain management tools; these tools all relate to continuous improvement. This confirms that Six Sigma methodology is still very fashionable. Internal and external mapping (M=5.3, SD= .72) is well known and widely used to manage supply chain risk. Actually, tools of risk management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma

case, and they provide important safeguards in management of risk. Score method (M=4, SD=1.1) is the tools least often used (see Table 19).

Table 19: Ranking of risk management tools for Firm C

	N	Mean	Std. Deviation
PDCA cycle, Deming cycle, Six Sigma, permanent improvement	3	5.4667	.91548
Internal and external processes mapping	3	5.3333	.72375
Ishikawa diagram, brainstorm	3	5.2000	.94112
Question positioning approach	3	5.0000	.84515
Pareto diagram, ABC ranking	3	4.4667	.99043
Score method	3	4.0000	1.13389
Valid N (listwise)	3		

5.6.3.3 Identifying risks

The study identified the risks in the supply chain of maritime firms. Risk has been found in the firms as follows:

- ✓ Financial risk
 - Credit risk
 - Foreign exchange risk
 - Liquidity
 - Bunker price
 - Interest rate risk
- ✓ Operational risk
 - Production and productivity losses
 - Health and safety
 - Lack of education, practices and training
 - Ship accident or oil spill

- Piracy and maritime robbery
 - Personnel injury
 - Transportation incidents and denial of access
 - Vessel operation
- ✓ Strategical risk
- Competition, reputation loss & negative campaign
 - Political risk
 - Economic risk
 - Lack of security
 - Natural disaster events
 - Oil

“Those categories – financial risk, operational risk and strategic risk – are suitable for our firm”

(Logistics Manager, Firm C)

However, the researcher requested the participants to evaluate these risks in order to identify which risk is more common in Firm C.

Financial risk (credit and interest rate at the top) ($M=6.2$, $SD=.7$) is considered the highest risk might face Firm C. Strategic risk (lack of security at the top) is ($M=6.1$, $SD=.5$) the second risk. However, the risks that are least likely to occur in the supply chain channel are transportation incidents and denial of access in operational risk ($M=4.0$, $SD=1.1$), as shown in Table 20.

Table 20: Ranking of risk in Firm C

	N	Mean	Std. Deviation
Financial risk	3	6.200	0.7712
Strategic risk	3	6.1757	.50043
Operational risk	3	4.0000	1.13389
Valid N (listwise)	3		

5.6.3.4 Techniques to reduce supply chain risk

The researcher noted that many techniques exist for minimising risk in maritime firms. The techniques found in Firm C are listed as follows:

- Information exchange & communication
- Forecast accuracy
- Initial and periodic training
- Applying maritime security
- Improving performance for every factor
- Marine constructions
- Scenarios for emergency
- Communicating terrorism information to partner
- Acquiring business disruption insurance
- Implementing quality management
- Distribution centralisation
- Operations centralisation (stock, production and distribution)

- Strict and formal procedures
- Using alert levels
- Voluntary logistics security programs
- Solid relations with suppliers
- Advanced planning system (APS)
- Safety stocks (VOI or in-house)
- Fewer suppliers
- Third party to coordinates supply chain
- External safety stocks by partner
- Dual sourcing or manufacturing
- Product postponement
- Responsiveness to supply chain event management

“These methods have been revealed to our firm and they are the most likely to be effective to decrease possible risks”

(Operation Manager, Firm C)

However, the researcher requested the participants to evaluate these techniques in order to minimise risk in Firm C.

Information exchange & communication with partner (M=6.2, SD=.81) is considered the best way to manage risk. Applying maritime security (M=6.1, SD=.67), acquiring business disruption insurance (M=5.8, SD=.60), marine constructions (M=5.7, SD=.61) and improving performance for every factor (M=5.6, SD= .75) follow closely as the most frequently chosen alternatives. The least popular means is product postponement (M=3.1, SD=.83), as shown in Table 21.

Table 21: Ranking of techniques used to reduce supply chain risk in Firm C

	N	Mean	Std. Deviation
Information exchange & communication	3	6.2343	.81650
Forecast accuracy	3	6.1333	.67794
Initial and periodic training	3	5.8563	.60373
Applying maritime security	3	5.6333	.75321
Improving performance for every factor	3	5.4333	.59362
Marine constructions	3	5.3400	.73679
Scenarios for emergency	3	5.3400	.73679
Communicating terrorism information to partner	3	5.2667	.70373
Acquiring business disruption insurance	3	5.2667	.70373
Implementing quality management	3	5.2667	.59362
Distribution centralisation	3	5.2667	.70373
Operations centralisation (stock, production and distribution)	3	5.2000	.67612
Strict and formal procedures	3	5.2000	.77460
Using alert levels	3	5.1333	.51640
Voluntary logistics security programs	3	5.1333	.83381
Solid relations with suppliers	3	4.9333	.88372
Advanced planning system (APS)	3	4.8000	.77460
Safety stocks (VOI or in-house)	3	4.4667	.74322
Less suppliers	3	4.3333	.81650
Third party to coordinates supply chain	3	4.2000	.94112
External safety stocks by partner	3	4.0000	.84515
Dual sourcing or manufacturing	3	3.8000	1.01419
Responsiveness to supply chain event management	3	3.4667	.63994
Product postponement	3	3.1333	.83381
Valid N (listwise)	3		

5.6.4 Firm D

Firm D performs many services in Saudi Arabia. It is a marine services provider in the Middle East. Firm D performs activities such as marine services, ship chandelling, ship chartering, maritime agency, construction services contracting, offshore shipbuilding, ship & rig repair and sea port operation and management.

It is a large firm in Saudi Arabia. The paid capital of this firm is about £80 million. The participants were managers in three different levels of the firm, an operational manager, a transport manager and a terminal manager. All three have a good understanding of logistics and risk management. However, SCRM is a new term to them. Semi-structured questions were asked in order to discuss and analyse the supply chain risk process. The questions were divided into four sections, and the findings are presented accordingly.

5.6.4.1 Approach to risks

This study found that there are six basic strategies to confront risk:

- Financing risk
- Eliminating risk by internal actions
- Implementing security
- Transferring risk to another partner
- Sharing risk with another partner
- Ignoring the risk

“These strategies are fundamental and could facilitate the approach of risks that might face our company”

(Distribution Manager, Firm D)

These strategies were evident during the initial exploratory study with interviews of the managers and the focus groups. They derive from the literature review as well. The researcher asked the participants to evaluate these strategies in order to learn more about how to approach risk in Firm D.

Firm D principally seeks the financing risk strategy ($M= 5.4$, $SD= 0.71$) and security strategy ($M=5.2$, $SD=1.03$). The transferring strategy was also a popular approach ($M=4.9$, $SD=.7$) to have an operative SCRM (see Table 22). All managers adopt proactive and practical attitudes toward risk. The response to this position

produced a low average (1.4) and a very low standard deviation (0.7), reflecting a strong agreement of responses. Managers agree that it is essential to act and to take risk into account in supply chain management decisions.

Table 22: Ranking of risk strategies for Firm D

	N	Mean	Std. Deviation
Financing the risk	3	5.4467	.71322
Securing the supply chain channel	3	5.2000	1.03026
Transferring the risk to another partner	3	4.9667	0.73280
Sharing the risk with another partner	3	4.4333	.70373
Reducing or eliminating the risk by internal actions	3	3.9333	.88372
Ignoring the risk	3	1.4333	.71640
Valid N (listwise)	3		

5.6.4.2 Risk management tools

This study found several basic tools to confront risk:

- Internal and external processes mapping
- Score method
- Pareto diagram, ABC ranking
- Ishikawa diagram, brainstorm
- PDCA cycle, Deming cycle, Six Sigma, permanent improvement

As mentioned previously, the researcher also asked the participants to evaluate these tools in order to learn more about how to identify and assess risk in Firm D.

The PDCA cycle, Deming cycle, Six Sigma, permanent improvement (M=5.3, SD=.81) are the most popular supply chain management tools; these tools all relate to continuous improvement. This confirms that Six Sigma methodology is still very fashionable. Internal and external mapping (M=5.0, SD= .72) is well known and widely used to manage supply chain risk. Actually, tools of risk

management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma case, and they provide important safeguards in management of risk. Pareto diagram and ABC ranking (M=3.9, SD=.91) are the tools least often used (see Table 23).

Table 23: Ranking of risk management tools for Firm D

	N	Mean	Std. Deviation
PDCA cycle, Deming cycle, Six Sigma, permanent improvement	3	5.3743	.81612
Internal and external processes mapping	3	5.2650	.76880
Ishikawa diagram, brainstorm	3	4.6544	.94112
Score method	3	4.4667	.99043
Pareto diagram, ABC ranking	3	3.9344	.91389
Valid N (listwise)	3		

5.6.4.3 Identifying risks

The study identified the risks in the supply chain of maritime firms. Risk has been found in the firms as follows:

- ✓ Financial risk
 - Credit risk
 - Foreign exchange risk
 - Liquidity
 - Interest rate risk
- ✓ Operational risk
 - Health and safety
 - Lack of education, practices and training
 - Ship accident or oil spill
 - Piracy and maritime robbery
 - Vessel operation

Strategical risk

- Lack of security
- Natural disaster events
- Oil

“Those types of risks could be respectable to identify risks in the company”

(Logistics Manager, Firm D)

However, the researcher requested the participants to evaluate these risks in order to identify which risk is more common in Firm D.

Financial risk (credit risk & foreign exchange risk are the most) (M=5.8, SD=.5) is considered the highest risk for Firm D. Operational risk (lack of education, practices and training is the top) is (M=5.6, SD=.7) as the second risk. The risk least likely to occur in the supply chain channel is natural disaster events in strategic risk (M=3.0, SD=1.1), as shown in Table 24.

Table 24: Ranking of risk in Firm D

	N	Mean	Std. Deviation
Operational risk	3	5.8000	0.50712
Financial risk	3	5.6323	.70043
Strategic risk	3	3.0000	1.13389
Valid N (listwise)	3		

5.6.4.4 Techniques to reduce supply chain risk

The researcher noted that many techniques exist for minimising risk in maritime firms. The techniques found in Firm D are listed as follows:

- Initial and periodic training
- Information exchange

- Scenarios for emergency
- Improving performance for every factor
- Responsiveness to supply chain event management
- Acquiring business disruption insurance
- Applying maritime security
- Strict and formal procedures
- Solid relations with suppliers
- Third party to coordinates supply chain
- External safety stocks by partner
- Dual sourcing or manufacturing

“There are several techniques that have been exposed to us that are most likely functioning to reduce potential risks in the firm”

(Operation Manager, Firm D)

However, the researcher requested the participants to evaluate these techniques in order to minimise risk in Firm D.

