Dissertation

on

Managing Risk in Supply Chain Management

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Submitted to:

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Submitted for the partial fulfillment of the degree of

MBA in Supply Chain Management (MSCM)



Sonargaon University (SU)

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Date of Submission: September 25, 2021

Letter of Transmittal

September 25, 2021
Amir Husen
Assistant Professor
Department of Business Administration
Sonargaon University (SU)

Subject: Submission of dissertation report.

Dear Sir,
With humble honor and respect, I am submitting my dissertation report on **"Managing Risk in Supply Chain Management "**. I have written this report based on my experience in " Kazi Food Industries Limited" as per partial accomplishment of the requirements for the MSCM degree, this thesis has been carried out under the supervision of you.

This report is an integral part of our academic courses in completion of the MSCM program which has given me the opportunity to have an insight into the manging risk in supply chain management. I hope this report reflects on the contemporary issues on the risk management that are being practiced by organizations in our country.

In completing the report, I tried my best to blend all my knowledge, experience and imparted every available detail and also attempted to avoid unnecessary amplification of the report.
I humbly request you to accept this report for your kind evaluation.

Sincerely,

_____

Moha. Ziaul Hoque
ID: MSCM2001019003
Department of Business Administration
Sonargaon University (SU)

Letter of Authorization

Certified that this dissertation report titled “Managing risk in supply chain Management” is the bonafide work of Moha. Ziaul Hoque, who carried out the research under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

……

Amir Husen
Assistant Professor
Department of Business Administration
Sonargaon University (SU)

EXECUTIVE SUMMARY

The core objective of the dissertation is to fulfill the requirement of the MSCM program as prescribed by the SU. I have been working as a supply chain professional of Kazi Food Industries Limited since eight years. The main objective of the dissertation is to get the hands-on experience of the real-world organization. The dissertation was completed with the objective of getting practical knowledge in the risk management of supply chain department of Kazi Food Industries Ltd.

Managing risk in supply chain is one of the major parts of my work responsibilities. I have to manage and mitigate the risk in supply chain of the organization. I realized that, I am successful to gather a lot of significant learning experiences which would be helpful in my present and future career. The supply chain department of KFIL provided me ample space and opportunities, not only to learn but also to exhibit my skills as a part of supply chain department. I could use my theoretical knowledge of risk management in real practice while participating in many discussions. I am actively involved in the department activities where I have been applied my knowledge and views regarding risk management of KFIL.

I also attempted to gather more information on basic job functions of other departments to have better understanding of the relation between them and the supply chain department. It was commendable to see how wholeheartedly they welcomed, acknowledged and appreciated new ideas and knowledge. I have provided few recommendations based upon my understanding and knowledge.

I have been completed all the assigned duties successfully. I am enjoying the challenges that came along every single day. I could also bring some minor improvisations during my professional life which were able to leave their marks. These lessons that I have learned will be a valuable one for my future endeavors as well.

This dissertation will first explain the main idea and concepts behind risk and supply chain risk management (SCRM), objectives, benefits and challenges. After that, the main steps and tools for SCRM are going to be presented. In this dissertation, different approaches and strategies are going to be combined to elaborate some best practices, which make possible the increase of resiliency in supply chain and the resistance against disruptions.
Nevertheless, the risk on the operations has increased significantly on the past years, the effective use of risk management is still far from the ideal. That happens for several reasons, as will be detailed later in this paper.

Supply chain risk management (SCRM) involves risk identification, risk assessment, risk mitigation, and risk control. This dissertation will explain each of these steps and why they are so important on the decision-making scenario.