Information exchange & communication with partner (M=6.3, SD=.71) is considered the best way to manage risk. Initial and periodic training (M=6.1, SD=.63), improving performance for every factor (M=5.8, SD=.90), marine constructions (M=5.7, SD=.89) and applying maritime security (M=5.7, SD=.75) followed closely as the most frequently chosen alternatives. The least popular means is dual sourcing or manufacturing (M=3.1, SD=.83), as shown in Table 25.

Table 25: Ranking of techniques used to reduce supply chain risk in Firm D

Table 20: Ranking of techniques used to reduce supply chain risk in Firm D

	N	Mean	Std. Deviation
Information exchange & communication	3	6.3333	.63640
Initial and periodic training	3	5.8333	.90362
Improving performance for every factors	3	5.7342	.89679
Applying maritime security	3	5.7211	.75881
Communicating terrorism information to partner	3	5.2667	.70373
Acquiring business disruption insurance	3	5.2667	.70373
Strict and formal procedures	3	5.2000	.77460
Solid relations with suppliers	3	4.9333	.88372
External safety stocks by partner	3	4.2000	.94112
Third party to coordinates supply chain	3	4.0000	.84515
Dual sourcing or manufacturing	3	3.1000	.41900
Valid N (listwise)	3		

5.6.5 Firm E

Firm E performs many services, such as general cargo services, marine services and ship management. It has many branches in different locations around Saudi Arabia. The paid capital of this firm is about £500 million. The participants were managers in three different levels of the firm, an operational manager, a logistic manager and a distribution manager.

All three have a good understanding of logistics and risk management. However, SCRM is a new term to them. Semi-structured questions were asked in order to discuss and analyse the supply chain risk process. The questions were divided into four sections, and the findings are presented accordingly.

5.6.5.1 Approach to risks

This study found that there are six basic strategies to confront risk:

- Financing risk

- Eliminating risk by internal actions
- Implementing security
- Transferring risk to another partner
- Sharing risk with another partner
- Ignoring the risk

“The approaches to risks are more likely critical to understand in order to know risks that possibly face our company”

(Transport Manager, Firm E)

These strategies were evident during the initial exploratory study with interviews of the managers and the focus groups. They derive from the literature review as well. The researcher asked the participants to evaluate these strategies in order to learn more about how to approach risk in Firm E.

Firm E primarily and principally seeks the security strategy (M= 5.8, SD= 0.74). Financing risk is second (M=5.6, SD=0.91). Sharing solutions to manage and reduce or eliminate supply chain risks with their partners was also a popular approach (M=5.2, SD=1.0) to have an operative SCRM (see Table 4). It also shows that all managers adopt proactive and practical attitudes toward risk. The response to this position produced a low average (1.5) and a very low standard deviation (0.51), reflecting a strong agreement of responses. Managers agree that it is essential to act and to take risk into account in supply chain management decisions.

Table 26: Ranking of risk strategies for Firm E

	N	Mean	Std. Deviation
Financing the risk	3	5.8667	.74322
Securing the supply chain channel	3	5.6000	.91026
Sharing the risk with another partner	3	5.2667	1.03280
Transferring the risk to another partner	3	4.9333	.70373
Reducing or eliminating the risk by internal actions	3	3.9333	.88372

Ignoring the risk	3	1.5333	.51640
Valid N (listwise)	3		

5.6.5.2 Risk management tools

This study found that there are several basic tools to confront risk:

- Internal and external processes mapping
- Question positioning approach
- Score method
- Pareto diagram, ABC ranking
- Ishikawa diagram, brainstorm
- PDCA cycle, Deming cycle, Six Sigma, permanent improvement

As mentioned previously, the researcher asked the participants to evaluate these tools in order to learn more about how to identify and assess risk in Firm E.

The PDCA cycle, Deming cycle, Six Sigma, permanent improvement (M=5.4, SD=.91) are the most popular supply chain management tools; these tools all relate to continuous improvement. This confirms that Six Sigma methodology is still very fashionable. Internal and external mapping (M=5.3, SD= .72) is well known and widely used to manage supply chain risk. Actually, tools of risk management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma case, and they provide important safeguards in management of risk. Score method (M=4, SD=1.1) is the tools least often used (see Table 27).

Table 27: Ranking of risk management tools for Firm E

	N	Sum	Mean	Std. Deviation
PDCA cycle, Deming cycle, Six Sigma, permanent improvement	3	82.00	5.4667	.91548
Internal and external processes mapping	3	80.00	5.3333	.72375
Ishikawa diagram, brainstorm	3	78.00	5.2000	.94112
Question positioning approach	3	75.00	5.0000	.84515
Pareto diagram, ABC ranking	3	67.00	4.4667	.99043
Score method	3	60.00	4.0000	1.13389
Valid N (listwise)	3			

5.6.5.3 Identifying risks

The study identified the risks in the supply chain of maritime firms. Risk has been found in the firms as follows:

✓ Financial risk

- Credit risk
- Foreign exchange risk
- Interest rate risk

✓ Operational risk

- Production and productivity losses
- Health and safety
- Lack of education, practices and training
- Transportation incidents and denial of access
- Vessel operation

✓ Strategical risk

- Economic risk
- Lack of security
- Oil

“Those categories – financial risk, operational risk and strategic risk – are most likely acceptable to identify risks in our firm”

(Purchasing Manager, Firm E)

However, the researcher requested the participants to evaluate these risks in order to identify which risk is more common in Firm E.

Financial risk (credit and interest rate are at the top) (M=6.6, SD=.5) is considered the highest risk for Firm E. Strategic risk (Lack of security is the top) is (M=6.3, SD=.5) as the second risk. However, the risks considered least likely to occur in the supply chain channel are transportation incidents and denial of access in operational risk (M=4.0, SD=1.1), as shown in Table 28.

Table 28: Ranking of risk in Firm E

	N	Mean	Std. Deviation
Financial risk	3	6.6000	0.50712
Strategic risk	3	6.3757	.50043
Operational risk	3	4.0000	1.13389
Valid N (listwise)	3		

5.6.5.4 Techniques to reduce supply chain risk

The researcher noted that many techniques exist for minimising risk in maritime firms. The techniques found in firm E are listed as follows:

- Initial and periodic training,
- Information exchange
- Scenarios for emergency
- Forecast accuracy
- Distribution centralisation
- Implementing quality management

- Applying maritime security
- Using alert levels
- Advanced planning system (APS)
- Safety stocks (VOI or in-house)
- Less suppliers
- External safety stocks by partner
- Product postponement

“These techniques have been shown to us are most likely effective to decrease potential risks in the firm”

(Operation Manager, Firm E)

However, the researcher requested the participants to evaluate these techniques in order to minimise risk in Firm E.

Information exchange & communication with partner ($M=6.5$, $SD=.51$) is considered the best way to manage risk. Forecasting accuracy ($M=6.1$, $SD=.63$), initial and periodic Training ($M=5.9$, $SD=.70$), voluntary logistics security programs ($M=5.7$, $SD=.59$) and applying maritime security ($M=5.7$, $SD=.79$) follow closely as the most frequently chosen alternatives. The least popular means is responsiveness to supply chain event management ($M=3.1$, $SD=.83$), as shown in Table 29.

Table 29: Ranking of techniques used to reduce supply chain risk in Firm E

	N	Mean	Std. Deviation
Information exchange & communication	3	6.5333	.51640
Forecast accuracy	3	6.1333	.63994
Initial and periodic training	3	5.9333	.70373
Applying maritime security	3	5.7333	.79881
Distribution centralisation	3	5.2667	.70373
Acquiring business disruption insurance	3	5.2667	.70373
Implementing quality management	3	5.2667	.59362
Using alert levels	3	5.1333	.51640
Advanced planning system (APS)	3	4.8000	.77460
Safety stocks (VOI or in-house)	3	4.4667	.74322
Less suppliers	3	4.3333	.81650
External safety stocks by partner	3	4.0000	.84515
Product postponement	3	3.4667	.63994
Valid N (listwise)	3		

5.6.6 The cross case analysis

The study shows that managers in all firms (A, B, C, D, E) have strong and similar attitudes regarding risk.

5.6.6.1 Approach to risks

Clearly the firms primarily and principally seek the financing strategy (M= 5.8, SD= 0.74) and security risk strategy (M=5.6, SD=0.91). Sharing solutions to manage and reduce or eliminate supply chain risks with their partners was also a popular approach (M=5.2, SD=1.0) to have an operative SCRM (see table 30). This also shows that all firms (A, B, C, D, E) adopt proactive and practical attitudes toward risk. The response to this position produced a low average (1.5) and a very low standard deviation (0.51), reflecting a strong agreement of responses.

Managers in all the firms (A, B, C, D, E) agree that it is essential to act and to take risk into account in supply chain management decisions.

Table 30: Ranking of risk strategies for all firms

	N	Mean	Std. Deviation
Securing the supply chain channel	15	5.8667	.74322
Sharing the risk with another partner	15	5.6000	.91026
Financing the risk	15	5.2667	1.03280
Transferring the risk to another partner	15	4.9333	.70373
Reducing or eliminating the risk by internal actions	15	3.9333	.88372
Ignoring the risk	15	1.5333	.51640
Valid N (listwise)	15		

5.6.6.2 Risk management tools

All firms (A, B, C, D, E) agreed that the PDCA cycle, Deming cycle, Six Sigma, permanent improvement (M=5.4, SD=.91) are the most popular supply chain management tools; all these tools relate to continuous improvement. This confirms that Six Sigma methodology is still very fashionable. Internal and external mapping (M=5.3, SD= .72) is well known and widely used to manage supply chain risk. Actually, tools of risk management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma case, and they provide important safeguards in management of risk. Score method (M=4, SD=1.1) is the tool least often used (see Table 31).

Table 31: Ranking of risk management tools for all firms

	N	Sum	Mean	Std. Deviation
PDCA cycle, Deming cycle, Six Sigma, permanent improvement	15	82.00	5.4667	.91548
Internal and external processes mapping	15	80.00	5.3333	.72375
Ishikawa diagram, brainstorm	15	78.00	5.2000	.94112
Question positioning approach	15	75.00	5.0000	.84515
Pareto diagram, ABC ranking	15	67.00	4.4667	.99043
Score method	15	60.00	4.0000	1.13389
Valid N (listwise)	15			

5.6.6.3 Identifying risks

Financial risk (M=6.6, SD=.5) is considered the highest risk for all firms (A, B, C, D, E). Operational risk (M=6.3, SD=.61) came in second place. The third risk most likely to occur in the supply chain channel is strategical risk (M=4.2, SD=1.1).

Table 32: Ranking of risk for all firms

	N	Mean	Std. Deviation
Financial risk	15	6.600	0.5712
Operational risk	15	6.3757	.61043
Strategic risk	15	4.2000	1.13389
Valid N (listwise)	15		

5.6.6.4 Techniques to reduce supply chain risk

All firms (A, B, C, D, E) considered information exchange & communication with partner (M=6.5, SD=.51) the best way to manage risk. Applying maritime security (M=6.1, SD=.63), initial and periodic training (M=5.9, SD=.70), improving performance (M=5.7, SD=.59) and forecasting accuracy (M=5.7, SD=.79) follow closely as the most frequently chosen alternatives. The least popular means are

product postponement (M=3.4, SD=.63) and responsiveness to supply chain event management (M=3.1, SD=.83), as shown in Table 33.

Table 33: Ranking of techniques used to reduce supply chain risk in all firms

	N	Mean	Std. Deviation
Information exchange & communication	15	6.2343	.81650
Forecast accuracy	15	6.1333	.67794
Initial and periodic training	15	5.8563	.60373
Applying maritime security	15	5.6333	.75321
Improving performance for every factors	15	5.4333	.59362
Marine constructions	15	5.3400	.73679
Scenarios for emergency	15	5.3400	.73679
Communicating terrorism information to partner	15	5.2667	.70373
Acquiring business disruption insurance	15	5.2667	.70373
Implementing quality management	15	5.2667	.59362
Distribution centralisation	15	5.2667	.70373
Operations centralisation (stock, production and distribution)	15	5.2000	.67612
Strict and formal procedures	15	5.2000	.77460
Using alert levels	15	5.1333	.51640
Voluntary logistics security programs	15	5.1333	.83381
Solid relations with suppliers	15	4.9333	.88372
Advanced planning system (APS)	15	4.8000	.77460
Safety stocks (VOI or in-house)	15	4.4667	.74322
Less suppliers	15	4.3333	.81650
Third party to coordinates supply chain	15	4.2000	.94112
External safety stocks by partner	15	4.0000	.84515
Dual sourcing or manufacturing	15	3.8000	1.01419
Responsiveness to supply chain event management	15	3.4667	.63994
Product postponement	15	3.1333	.83381
Valid N (listwise)	15		

5.7 Chapter summary

The researcher conducted a case study in the field of maritime firms in Saudi Arabia by using the semi-structured interviews. The participants were asked questions related to SCRM. They also were asked what sorts of risks they noticed currently, the significance of SCRM in context of risks, and the causes that the participants have felt to identify risk and the views of SCRM in general. The chapter critically described the steps firms can take to address a wide variety of risks. It also noted the strategies that might be useful to reduce risk. This chapter explored the findings of this case study from interviewees and focus groups. Each firm was analysed individually, then findings were presented as one.

At the end, the case study found that the presented process was a decent tool to identify risk through SCRM. All interviewees and focus group members agreed that SCRM is important in order to identify, assess and reduce risk. The following chapter discusses the findings from the exploratory case study.

CHAPTER SIX: THE DISCUSSION

6.1 Introduction

The findings of the case study that applied in maritime firms in the Kingdom of Saudi Arabia have been noted in the previous chapter. This chapter discusses these findings in detail. Furthermore, the chapter answers the research questions stated in Chapter One.

6.2 Case study discussion

As mentioned before, there are three major issues found in SCRM research:

- There is no clear consensus research on the definition of SCRM.
- There is a lack of commensurate research on response to supply chain risk incidents.
- There is a shortage of empirical research in the SCRM area. (Sodhi *et al.*, 2011)

This study was an exploratory case study in terms of empirical research in the area of SCRM. It aimed to understand SCRM from a specific perspective. Khan *et al.*, (2007) advised that case studies is a way to explore how firms manage risk in supply chain and what are processes that those firms normally apply in order to identify and evaluate risk in firms' supply chain. This exploratory case study examined how the participants manage risk in supply chain, and how to identify risk. No research has previously been done to analyse risk in supply chain maritime firms in Saudi Arabia, so this SCRM analysis on Saudi Arabia can increase the knowledge to the supply chain management literature:

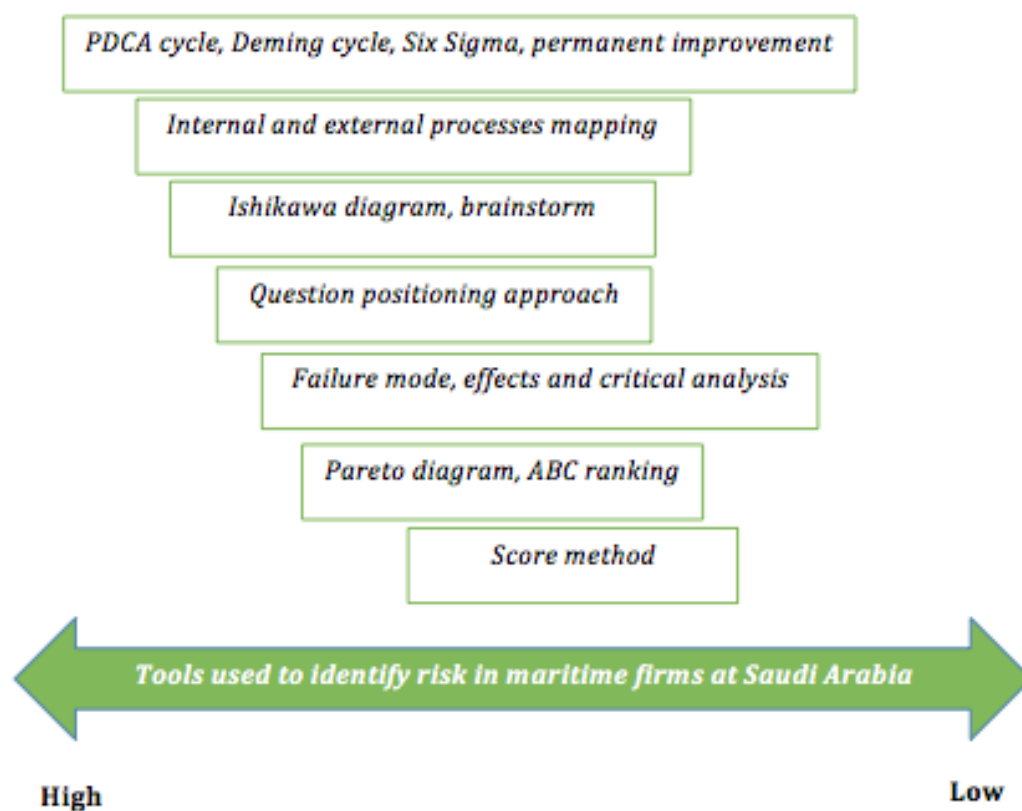
"Supply chain risk management is a new concept in the Kingdom of Saudi Arabia and it's necessary to understand it more"

(Focus group member)

It is also noted that SCRM gains trust among firms and facilitates information exchange, coordination and cooperation (Albores *et al.*, 2007).

Additionally, it is noted that there are tools can help firms to identify the source of a problem and, more importantly, the sources of variation before the sources turn into a problem. Applying total quality management (TQM) principles, e.g., Six Sigma approach reduces disruptive risks (Figure 14).

Figure 14 Tools to identify risk at Saudi Arabia



The following risks have been identified as arising in maritime firms in Saudi Arabia:

Financial risk

- Credit risk
- Foreign exchange risk
- Liquidity

- Bunker price
- Interest rate risk

Operational risk

- Production and productivity losses
- Health and safety
- Lack of education, practices and training
- Ship accident or oil spill
- Piracy and maritime robbery
- Personnel injury
- Transportation incidents and denial of access
- Vessel operation

Strategical risk

- Competition, Reputation loss & Negative campaign
- Political risk
- Economic risk
- Lack of security
- Natural disaster events
- Oil

“We could feel that these risks are most likely potential threats that face maritime firms in Saudi Arabia”

(Focus group member)

All participants agreed that some risks are more frequent than others. Additionally, the financial risk category was the one most likely to occur in maritime firms in Saudi Arabia. Operational risk followed, and strategic risk came third. (Figure 15)

Figure 15 Risk in Maritime firms at Saudi Arabia



The findings of this study revealed that most professionals involved in risk management decisions in the maritime industry view their companies' risks management processes as efficient:

"As a manager in a maritime firm, it's highly recommended to understand risk management in the supply chain concept in order to recognise the most accurate decision at the right time"

(Logistics Manager, Firm B)

These findings are supported by the rest of the findings of the study, which indicate that many companies follow appropriate risk management steps in order to mitigate risks and use appropriate strategies to decrease their risks and liabilities.

In contrast to these findings, the study also found that some participants did not use a risk management plan necessary to determining the risks that various projects face:

"A risk management plan is not always an option in order to approach risks that could face maritime firms"

(Distribution Manager, Firm E)

In particular, the study found that the majority of participants disagreed with the statement that they create a risk management plan in order to figure out how to best deal with risks in their industry. This finding is not supported by the other findings of the study, which actually indicate that their approach to risk management is quite formal and organised. Likewise, this finding is not supported by the literature on risk management, which indicates that developing a risk management plan before beginning work on a project is one of the best ways to approach the risk mitigation and management process.

Peleg-Gillai *et al.* (2006) have identified further factors that can enhance SCRM: these include higher supply chain visibility; improved supply chain efficiency; better customer satisfaction; improved inventory management; reduced cycle time and shipping time; and cost reduction following the above-mentioned collateral benefits. These factors are features of security as a source of competitive advantage. Absence of any one of these features would impact a company heavily and most likely affect the supply chain. Security risk is also an important strategy to reduce risk, as the security of maritime supply chain components is also one of the risks firms face. Security risk involves components such as cargo, vessels, ports, people, information and financing. Any risk involved in any of these components might delay or obstruct the movement of the supply chain. Moreover, continuing staff education, practices and training are highly important to reduce risks. Such training and development means that threat awareness can be established and maintained so that staff can quickly recognise dangers early at each point of the supply chain. Additional training should be provided to employees in maritime firms.