LIST OF ACRONYMS

KFIL	Kazi Food Industries Limited
SCMD	Supply Chain Management Department
HR	Human Resource
MSCM	MBA in Supply Chain Department
SCRM	Supply Chain Risk Management
SU	Sonargaon University
JIT	Just-in-time
CPFR	Collaborative Planning Forecasting and Replenishment (CPFR)
LCC	Low cost country
FMEA	Failure Mode Effect Analysis
RPN	Risk Priority Number
FTA	Fault tree analysis
ETA	Event tree analysis
SCQRM	Effective supply chain quality risk management
HACCP	Hazard Analysis and Critical Control Points
HAZOP	Hazard Operability Analysis

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CHAPTER-1
INTRODUCTION

1.1. INTRODUCTION

In the past years, globalization has become more intense, and the supply chain has become more complex and wider. It passes through many different countries and cultures, dispersed around the world and working in widely different conditions. At the same time, there is a constant pressure on managers to improve the efficiency of their supply chain, making the movement of the material cheaper and quicker, reducing the inventory and use just-in-time (JIT) or lean operations.

This complex and wide supply chain combined with this pressure on the managers bring many risks to the chain. These risks are unexpected events that might disrupt the flow of materials or the planned operations. They can be late deliveries, poor forecast or involve rarer scenarios such as hurricane and earthquake.



Figure: 1 Global environment

In recent years, many companies have faced supply chain disruptions which can strongly impact the performance of these organizations. The case of Ericsson is well known on this scenario. After a fire at a Phillips Chips fabric in New Mexico, Ericsson's only supplier, the production was disrupted. This disruption led to a loss of $400 million to Ericsson. The earthquake, tsunami, and the subsequent nuclear crisis that occurred in Japan in 2011 damaged Toyota's production and it led to a drop of 40,000 vehicles. The damages caused a loss of $72 million in profits per

day. (Bloomberg News, 2011).

Risk occurs because it is not possible to forecast exactly what is going to be the outcome of future events. Even if a company uses the best analyses approaches and software to predict what is going to happen, there is always uncertainty in the future and this brings the risks. Daimler can meticulously plan its production, only to find out that an important machine in the production line is broken, or Sony can prepare a ship delivery, and find that the port will be on strike, or even that an earthquake will affects it chip suppliers in Japan.

The supply chain has become more complex and wider. It passes thorough many different countries and cultures, dispersed around the world and working in widely different conditions. The complexity of the supply chain combined with the pressure on the managers bring many risks to the chain. These risks are unexpected events that might disrupt the flow of materials or the planned operations. They can be late deliveries, poor forecast or they can involve rarer scenarios as hurricane or earthquake.

Although most of the managers are aware of the existence of risk on the supply chain and its importance, a very low number of companies has outside expertise in assessing the risks on their supply chain, and most of the managers have problems with handling risk effectively. This discrepancy between knowing its importance and not using the correct approaches to face the risks have many reasons.

For some managers, risk management is easy to understand but very difficult to use and handle in real situations. In other cases, companies recommend the usage of these practices to their managers but they fail in providing the necessary training or tools. There are also many companies that do not provide incentives or reward for risk management, which might not stimulate the employee's responsibility for these activities. (Dittmann, 2014, p. 1-4).

Supply chain management is a very complex set of operations and functions with an enormous range of inherent risks. These can be a minor irritation such as a small delay which does not cause a significant consequence or a major problem such as a fire in a supplier's warehouse which can cause the disruption of the entire chain. Risk on the supply chain consists in every risk that might affect the planned flow of material. (Waters, 2011, p. 48-49).Supply chain risk

management involves four basic steps:

• risk identification
• risk assessment
• risk mitigation
• risk control

This thesis will try to fulfill this lack of consistency between the researches, theoretical studies and the practical usage by companies. Therefore, this paper is going to start by explaining with simple and direct approach the main idea and concepts behind risk and supply chain risk management (SCRM), followed by its objectives, benefits and challenges. After that, the main steps and tools for SCRM and the best practices to achieve one resilient supply chain are going to be explained. The conclusion will provide some comments about what was experienced while developing this thesis and some possibilities for further research.

1.2. MAIN OBJECTIVE AND RESEARCH METHODS

Flick (2014, p. 11-15) describes the importance of qualitative research due the rapid social change and the new sensitivity to the empirical study. He describes the importance of starting a paper with a qualitative approach, since the information available about one specific topic might be too limited for starting and proceeding to make tests on the research. Flick (2014, p. 11-15) also points out some of the relevant features on qualitative research:

• Correct choice of appropriate methods
• Analysis and understanding of different perspectives
• Research's reflection as relevant part of the process of knowledge production

The start of each research is stimulated by questions and possible lack of information. The main objective of the thesis is to provide easily understandable material that supports companies to understand, face and handle supply chain risk management by answering these three original questions:

Research Question 1: Which are the main risk exposures on supply chain risk management?
Research Question 2: Which are the main steps and tools for supply chain risk management?
Research Question 3: What are the best practices for achieving a resilient supply chain?

Supply chain risk management is the intersection of two major fields: risk management and supply chain management, as illustrated in the Figure 1. Related literature in these fields will be used as a research method for this thesis.

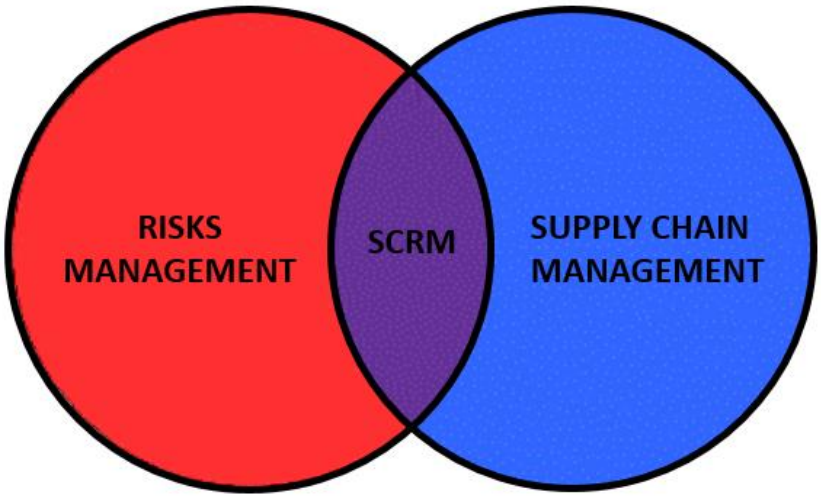


Figure 2. SCRM: supply chain management & risk management

Flick (2014, p. 112-132) presents different qualitative research sources. Some of these research methods include books, on line platforms for articles and papers, case studies and comparative studies. This thesis will be based on different sources, such as the library, XAMK e-library , Google Scholar, SciELO, Scopus and other online databases for articles and papers.

Supply chain risk management (SCRM) is a complex theme and involves many variables. In order to have a better understanding of SCRM, it is important to first have the basic knowledge of what risk and risk management mean.

1.3. RISK MANAGEMENT IS BECOMING IMPORTANT

Managing risk in supply chains is an important topic in supply chain management. The topic's importance is due to several industry trends currently in place: increase in strategic outsourcing

by firms, globalizations of markets, increasing reliance on suppliers for specialized capabilities and innovation, reliance on supply networks for competitive advantage, and emergence of information technologies that make it possible to control and coordinate extended supply chains. These trends have manifested themselves in an increase in outsourcing and off-shoring of manufacturing and R&D activities, low cost country (LCC) sourcing, and collaboration with international supplier partners. While these increase the strategic options for firms, they also increase the probability of experiencing adverse events in supply chains that significantly threaten normal business operations of firms in the supply chains. Along with the increase in these initiatives, there has been an increase in the potential and magnitude of supply chain risks.

CHAPTER-2

PROFILE OF THE ORGANIZATION

2.1. OVERVIEW OF KAZI FOOD INDUSTRIES LIMITED

Kazi Food Industries Limited is a recent venture of the Kazi Farms Group. started its journey in the year 2011. Its corporate office located in Beron, Ashulia, Savar, Dhaka. KFIL produces and sells premium dairy ice cream with minimum 10% milk fat (as per international standard) under the brand name Bellissimo.