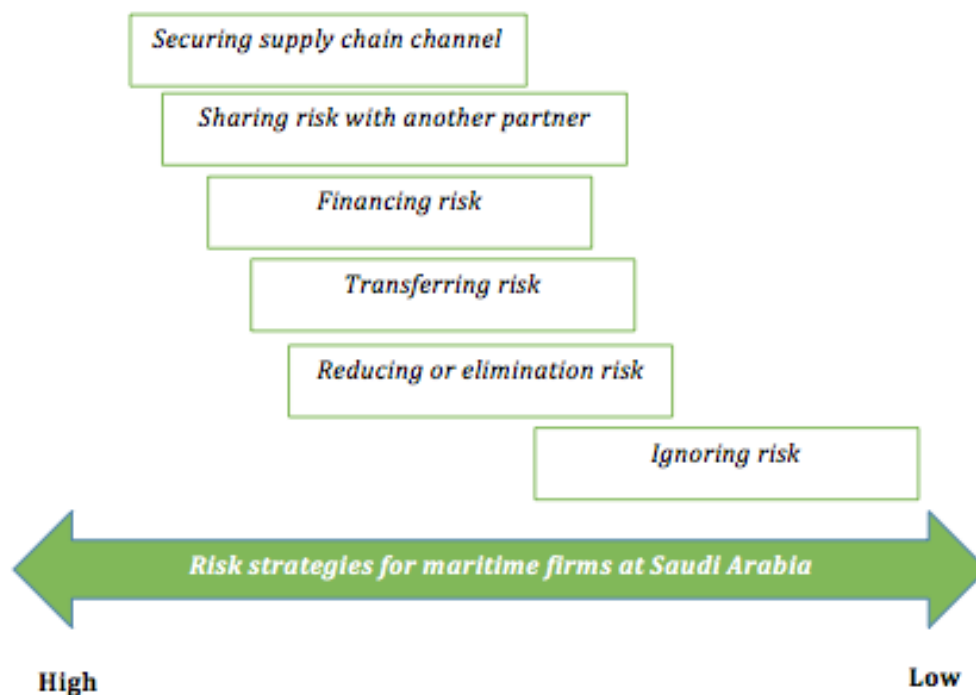
One of the most relevant outcomes of maritime security is that it could contribute to the generation of competitive advantage and securing supply chain components:

“Security in the maritime field is a serious matter, but it also has become an aspect of competitive advantage. Security allows firms to overtake their competitors”

(Focus group member)

Although most firms still tend to view security as a cost element – mostly as a result of the focus on direct expenses following security initiatives – there is increasing evidence that collateral benefits can be obtained through maritime South China Sea (Peleg-Gillai *et al.*, 2006). Supply chain investment thus contributes positively to the competitive position of the firm and is not only a cost (Figure 16). In the specific case of maritime transport, voluntary logistics security programs, such as C-TPAT, by improving collaboration among logistics service providers, shippers and carriers, can bring substantial improvements to the chain.

Figure 16 Risk strategies for maritime firms at Saudi Arabia



Maritime supply chain security can, therefore, be interpreted as a parameter of quality of service, taking advantage of the concepts developed in the “total supply chain” approach (Sheu *et al.*, 2006). Risk can also be mitigated through the successful implementation of training. There are many strategies and training techniques that can be utilised, such as initial and serial training, using alert levels, communicating terrorism information to employees, training videos, online security courses and continuing education. Facilitating this shift in

perspective is important, as supply chains rooted in strong relationships are much more likely to be effective, efficient and relevant (Bowersox et al., 1999) (Figure 17).

Figure 17 techniques to reduce risk in maritime firms at Saudi Arabia



The strategies can be applied for mitigating the other supply chain risks in the maritime supply chain. Although risks are not classed as 'extreme', this is an important activity if the firm wishes to prepare for worst-case scenarios.

There are three main considerations to attend to when examining operational risk: ex ante (prevention), in process and ex post (after the risk event). The first, prevention, is the same as the quality management concepts of "doing it right the first time" and mistake proofing (or in Japanese, 'poka yoke'). One method of implementing an ex ante mechanism is building standard operating procedures (SOP) and ensuring that these procedures are carried out correctly by assigning quality control and inspection. Next, an in-process mechanism, such as human safety management, can be carried out to further reduce risk. These first two considerations deal with the preventative side of risk; if this risk is categorised as high-impact but low-occurrence then all the company needs to do is to ensure that all the processes follow all the set standards. After a risk event, ex post, then a company can only attempt to reduce the impact of the risk. If there is a problem with mechanical equipment, for instance, business interruption insurance, bought in advance, will address the problem (Svensson, 2004).

The implementation of these procedures can have far reaching benefits outside of their intended purpose. Successful implementation of quality management tools, for example, could act as a preventative measure against strategic uncertainties. Moreover, reconfiguring the supply base increases the quality control for inbound products; it can also prevent the material delivery problem to avoid delay.

As previously mentioned, the severity of risks can vary right up to catastrophic risks, such as oil spills and terrorist attacks, and operational risks can prove extremely risky for firms. Economic conditions can play a large role in causing and exacerbating operational risk. The effect of this can be decreased forecast accuracy, which, in turn, can increase the cost of inventory or stock. In order to mitigate these risks, the firm can use pool or aggregate demand forecasting (Chopra and Sodhi, 2004). One of the benefits of working within maritime transport is the relative stability of the sector, with demand remaining at a near constant. As a result of this predictability, 'Collaborative Demand Planning' with

customers (downstream) is a useful option to address operational risk.

All parties see the benefits when implementing Collaborative Demand Planning. It allows both partners to streamline their work processes and as a result to benefit from increased accuracy in their forecasting, better market transparency, greater stability, reduced inventory and better communication. Furthermore, using postponement strategy can reduce the impact of fluctuations in demand. This is a strategy that can be undertaken by manufacturers to delay the final activities before packaging and release of goods to customers. Originally adopted to reduce the wastage associated with excessive release of goods, this strategy helps improve a company's product flexibility, thus allowing it to cope with fluctuating demand. A company can also attempt to maintain regularity in its supply by maintaining a positive public image through responsible corporate, social and environmental activity. This activity can help overcome the effect of a negative campaign from competitors.

One of the aims of this study was to explore how industry professionals view the process of risk management within the maritime industry. In particular, the study focused on the processes used to identify, assess and manage risk, and examined how effective they deemed these processes to be.

6.3 Chapter summary

Both managers and focus group's members agreed that identifying risk was important through the use of SCRM approach. The relationships between all members in a supply chain channel were building more good understanding. The thesis findings were reviewed in order to present the risks that occur in maritime firms in Saudi Arabia and their classifications and strategies.

CHAPTER SEVEN CONCLUSION

7.1 Introduction

In this chapter, the researcher overviews the contributions and concludes the thesis. The research limitations will too explore and then follows by further research and the opportunities.

7.2 The original contribution of the thesis

This thesis has explored an area of critical importance to the world economy that has received too little attention from the academic community, namely the management of supply chain risks in the maritime transport industry in the Kingdom of Saudi Arabia. It is a topic of global concern because the transport of oil from this region impacts the economies of countries around the world.

This thesis has helped to expand the field of SCRM by looking at how these concepts and practices are understood and implemented in this region. In addition, this thesis has drawn upon qualitative methodologies to gain insight into how practitioners in Saudi Arabia understand the risks they face and the strategies available to them for coping with these risks. This is an important aspect of this research because the majority of models developed in this field are rooted in the US or Europe. Exploring these concepts through a different cultural lens, such as that of Saudi Arabia, offers insights not available to other studies. This research offers a start, but there is substantially more work needed in this area.

Phillips and Pugh (2010) classified a list in which research can be original:

1. Setting down a major piece of new information in writing for the first time;
2. Continuing a previously original piece of work;
3. Carrying out original work designed by the supervisor;
4. Providing a single original technique, observation, or result in an otherwise unoriginal but competent piece of research;

5. Having many original ideas, methods and interpretations all performed by others under the direction of the postgraduate;
6. Showing originality in testing somebody else's idea;
7. Carrying out empirical work that hasn't been done before;
8. Making a synthesis that hasn't been made before;
9. Using already known material but with a new interpretation;
10. Trying out something in Britain that has previously only been done abroad;
11. Taking a particular technique and applying it in a new area;
12. Bringing new evidence to bear on an old issue;
13. Being cross-disciplinary and using different methodologies;
14. Looking at areas that people in the discipline haven't looked at before;
and
15. Adding to knowledge in a way that hasn't been done before.

The researcher has provided a list, which was extracted from the above, to present how this thesis is original:

- “Carrying out empirical work that hasn't been done before”

Empirical work has not been previously conducted in SCRM and maritime firms. There are investigations gathered supply chains and risk (e.g. Hallikas *et al.*, 2002; Zsidisin, 2003; Norrman and Jansson, 2004; Chopra and Sodhi, 2004; Sinha *et al.*, 2004; Wu *et al.*, 2006; Tomlin, 2006; Mohd Nishat *et al.*, 2006; Juttner, 2011; Giannakis and Louis, 2011; Lavastre *et al.*, 2012; Boyson, 2014; Ho *et al.*, 2015; Nooraie and Mellat Parast, 2015), but not no empirical work on maritime firms in Saudi Arabia, where SCRM is still a new concept in every industry in the country. Furthermore, empirical work has not been applied to the maritime industry.

- “Being cross-disciplinary and using different methodologies”

The thesis adopts cross-disciplinary approach in supply chain management, risk management, supply chain risk and maritime industry. Furthermore, the thesis applied a method approach to study the research themes that wae

developed from interviews and to investigate the research findings via focus groups.

- “Looking at areas that people in the discipline haven’t looked at before”

Supply chain risk in the context of maritime firms in Saudi Arabia has not been explored in published literature. No research has been done on the maritime industry in Saudi Arabia in terms of SCRM perspective.

- “Taking a particular technique and applying it in a new area”

The particular technique of SCRM were investigated in several areas in the literature, but this thesis marks the first time the SCRM approach has been used to identify risk in Saudi Arabia.

- “Adding to knowledge in a way that hasn’t been done before”

This study has added to the knowledge base of SCRM, maritime industry and risk management. The thesis findings can be explored to further study supply chain risk in the maritime industry in Saudi Arabia and other countries.

7.3 The research questions

In this thesis, the researcher sought to add depth and detail to the understanding of the SCRM environment and, in particular, to the way that this environment was perceived by the managers directly working in companies involved in the shipping sector in Saudi Arabia. In addition, the thesis explored the perceptions and experiences of these managers in employing the strategies that have been developed by academics and practitioners to manage supply chain risk. One of the particular objectives of the thesis was to gain an understanding of the influence of cultural differences, as practitioners in Saudi Arabia must currently draw upon conceptual frameworks and strategies developed by and in Europe and North America.

A key goal of the thesis was to examine the theoretical approaches to SCRM and to see how those theories were applied within the context of the Saudi Arabian maritime industry. To test the application of these theories, the thesis identified

the risks that maritime firms in Saudi Arabia faced, how the managers at these firms understood these risks and how they perceived and used the strategic tools available to them for managing the risks. As a part of this analysis, the thesis also explored areas where the existing models and theories could be modified in order to improve or strengthen the risk management strategies.

The research has revolved around three key questions:

- How do maritime firms in Saudi Arabia face supply chain risks?
- How can managers find and identify supply chain risks?
- How can risk strategies help to minimise or eliminate supply chain risks?