Another line of ice creams and ice lollies is produced and sold under the brand name ZaNZee.

A range of frozen food products are sold under the brand name Kazi Farms Kitchen. These are all guaranteed to not contain any antibiotic residues, as chickens are not fed any antibiotics within 7 days of slaughter, as per international practice. The meat is also guaranteed to be produced from chickens raised on feed not containing MBM (meat and bone meal) as per European standards. The meat products are also guaranteed to be MSG and nitrate-free, as we do not use any of these chemicals during food preparation.

2.2. MANAGEMENT OF KAZI FOOD INDUSTRIES LIMITED

Mr.. Kazi Zahedul Hasan, an architect/engineer, obtained his M. Arch degree from Harvard University in the USA. He was a professor of the Department of Architecture at Bangladesh University of Engineering and Technology, Dhaka & in the School of Environment Design, King Abdul Aziz University, Jeddah,Saudi Arabia. He has extensive experience as an architect in the USA & KSA . He is a member of the American Institute of Architects as well as the Royal Institute of British Architects . He was founder & MD of Kazi Fashion Limited for almost 20 years, until selling it in 2002 in order to focus on poultry. He is the founder & Managing Director of Kazi Farms Group and Kazi Food Industries Limited.

Dr. Perween Hasan, wife of Mr. Kazi Zahedul Hasan, gained an M.A. in English from Dhaka University, and another M.A. and a Ph.D. (History of Fine Arts) from Harvard University. USA. Presently, she is a professor at Dhaka University. She is a Director of all companies in Kazi Farms Group. Also he is founder of Central Women's University.

Mr. Kazi Zeeshan Hasan, earned his B.A. in Economics from Oberlin College, USA, his M. Theological Studies from Harvard University, USA, and an his M.Sc. (Management of Information Systems) from the London School of Economics, UK. He is a Director of Kazi Farms Limited and its sister companies, where he is directly involved in overseeing management of sales and raw materials purchases. He has gained training in feed milling and raw materials evaluation from Cargill Indonesia.

Mr. Kazi Zahin Hasan, gained his B.A. (Economics) from Oberlin College, USA, and his Master of Public Administration degree from Columbia University, USA. He is a Director of Kazi Farms Limited and its sister companies. He has been responsible for the production operations of Kazi Farms Group for the past ten years. He has earned training in poultry in the U.S.A. and Thailand.

2.3 CORPORATE OFFICE OF KAZI FOOD INDUSTRIES LIMITED

Name of the Company: Kazi Food Industries Limited
Company Type: Private Limited Company

Industry Type: Food & Beverage

Head Office: Ahmad & Kazi Tower , Road-02, Dhanmondi, Dhaka-1205

Factory: Beron, Ashulia, Saver, Dhaka

Establish Year: 2011

Telephone: 880-2-9123432, 9134276, 9128062

E-mail: info@kazifoodindustrieslimited.com

2.4. CSR OF KAZI FOOD INDUSTRIES LIMITED

- ➔ From 2010 to 2019, Kazi Farms Group gave fifty three core Taka of economic corroboration to Central Women's University, the 1 st women private university in Bangladesh.
- ➔ Besides Kazi Farms Group contributes to the function of Kazi Zahural Huq College in Mary Gopinathpur, Gopalganj, that is the hometown of the Managing Director of Kazi Farms Group. These is a free privately-driven HSC college along with one of the greatest pass rates of the district.
- ➔ They are giving fifteen core Taka for the construction of a modern conference center at Bangladesh University of Engineering and Technology (BUET). The managing Director of kazi farrms was student and as well as teacher of BUET.
- ➔ They gave One point Nine acres of land in Gazipur to UTSHO in 2003 as the reason of construction of a permanent residential school for underprivileged children.

2.5. SUPPLY CHAIN DEPARTMENT OF KFIL

KFIL supply chain department committed and liable to ensure the customer satisfaction, reduce cost, add value in order to maximize profit of the organization.

Duties and responsibilities of KFIL supply chain personnel as follows:

- Analyze data from shipping and delivering processes to find bottlenecks and other issues
- Risk management.
- Evaluate and report on KPIs
- Managing contracts

- Monitor logistics to make sure they run smoothly
- Maintain supply chain inventory and records
- Train and guide employees
- Find cost-effective solutions for supply chain processes
- Collaborate with other departments to create coordinated plans for business growth
- Develop and implement safety guidelines in all aspects of the supply chain
- Ensure supply chain processes meet legal requirements and standards
- Communicate and negotiate with suppliers and vendors to land more profitable deals

CHAPTER-3
THEORETICAL FRAMEWORK

3.1. DEFINITION OF RISK

Risk can be broadly defined as a chance of danger, damage, loss, injury or any other undesired consequences. A more scientific definition of risk was provided by the Royal Society (1992): ‘‘the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge”.

Risk occurs because it is not possible to forecast exactly what is going to be the outcome in future events. Even if a company uses the best analyses approaches and softwares to predict what is going to happen, there is always uncertainty in the future and this bring risks. Daimler can meticulously plan its production, only to find out that an important machine in the production line is broken; or Sony can prepare a ship delivery, and find that the port will be on strike, or even an earthquake hits it chip suppliers in Japan.

Although risk can be connected to positive results or good outcomes, it is usually associated with negative results and outcomes. Most of the times, managers talk about risk when they discuss the percentage or likelihood of some negative output, such as delayed delivery, accident on the production, some product doesn’t sell as expected or other negative outputs. (Khan, 2010, p. 2).

As described above, different authors have many different definitions and meanings for risk. In order to have a better understanding of risk management and supply chain risk management, it is important to first understand what risk is and why it is important. One very accepted definition of risk is the following: risk refers to the uncertainty that surrounds future events and outcomes of operations. Therefore, risk is not only about negative outputs, but also the likelihood of these outputs, negative or positive. This is the definition that will be applied in this thesis. (Waters, 2011, p. 14-16)

3.2. RISK MANAGEMENT

Risks can come from various sources. Some of them could be avoided, others not, but this uncertainty in the future events should be studied and analyzed. Risk management is about identifying operations which involve risk, trying to prevent the failure before it happens, stopping them when they do happen, reducing the negative consequences in these events and trying to recover the operations as planned. (Slack & Brandon-Jones & Johnston, 2016, p. 617).

Risk management is the identification, understanding and prioritization of risks, combined with actions to minimize or mitigate risks. After the risks have been, they should be monitored and controlled in order to reduce their negative impact in unfortunate events or to maximize the realization of opportunities. The risk management's objective is to assure the flow of the planned operations and to protect the company against supply chain disruptions.

3.3. SUPPLY CHAIN MANAGEMENT

Supply Chain Management (SCM) is aims to reduce the cost and maximize the value in total process. Supply chain processes is Plan, Source, Make, deliver and return. Managing risk in supply chains is most important to achieve the supply chain goal.

3.4. SOURCES OF RISK

Supply chain consists of the set of processes and activities that move the material trough the supply chain from the initial suppliers to the final customer. Risk on the supply chain consists in every factor that might affect the planned flow of material (Waters, 2011, p. 7-8). Although many of these risks can be common and well known such as supplier delays or excess stock, others could be more complex and unusual, such as wars or outbreak of disease.

The truth is that these risks can be very diversified, complex and from different sources. It is important to categorize them to have a better understanding in how they originate and how their consequences might

impact the company.

3.4.1. SUPPLY RISK

Supply risk relates to potential or actual disturbances to the flow of product or information emanating within the network, upstream of the focal company. Therefore, it is risk associated with a company's suppliers, or supplier's suppliers being unable to deliver the materials the company needs to effectively meet its production requirements/ demand forecasts. It adversely affects inward flow of any type of resource to enable operations to take place; also termed as ‘input risk’. It includes.