The answers to these questions, as provided in this thesis, are summarised in the following three sections.

7.3.1 How do maritime firms in Saudi Arabia face supply chain risk?

This study found that operational accidents, operational catastrophes and strategic uncertainty are the most commonly cited types of risks in the literature (Juttner *et al.*, 2003; Zsidisin, 2003; Christopher and Peck, 2004; Norrman and Jansson, 2004; Peck, 2005; Wagner and Bode, 2006; Wu *et al.*, 2006). However, the literature has revealed that perspectives on disruption risks in each industry are unique, and these perspectives are different from firm to firm. Therefore, the study has provided a new classification of risk in terms of the maritime industry.

Most of the types of risk that were given by participants are communal. However, the researcher has classified the risks based on the connections and similarities between them (Figure 18). The classification is details as follows:

✓ Financial risk

Financial risk is a term for multiple types of risk associated with financing, including financial transactions that include company loans in risk of default. They are several risks related to finance:

- Credit risk
- Foreign exchange risk
- Liquidity
- Bunker price
- Interest rate risk

✓ Operational risk

Operational risk is defined as the risk of loss resulting from inadequate or failed processes, people and systems or from external events. Risks related to operations, which are the most numerous, are the following:

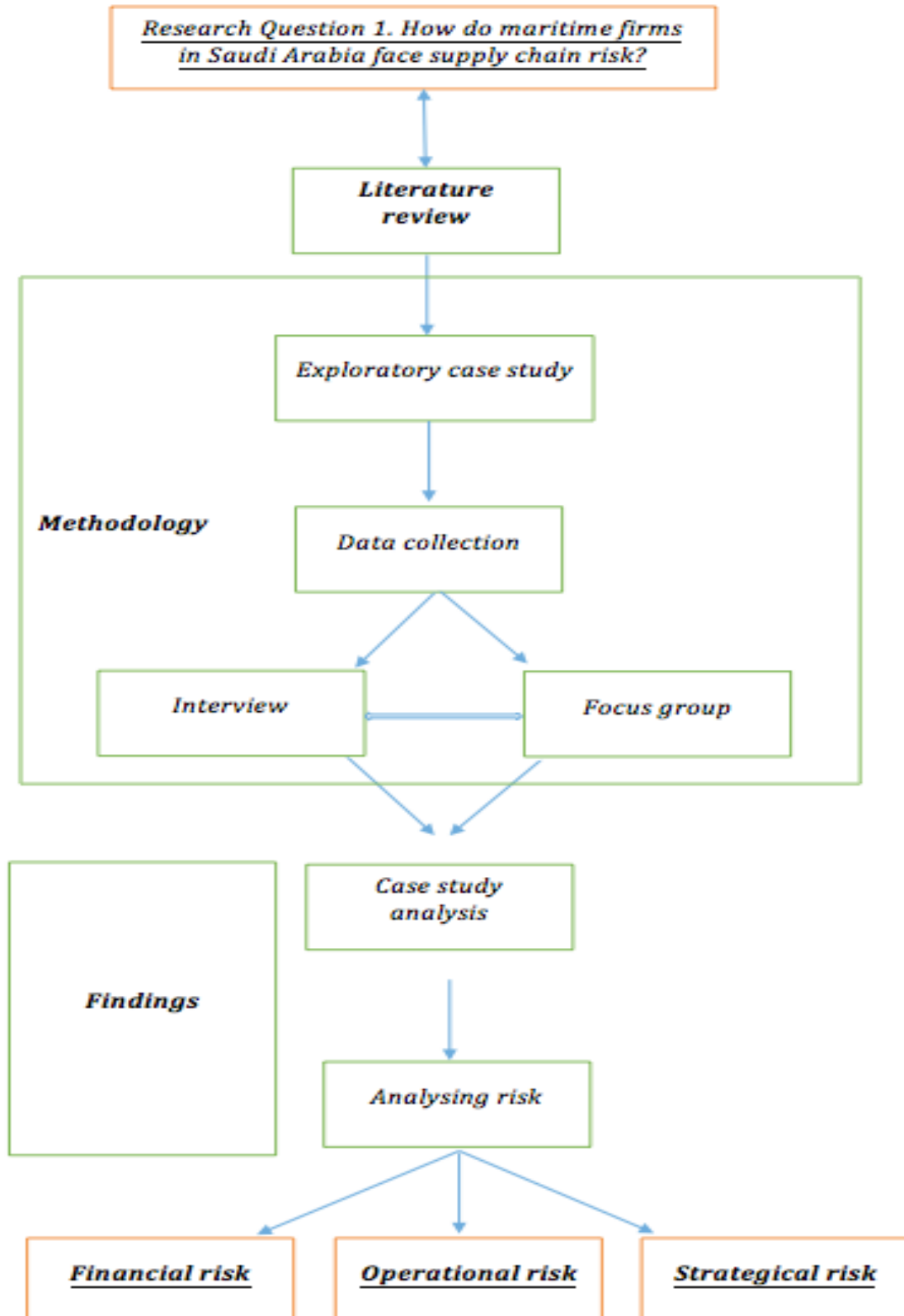
- Production and productivity losses
- Health and safety
- Lack of education, practices and training
- Ship accident or oil spill
- Piracy and maritime robbery
- Personnel injury
- Transportation incidents and denial of access
- Vessel operation

✓ Strategical risk

Strategical risk is the uncertainties and untapped opportunities embedded in a strategic intent and how well that opportunities are executed. Strategic risk consists of the following:

- Competition, reputation loss & negative campaign
- Political risk
- Economic risk
- Lack of security
- Natural disaster events
- Oil

Figure 18 Diagram of research question 1



7.3.2 How can managers find and identify supply chain risks?

The tools identified in this thesis can be used in many different stages of SCRM, in risk identification and analysis, risk assessment, decision and implementation of risk management actions and risk monitoring (Hallikas et al., 2004; Zsidisin *et al.*, 2005; Wu *et al.*, 2007; Lavastre *et al.*, 2012). However, risk identification and risk assessment stages are usually used. Sinha *et al.* (2004) noted that there is a developed prescriptive method to decrease risk in an aerospace supply chain and propose the following five activities: identifying risks, assessing risks, planning and implementing solutions, conducting failure modes and effects analysis (FMEA) and continuously improving.

The relationship between quality management and supply chain management practices was examined by Flynn and Flynn (2005). They ended with a result of there is a strong relationship between quality management and supply management that affects business performance. There were seven classic quality management tools identified in the literature.. Seven classic tools of quality management are identified in the literature. They were commonly applied to identify, understand and solve risks in supply chain and they are the following:

- Failure mode, effects and critical analysis
- Internal and external processes mapping
- Question positioning approach
- Score method
- Pareto diagram, ABC ranking
- Ishikawa diagram, brainstorm
- PDCA cycle, Deming cycle, Six Sigma, permanent improvement

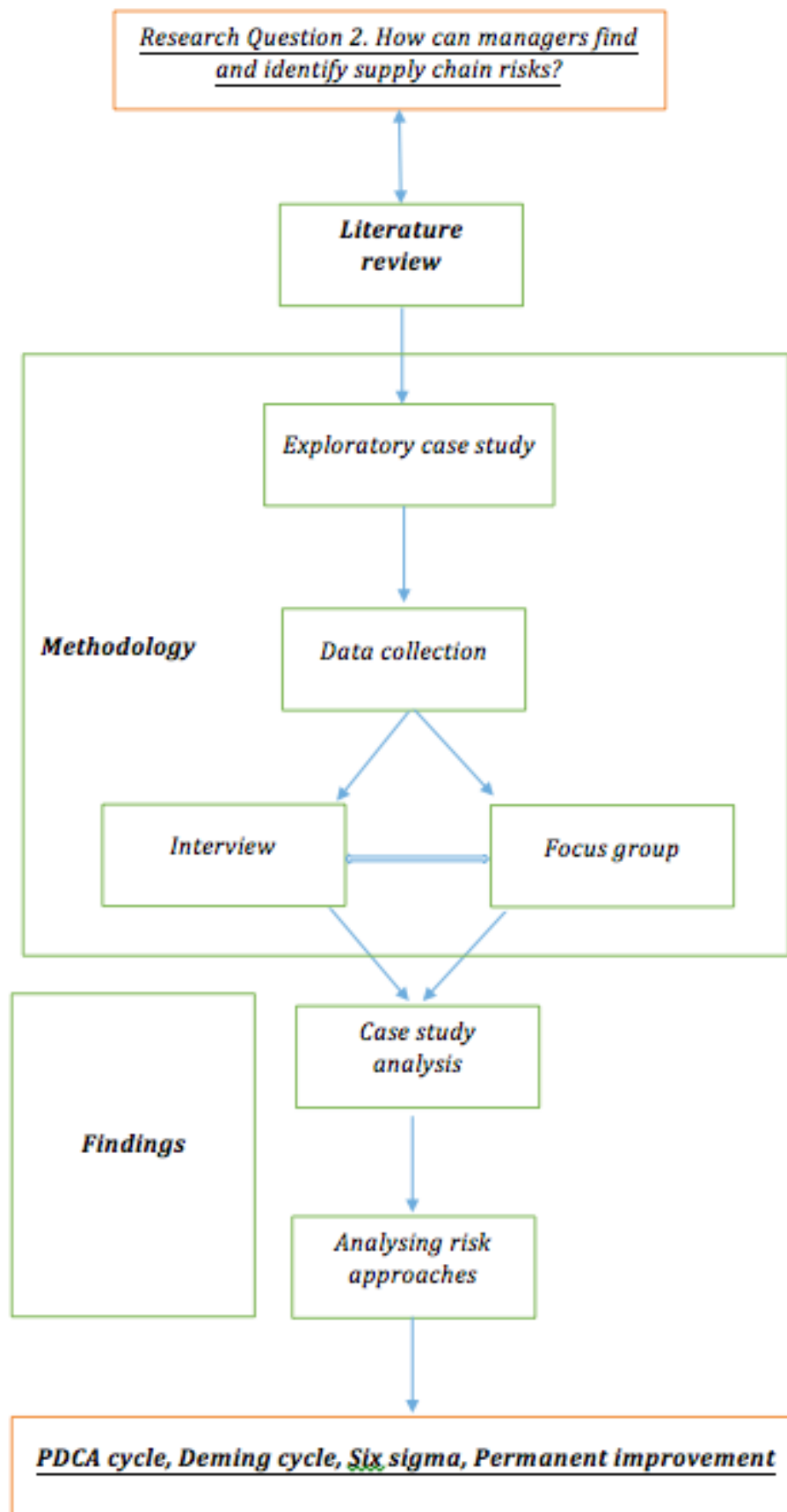
Applying Six Sigma approach, provides leverage in achieving higher supply chain security and reduction of disruptive risks faced while reducing operating costs. Recently there has been much interest in the Six Sigma methodology as a way of

reducing variability in processes (for example, George, 2002). Six Sigma tools such as control charts and failure modes and effects analysis (FMEA) can be very helpful in identifying the opportunities for reducing process variability in supply chains.