• Dependency on key suppliers
• Consolidation in supply markets
• Quality and management issues arising from off- shore sourcing
• Potential disruption at 2 tier level
• Length and variability of replenishment lead-times

3.4.2.DEMAND RISK

Demand risk relates to potential or actual disturbances to flow of product, information, and cash, emanating from within the network, between the focal company and the market. This demand risk can be a failure on either the high or low side to accurately accommodate the level of demand. It encompasses uncertainties in both product volume and mix which includes.

•Loss of major accounts
•Volatility of demand
• Concentration of customer base
• Innovative competitors

3.4.3. PROCESS RISK

Processes are the sequences of value-adding and managerial activities undertaken by the company. Process risk relates to disruptions to these processes. It affects a firm’s internal ability to produce and supply goods/services, which results from the consequences of a breakdown in a core operating, manufacturing or processing capability. It includes.

• Manufacturing yield variability

• Lengthy set-up times and inflexible processes
• Equipment reliability
• Limited capacity/bottlenecks
• Outsourcing key business processes

3.4.4. CONTROL RISK

Controls are the assumptions, rules, systems and procedures that govern how an organization exerts control over the processes. In terms of the supply chain they may be order quantities, batch sizes, safety stock policies etc. Control risk is therefore the risk arising from the application or misapplication of these rules. It includes.

• Inappropriate rules that distort demand
• Poor visibility along the pipeline
• Lack of collaborative planning and forecasts
• Bullwhip effects due to multiple echelons

3.4.5. ENVIRONMENTAL RISK

Environmental risk is the risk associated with external and, from the company's perspective; uncontrollable events. It consists of any uncertainties arising from the supply chain and environmental interactions. These may be the result of accidents, man- made or natural disasters. It includes.

• Natural disasters
• Terrorism and war
• Regulatory changes
• Strikes

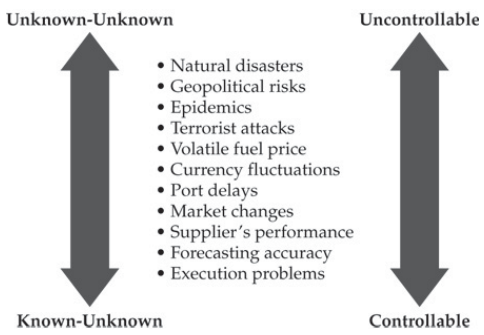


Figure 3 Risk sources and their characteristics

3.5. SUPPLY CHAIN RISK MANAGEMENT (SCRM)

SCRM is viewed as “the management of supply chain risk through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity”. Risk management is the process of measuring or assessing risk and then developing strategies to manage the risk. These strategies can involve the transference of risk to another party, risk avoidance or mitigation, and channel risk sharing. SCM risk assessments balance the probability of demand, the likelihood of reliable supply, the most effective allocation

of resources, and the probability of success of new product introductions, market conditions, and the opportunity costs of alternative decision paths. A framework for Supply Chain Risk Management is shown below:

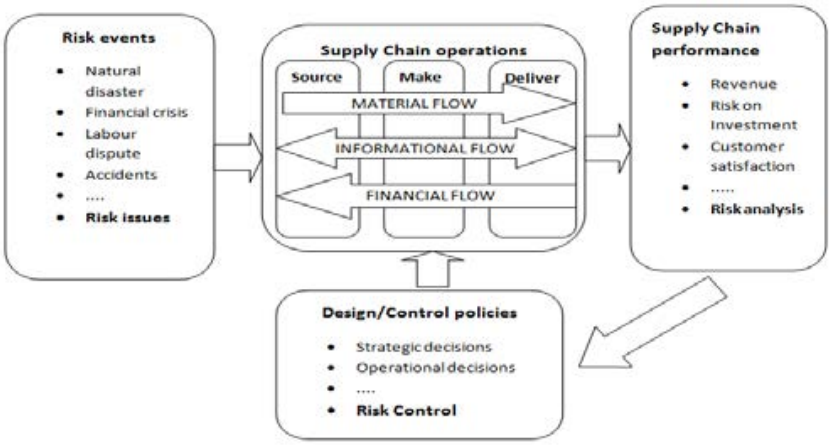


Figure 4 : Framework for Supply Chain Risk Management

This figure shows that the continuity of supply chain operations can be affected by various risk events. A solid risk analysis process could identify the impact of 21 disruption on supply chains. This could be established by monitoring supply chain performance, for example the production or financial performances. With a proper implementation of risk control, for instance via risk mitigation strategies, the impact of disruption on flows could be diminished, or even avoided.