However, these tools and methodologies are primarily of benefit within the business for the control of repetitive activities. Roth *et al.* (2008) proposed a Six Sigma based framework of food supply chain control, relying on traceability, transparency, testability, time, trust and training. To improve internal quality and capabilities, firms have also invested heavily over the past decade in programmes such as Total Quality Management (TQM), Lean Manufacturing and Six Sigma. Furthermore, Six Sigma tools can help companies identify the source of a problem and, more importantly, the sources of variation before the sources turn into a problem. Applying total quality management (TQM) principles, e.g., Six Sigma approach, reduces disruptive risks.

As result, one of the most common tools of supply chain management is a continuous improvement such as Six Sigma and PDCA. This thises confirmed that Six Sigma method is widely popular and used in the maritime industry. tools of risk management such as PDCA, Six Sigma, continuous improvement are standard quality management tools. The benefit is rigorous approach, mainly in Six Sigma case, and they provide important safeguards in management of risk.

Figure 19 Diagram of research question 2



The study shows that Saudi Arabian firms using Six Sigma approach enjoy the following substantial benefits:

- Reduced process variability in supply chains
- Higher supply chain security
- Higher reliability
- Disruptive risks reduction
- Control over repetitive activities
- Continuous improvement in process design
- Identification of the source of potential problems
- Higher quality and capabilities
- Reduced operating costs

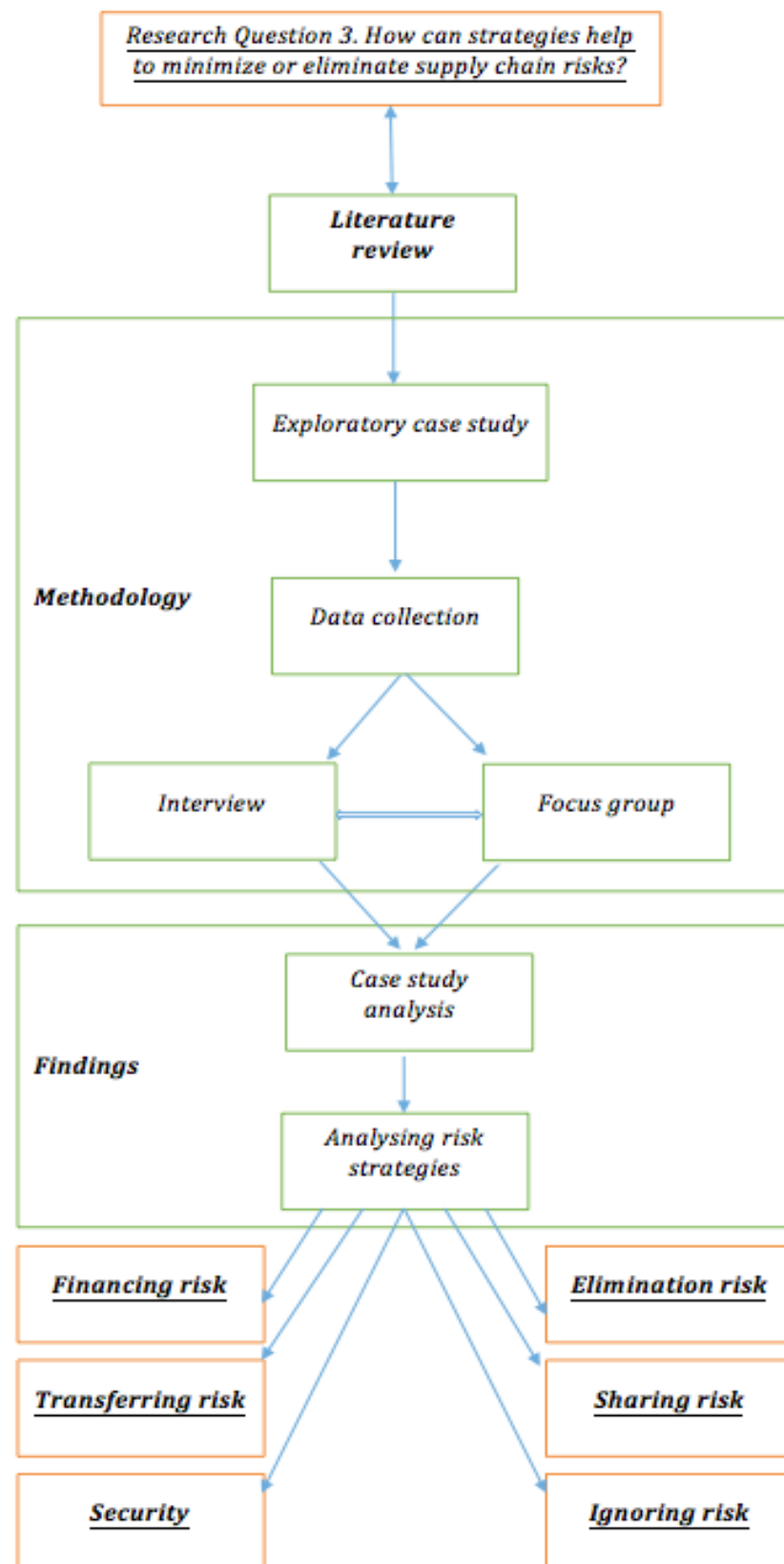
7.3.3 How can risk strategies help to minimise or eliminate supply chain risks?

The study showed that strategies of risk management can be categorised primarily into seven categories: avoidance, postponement, speculation, hedging, control, sharing/transferring, and security (Jüttner *et al.*, 2003; Miller, 1991; Manuj and Mentzer 2008). However, those strategies are narrowly correlated to each other. Additional, applying one strategy to one section of the firm might necessitate the use of another strategy to another unit or section (e.g., a hedging strategy entails avoiding some risks).

The researcher found that the following basic strategies are suitable to confront risk in maritime industry (Figure 20). These strategies were evident during the initial exploratory study with interviews of the managers and the members of focus group . They also derive from the literature review. The strategies are the following:

- Elimination or reducing risk by internal actions
- Security
- Transferring risk to another partner
- Sharing risk to another partner
- Ignoring the risk
- Financing risk

Figure 20 Diagram of research question 3



✓ Avoiding risk and reducing risks as a strategy

The study found that a large number of participants used risk avoidance as a risk management strategy. Avoiding risk whenever possible and plausible is a simple and efficient way of protecting the project from unnecessary harm and/or loss of financial resources. The findings of this study are supported by prior research on risk management strategies, which suggest that risk avoidance is one of the most common ways that organisations mitigate risk (Soares and Teixeira, 2001).

In addition to avoiding risks whenever it is possible and efficient, the study also found that risk reduction was a common strategy for mitigating risks. While many risks can be successfully avoided, maritime industry sites also employ techniques, such as security measures, that allow them to reduce risks (Soares and Teixeira, 2001). One example of a risk reduction strategy is the use of security measures. These findings are supported by the findings of prior studies, which indicate that risk reduction is a common strategy used to manage risk (Soares and Teixeira, 2001).

✓ Risk transfer and sharing as a strategy

The study found that risk transfer and/or risk sharing was a common strategy used by maritime industry professionals in managing their risk. Risk transfer and/or sharing is the strategy of employing a third party in helping the organisation to take on some of the risks associated with a given event in the project (Wang, 2006). A common example, and the one brought up in the study, is the use of insurance companies. The findings of this study are supported by prior research on risk management strategies and their use in maritime industry projects (Wang, 2006). Maritime industry companies buy policies to insure certain aspects of the project, such as a piece or a collection of equipment used on the project, in case something happens. That way, in case of a theft or an act of vandalism, the company receives monetary compensation for the loss that they encounter.

✓ Security as Strategy

The researcher found that there are several management approaches mentioned such as risk management (Thai and Grewal, 2007; Thai, 2009; Gould, et al., 2010), business continuity management (Gutiérrez, 2007; Thai, 2009; Gould, et al., 2010), quality management (Thai and Grewal, 2007; Thai, 2009, 2013; Hints, et al., 2009; Gould, et al., 2010; Urciuoli, et al., 2010), disaster management (Macdonald and Corsi, 2013), crisis management (Gutiérrez, 2007), layered approach (Bichou et al., 2014; Urciuoli et al., 2010), and total security management. Still, there are other frameworks were found in terms of maritime and supply chain security management; the supply chain security management model (SCSMM) which developed by Gutiérrez (2007), the framework for supply chain security management (FSCSM) proposed by Closs et al. (2008), the conceptual models of effective maritime security (CMEMS) introduced by Thai (2009), and the maritime security management system (MSMS) proposed by Thai and Grewal (2007).

Too, current technological research in the fields of sensors capable of identifying nuclear, chemical and/or biological elements may help to identify at-risk shipments. The capability to understand what is moving when and where, to identify unusual or suspicious elements and concentrate on them and to deal with the rest of the movements through a sampling based process may be a viable strategy. Efforts such as the Container Security Initiative, the Customs Trade Partnership Against Terrorism (CTPAT) and the overarching Operation Safe Commerce initiative provide directions that in the long term will enhance the security of global commerce (Downey 2004).

The previous chapter discussed the implication of these strategies in maritime firms in Saudi Arabia. The following section discusses the theoretical implications of the thesis.

7.4 The theoretical implications of the thesis

This thesis aims to close the research gap in SCRM research in terms of maritime industry at Kingdom of Saudi Arabia. In the literature review, the researcher noticed that SCRM was not fully understandable and in need of more development. However, several researchers have studied supply chain risk (Juttner, 2011; Giannakis and Louis, 2011; Lavastre *et al.*, 2012; Boyson, 2014; Ho *et al.*, 2015; Nooraie and Mellat Parast, 2015) while the researcher was working on this study. However, more empirical studies are needed to understand risk of supply chain further (Tazelaar and Snijders, 2013; Cantor, Blackhurst and Cortes, 2014; (Cordell, Turner and Chong, 2015; Venkatesh, Rathi and Patwa, 2015).

This thesis aimed to understand in more depth and detail the SCRM environment and strategies of the maritime sector in Saudi Arabia as perceived and experienced by managers directly working in these companies. The thesis aimed to establish research links between current SCRM and the maritime industry in Saudi Arabia. It also aimed to determine the impact of supply chain risks due to disruptions.