3.5.1. OBJECTIVES OF SCRM

The main objective is to analyses how supply chain risks can be effectively managed. Firstly, this is done by positioning the agenda in supply chain risk management (SCRM). Then, methods for effective management of supply chain risk are identified and analysed.

Based on the framework shown above, we can classify the objective into two sub-categories

Objective i : Identifying Supply Chain Risk Management Agenda.

It is important to identify the current agenda in this field. The exploration of various definitions, for both terminology and processes involved in this area, helps to clarify future scope. To achieve this objective, we hereby raise two questions as follows:

FQ1: What risk issues should be considered in supply chain operations?
FQ2: How does a risk event affects supply chain operations?

Objective ii : Identification of Effective Management of Supply Chain Risk.

The second objective focuses on finding how supply chain risk can be effectively managed. To achieve this objective, an investigation of selected approaches and methods will be conducted to analyses their competency and robustness in sustaining supply chain operations. Hence, to achieve the above objective, we raised three questions that focuses on risk analysis and risk control.

FQ3: How can we analyses supply chain performance from a risk management viewpoint?
FQ4: What kind of mitigation policies should be used for managing risk in supply chains?
FQ5: What modeling techniques and approaches are possible in this area?

3.6. SUPPLY CHAIN RISK MANAGEMENT PROCESS

Supply chain Risk Management process can be mainly classified into two categories

- Risk Analysis.

• Risk Control.

Risk Analysis deals with Identification, Estimation and Evaluation of risks, whereas Risk Control deals with Mitigation and Monitoring of risks. The Risk Management process can be developed with the aid of a flow chart which is shown below.

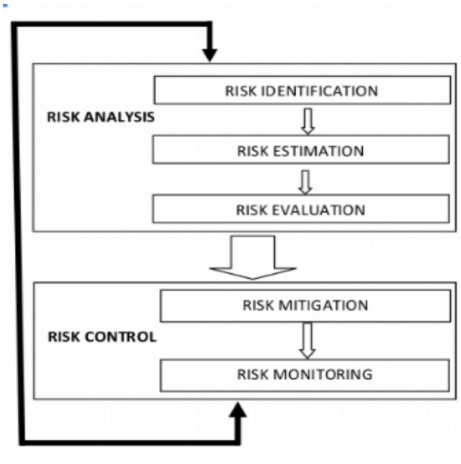


Figure 5 : Flow chart for Supply Chain Risk Management

Risk Management process which is constituted of two main elements; Supply chain Risk Analysis and Supply chain Risk Control, henceforth referred to risk analysis and risk control respectively. The term risk assessment is also interchangeably used in referring to risk analysis. The first process covers the identification, estimation and evaluation of risk. Proper implementation of all stages in this process will result in the recognition of potential risk events affecting supply chain. However, not all risk events fall under the category of disruption
risk events, and therefore the potential impact caused by an individual risk event needs to be carefully estimated and evaluated according to the individual supply chain operation's definition.

3.7. RISK IDENTIFICATION

It is generally agreed that risk identification is the first step and one of the most important processes in supply chain risk management. There is a extremely large number of possible risks in an almost endless variety. This step should identify anything that might interrupt the flow of materials or information and impact significantly in the company's supply chain. Thus, the risk identification should develop a list of the risks that are likely to affect the supply chain and bring consequences to the company, negative or positive (Vilko, 2012, p. 45-46).