This thesis has academic implications. First, it provides a valuable contribution to the literature on the performance of maritime firms by introducing categories and indicators that can be applicable to eliminate or reduce risks. This categorization is recommended for using by maritime firms to study the effectiveness of their SCRM. Moreover, this thesis represents one of the first studies conducted on the impacts of supply chain risk management in maritime firms.

This thesis has searched SCRM and used a case study approach to identify the risks and strategies that have provenance in practice and also within theory. These risks have been studied through focus groups within an academic setting. One of the aims of that was to expand the rigour and triangulation of the research. Too, it was to discuss the ideas from academia to practice and vice versa.

Moreover, the results of the thesis provide insights into the management of maritime firms risks in supply chains. The thesis provided a new classification of

risk in terms of the maritime industry. The second key finding was the tools that could help maritime firms to identify risk. Another key finding was that the strategies are suitable to confront risk in maritime industry. Those strategies were evident during the initial exploratory study with interviews of the managers and the members of focus group. Finally, the thesis' findings are both theoretical and practical.

7.5 The practical implications of the thesis

The thesis practical findings are the comparisons made of the perceptions of risk along the supply chain. These comparisons suggest that maritime firms need to exchange information and communicate better with other actors in the supply chain channel such as ports, vessels and people. Suppliers also need to be allowed to provide their views on risks.

However, a resource based economy or natural resource based economy is the economy of a country whose gross national product or gross domestic product to a large extent comes from natural resources. Saudi Arabia's command economy is petroleum-based economy, the government controls all majors' activities. With its absolute monarchy system of government, large state sector and supply of welfare benefits, the Saudi economy has been described as a bewildering (at least to outsiders) combination of a feudal fealty system and a more modern political patronage one. At every level in every sphere of activity, Saudis manoeuvre through life manipulating individual privileges, favours, obligations, and connections. By the same token, the government bureaucracy is a maze of overlapping or conflicting power centre under the patronage of various royal princes with their own priorities and agendas to pursue and dependents to satisfy.

On the other hand, many of US/Europe countries have different economies; mixed economy. A mixed economy is described as an economic system comprising of a combination of either markets and economic planning, public ownership and private ownership, or markets and economic interventionism. Though, in most cases, "mixed economy" refers to market economies with strong regulatory oversight and governmental provision of public goods, although some

mixed economies also feature a number of state-run enterprises. Generally, a mixed economy is characterized by a pragmatic division of the means of production between private ownership and public ownership. Profit-seeking enterprise and the accumulation of capital remain the fundamental driving force behind economic activity, while markets are subject to varying degrees of regulatory control. Unlike a free-market economy, the government wields indirect macroeconomic influence over the economy through fiscal and monetary policies designed to counteract capitalism's history of boom/bust cycles, unemployment, and growing income and wealth disparities, along with playing a role in interventions and civic institutions that promote social welfare. Afterward, many mixed economies have expanded in scope to include a role for indicative economic planning and/or large public enterprise sectors. Development of the public sector in mixed economies has tended to concentrate across universal civic requirements, such as health services, mass transportation, physical infrastructure, and management of public lands and resources.

As the result, this study showed that no matter country's economy is applied, risks in maritime industry at Saudi Arabia are similar to risks that found in western countries.

7.6 Limitations of the research study

All research studies have certain limitations, and this study was no exception. One of the major limitations of this study is that it only considered a limited number of types of risk analysis and supply chain management and asked a limited number of questions relevant to this topic. Though the research has made every effort to minimise the threats to validity, there were certain conditions which might have affected the internal validity of the study. All participants were subject to extraneous variables, which could not be accordingly controlled for in this study format. For example, participants and their attitudes and perceptions might have been affected by the physical environment in which they participated in the study, and factors such as heat or cold or other external factors might have given them certain impressions and attitudes that they might not otherwise hold (Figner and Weber, 2011). Other important extraneous variables that the

participants might have been subjected to were personal issues and the participants' general mood on the day of the survey. These extraneous variables might have played a role in affecting how the participants understood the questions and affected their attitudes and perceptions toward the questions on consumer behaviour. Finally, another important extraneous variable that needs to be considered is the length of the interview. The interview questions were not particularly long, but some participants might have thought that there were too many questions, and these feelings would have negatively affected their attitudes toward the questions in the interviews. Furthermore, participants might have encountered difficulties in interpreting the questions and might have understood the questions differently from how they were written. As a result, the questions are also important limitations of this research study.

Finally, another important limitation of the study comprises the attitude scores themselves. Research indicates that people's attitudes are affected by many factors including, but not limited to, their social circle and friends' attitudes toward risk management and prior experience with risk management. This research study tried to address some of these factors, but the study was not exhaustive.

7.7 Recommendations for further research

The thesis noted that future research could be grounded in more firms and in other industries. Also, those risks could be verified in other industries and firms through operating focus groups approach. The methodology could employ more of a mixed approach to check the findings, via quantitative methods, a survey, for example. This would improve the reliability of the findings and also the generalisability. In defence of the methodology used in this thesis, qualitative research was deeper and richer approach, which was related to the main research aim. This was the primary aim of the thesis, and future research could extend this thesis into other targets and also into different tiers of the supply chain.

7.8 Chapter summary

This chapter concluded the thesis by reviewing the contributions made by the researcher. It then answered the research questions and addressed the implications of the thesis for theory and practice. The limitations of the thesis were also covered, and then followed by the further research opportunities.

The methodology prescribed in chapter three, data was successfully gathered and analysed. Case study approach, interviews and focus groups may be limited in terms of their validity, generalisability, and reliability. Yet in the right context and methodology, these three aspects of research can be improved. The model of framework needs further testing and it also has a potential to develop to be applied in different industry.

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Appendix 1, Journal list and the numbers of articles in each journal

Journal	Articles
Advances in Engineering Software	1
Advances in Management	1
Agribusiness (New York)	1
AIChE Journal	3
American Journal of Agricultural Economics	2
Applied Economics	1

Applied Mathematical Modelling	1
Asia-Pacific Journal of Operational Research	1
Australian Economic Review	1
Automatica	2
Biotechnology Law Report	1
BMC Public Health	1
Bulletin of the World Health Organisation	1
Business Economics	1
California Management Review	1
Canadian Journal of Civil Engineering	1
Canadian Journal of Forest Research	1
Chemosphere	1
China Business Review	1
CILT World	1
Computer aided chemical engineering: European symposium on computer aided process engineering	1
Computers & Operations Research	2

Computers in Industry	2
Concurrent Engineering: Research and Applications	1
Corporate Social Responsibility and Environmental Management	1
Creativity and Innovation Management	1
Crop Protection	1
Decision Sciences	4
Decision Support Systems	2
Economic Modelling	1
Energy	2
Energy Economics	1
Energy Policy	3
Energy Procedia	1
Engineering Management	1
Environment International	1
Environmental Modelling & Software	2
Environmental Research	1

Environmental Science & Policy	1
European Journal of Operational Research	9
European Management Journal	1
Expert Systems with Applications	2
Financial Executive	2
Food Policy	1
Food Research International	1
Gastrointestinal Endoscopy	1
Healthcare Financial Management	1
ICFAI Journal of Supply Chain Management	1
IEE Proceedings -- Generation, Transmission & Distribution	1
IIE Transactions	2
IIMB Management Review (Indian Institute of Management Bangalore)	2
Industrial Engineering Journal	3
Information Knowledge Systems Management	1
Intel Technology Journal	1

Interfaces	1
International Game Theory Review	1
International Journal of Business, Economics, Finance and Management Sciences	1
International Journal of Hydrogen Energy	1
International Journal of Hydrogen Energy	1
International Journal of Hygiene and Environmental Health	1
International Journal of Physical Distribution & Logistics Management	11
International Journal of Production Economics	34
International Journal of Production Research	4
International Journal of Project Management	1
International Journal of Technology and applied finance	1
IUP Journal of Supply Chain Management	1
Ivey Business Journal Reprints	1
Journal of Banking & Finance	1
Journal of Business Forecasting	1
Journal of Business Logistics	3

Journal of Cleaner Production	1
Journal of Development Economics	1
Journal of Development Studies	1
Journal of Exposure Science and Environmental Epidemiology	1
Journal of Financial Economics	1
Journal of Health Economics	1
Journal of Information Systems	1
Journal of Labor Economics	1
Journal of Loss Prevention in the Process Industries	1
Journal of Management and Strategy	1
Journal of Management Information Systems	1
Journal of Operational Risk	1
Journal of Operations Management	6
Journal of Purchasing & Supply Management	5
Journal of Service Science and Management (JSSM)	2
Journal of Supply Chain Management	5

Journal of Systems Engineering and Electronics	1
Journal of the European Economic Association	1
Management Science	4
Manufacturing & Service Operations Management	1
Mathematical Methods of Operations Research	1
Mechanical Engineering-CIME	1
Medical Decision Making	1
MIT Sloan Management Review	1
Naval Research Logistics	2
Nuclear Engineering International	2
Omega	7
Operations Research	2
Pharmaceutical Technology	3
Physics and Chemistry of the Earth, Part B: Hydrology, Oceans and Atmosphere	1
PLoS Medicine	1
Power Engineering	1

Procedia - Social and Behavioral Sciences	2
Procedia Engineering	1
Procedia Environmental Sciences	2
Process Safety and Environmental Protection	1
Production & Operations Management	9
Progress in Applied Mathematics	1
Quality	1
Reliability Engineering & System Safety	3
Resources Policy	1
Review of Agricultural Economics	1
Risk Analysis: An International Journal	1
Risk Management	5
Safety Science	2
Serbian Journal of Management	1
Socio-Economic Planning Sciences	1
Strategic Finance	1

Strategic Outsourcing: an International Journal	1
Systems Engineering Procedia	1
Technological & Economic Development of Economy	1
Technological Forecasting and Social Change	1
The International Food and Agribusiness Management Review	1
The Journal of the Operational Research Society	5
The Ohio Journal of Science	1
Thunderbird International Business Review	1
Tourism Management	1
Transfusion and Apheresis Science	1
Transportation Journal	3
Transportation Journal (American Society of Transportation & Logistics Inc.)	1
Transportation Research Part A: Policy and Practice	1
Transportation Research Part E: Logistics and Transportation Review	2
Transportation Research: Part B	2
Vision (09722629)	1

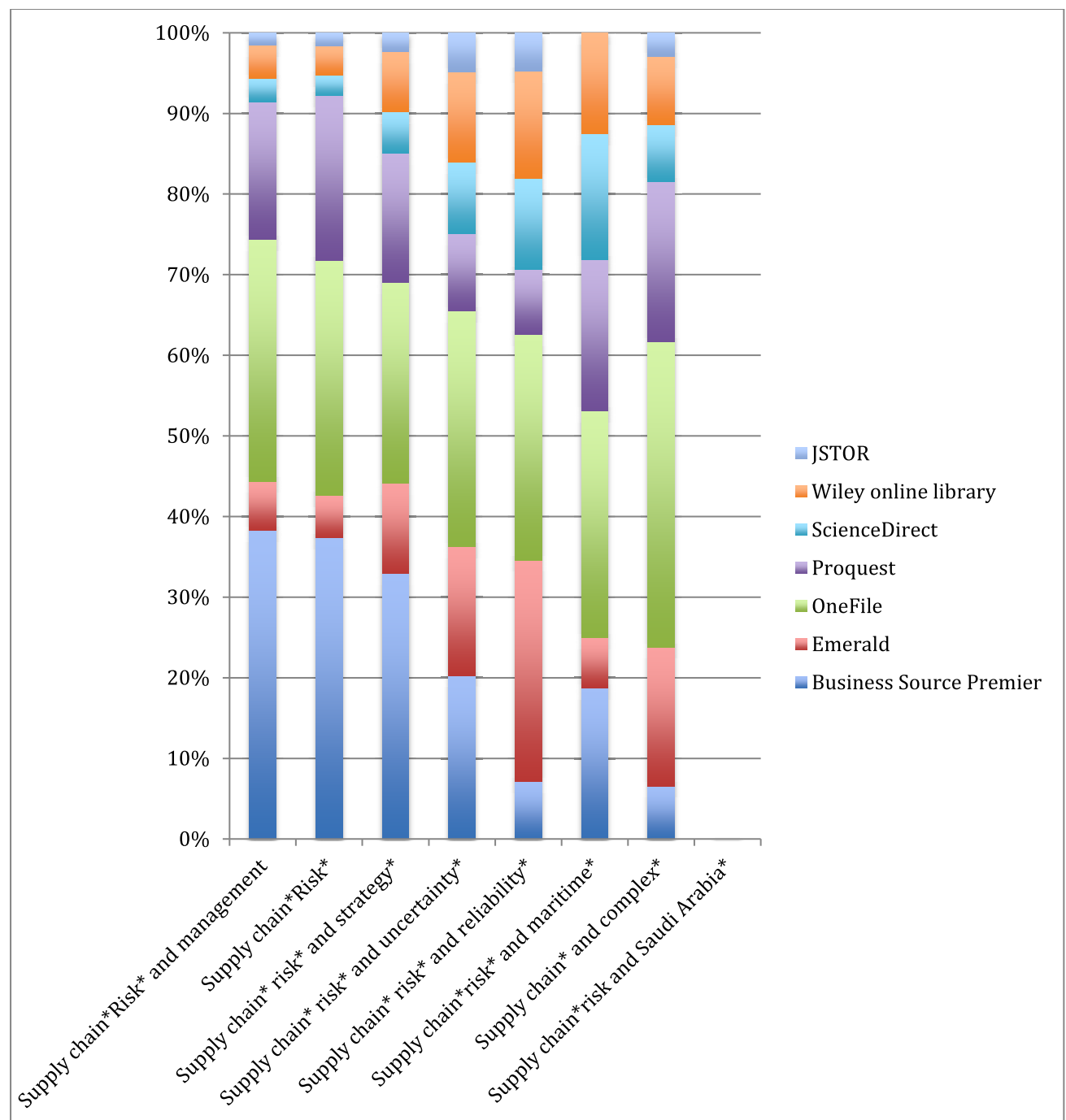
World Development	1
World Journal of Entrepreneurship, Management and Sustainable Development	1
Total	165

Appendix 2, An example of some of citation Statistics

Search string	Business Source Premier	Emerald	OneFile	Proquest	ScienceDirect	Wiley online library	JSTOR	Google Scholar
Supply chain*Risk* and management	551	88	432	246	42	59	22	13900
Supply chain*Risk*	626	88	489	343	43	61	27	14100
Supply chain* risk* and strategy*	238	81	180	116	37	54	17	12000
Supply chain* risk* and uncertainty*	91	72	131	43	40	50	22	8270
Supply chain* risk* and reliability*	15	58	59	17	24	28	10	11700
Supply chain*risk*	6	2	9	6	5	4	0	1340

and maritime*								
Supply chain* and complex*	27	71	156	82	29	35	12	7760
Supply chain*risk and Saudi Arabia*	0	0	0	0	0	0	0	302
Supply chain* and management	2347	826	3715	2905	993	1174	761	252000

Search String Analysis of Search Engines



Appendix 3, samples of Introducing and probing questions.

1. What do you think on any current risks in the supply chain?
2. What are the elements that might help to identify a risk in the supply chain?
3. Do you think that your firm is in strong relation with its suppliers?
4. Could you provide more details about identifying risk in your firm?
5. What would have to do in order to reduce risk in your firm?
6. What criteria did you use?
7. What is the connection between sharing information and decreasing risks?

Appendix 4, Guidelines for Moderator

Step one: Ground Rules

Welcoming the participants to the session
Read Informed Consent Statement (Appendix 5)
Introducing participants
All views are valuable and respected
All participants have the right to talk
Interruptions are not allowed
Please talk one at a time

Step two: Asking questions

An example of the questions that might ask:

What is the view of the speaker regarding to identify risks?
Is it possible to give an example of a situation when a risk can be identified?
What is the opinion of the speaker regarding to techniques to reduce risks?
Are there any advantages? If Yes; give an example
Are there any limitations?
Which do you think is the best technique to reduce or eliminate risk?
Are there any issues you would like to discuss?

Step three: Ending the session

A brief summary about key issues discussed
Thank the participants

Appendix 5, Participant information sheet

Supply chain risk management:

A Case Study of Maritime Firms in the Kingdom of Saudi Arabia

Name
Address

Date

Dear Name,

I'm a doctoral candidate at Anglia Ruskin University engaged in research for the purpose of supply chain risk management for a Doctor of philosophy degree. I'm also a lecturer at King Abdulaziz University. The purpose of this study is to identify the supply chain risks in Maritime Firms in the Kingdom of Saudi Arabia, and to emphasize the importance of supply chain risk management implementation. You are being invited to take part in a research study. It is always optional. If you decided to take part in the study, we would review the study with you, at (.....). This would be at a time that convenient for you.

Risks:

The risks of this study are minimal. These risks are similar to those you experience when disclosing work-related information to others.

Costs:

There is no cost for participation in this study. Participation is completely voluntary and no payment will be provided.

Confidentiality:

Information obtained in this study is strictly confidential. All data will be secured in a locked filing cabinet. Your name will not be used in the reporting of information in publications or conference presentations.

Voluntary Participation:

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you do decide to take part in this study, you will be asked to sign a consent form. If you decide to take part in this study, you are still free to withdraw at any time and without giving a reason. You are free to not answer any question or questions if you choose. This will not affect the relationship you have with the researcher.

Person To Contact:

If you have any queries concerning the nature of the research or are unclear about the extent of your involvement in it please contact me at
basim.aljabhan@student(anglia.ac.uk

I sincerely hope that you will be able to help me with my research. I will write to you on completion of the research and a copy of my final research report will be made available to you upon request. Thank you for taking the time to consider my request and I look forward to your reply.

Yours sincerely,
Basim Aljabhan

PhD candidate
LAB 313
Lord Ashcroft International Business School
Anglia Ruskin University
East Road
Cambridge
CB1 1PT

Thank you letter

Name

Date

Address

Dear Name,

Thank you so much for your participation in a research study; supply chain risk management: A case study of Maritime Firms in the Kingdom of Saudi Arabia.

I could not have done it without your help. It really turned out to be an enjoyable and exciting experience.

Thank you again for taking the time to be a part of this important meeting. If you have any comments or concerns, please feel free to contact me at basim.aljabhan@student.anglia.ac.uk

Yours sincerely,
Basim Aljabhan

PhD candidate
LAB 313
Lord Ashcroft International Business School
Anglia Ruskin University
East Road
Cambridge
CB1 1PT



Anglia Ruskin
University

Cambridge Institute
of Higher Education
The College
Cambridge

Phone: +44 (0)1223 316100
Fax: +44 (0)1223 316101
www.anglia.ac.uk

PARTICIPANT INFORMATION SHEET

Supply Chain Risk Management: A case study on the maritime firms in Kingdom of Saudi Arabia

Name

Date

Address

Dear Name,

I'm a doctoral candidate at Anglia Ruskin University engaged in research for the purpose of supply chain risk management for a Doctor of philosophy degree. I'm also a lecturer at King Abdulaziz University and this research is funded by the Ministry of Higher Education in Saudi Arabia. The purpose of this study is to identify the supply chain risks in the maritime firms in Kingdom of Saudi Arabia, and to emphasize the importance of supply chain risk management implementation. **You are being invited to take part in a research study.** It is always optional. If you decided to take part in the study, we would review the study with you, at {.....}. This would be at a time that convenient for you.

Risks:

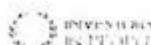
The risks of this study are minimal. These risks are similar to those you experience when disclosing work-related information to others.

Costs:

There is no cost for participation in this study. Participation is completely voluntary and no payment will be provided.

Confidentiality:

Information obtained in this study is strictly confidential. All data will be secured in a locked filing cabinet. Your name will not be used in the reporting of information in publications or conference presentations.



Participant Consent Form



Anglia Ruskin
University

Cambridge, Essex, Peterborough

Cambridge, Essex,
Peterborough
CB1 1PT

01223 316111
www.anglia.ac.uk

NAME OF PARTICIPANT

Title of the project
Supply Chain Risk Management: A Case Study on
the maritime firms in Kingdom of Saudi Arabia

Main investigator and contact details
Basim Aljabhan
PhD candidate
basim.aljabhan@student.anglia.ac.uk
LAB 313
Lord Ashcroft International Business School
Anglia Ruskin University
East Road
Cambridge
CB1 1PT

Members of the research team: Dr. Helen Benton and Dr. Peter Ball

1. I agree to take part in the above research. I have read the Participant Information Sheet which is attached to this form. I understand what my role will be in this research, and all my questions have been answered to my satisfaction.
2. I understand that I am free to withdraw from the research at any time, for any reason and without prejudice.
3. I have been informed that the confidentiality of the information I provide will be safeguarded.
4. I am free to ask any questions at any time before and during the study.
5. I have been provided with a copy of this form and the Participant Information Sheet.

Data Protection: I agree to the University processing personal data which I have supplied. I agree to the processing of such data for any purposes connected with the Research Project as outlined to me*

Name of participant (print).....Signed.....Date.....

YOU WILL BE GIVEN A COPY OF THIS FORM TO KEEP

* The University* includes Anglia Ruskin University and its partner colleges