Risk identification is the process of determining risks that could potentially affect the company. The sooner these risks are identified, the better actions can be taken to mitigate or manage them. If the company does not identify the risks, they are not able to analyze or mitigate these risks. A proactive tool for risk identification can bring important impact on the SCRM. This thesis will present some of the best options accepted for risk identification.

A key aspect of supply chain risk management is identification. Identification involves creating a list of potential events that could harm any aspect of the supply chain's performance. Risk identification allows an organization to take steps to create plans to manage risks before they occur. This is typically more cost effective then waiting to react to adverse events when they occur.

3.8. METHODS FOR IDENTIFYING RISK

The best approach for risk management depends on the company size, field or resources. The company Apple Inc, for instance, will need a much more detailed and complex risk management analyze than a small bakery. Each company should study some approaches and determine which one could best fit to their needs. This chapter will present and explain shortly some of the options below (Waters, 2011, pg 103-118):

• Consultants: this option could fit better to large and global companies. Experts are able to give some valuable insights and to identify more precisely the risks that surround the company and give some advices on how to mitigate them.

• Group Meetings and Brainstorming: this option is one of the main approaches for risk identification. In this method, a group of differently skilled managers can analyse different operations and processes and are encouraged to identify risky spots in a judgment- free environment. These meeting can also involve different partners and companies (networking). This action is important for achieving the integration of the risk management in the supply chain.

• Checklist available on the Internet any worker can identify risks at any time and actualize the risk list which is available for anyone to see. After that, one expert group should evaluate each of these risks and the ideal mitigation responses for the relevant ones.

• Pareto analyses Pareto Analyses is based on the observation that 80% of risks come from 20%

of causes. Thus, a frequency diagram which presents the risky events that have occurred in the past might help the companies to identify the events that are more likely to reoccur in the future, as shown in below figure:

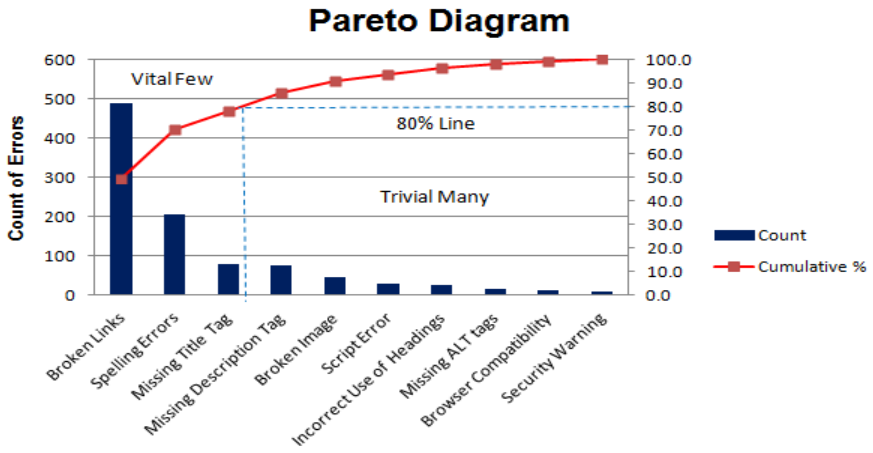


Figure 6. Example of Pareto Analyses Haughey (2015).

Geo mapping/Supply chain mapping – Visual maps of supply chains reveal supply chain structures, dependencies, and hand offs that may contain risk. Supply Chain Operation Reference (SCOR) mapping and Value Stream Mapping are two types of supply chain mapping that can be used. Looking at historical problems – Historical problems may have a high chance of recurring. Those problems may have happened to the organization itself or to others.

Researching industry trends – Other organizations and industry groups may have already researched risks that are applicable. Group of experts brainstorming – People with experience in different areas of your organization and supply chain have lots of knowledge of risks. Getting them together increases the knowledge sharing. (The Delphi method is one technique to conduct expert interviews.) Assessment surveys – Well designed surveys can be an effective way to quickly gather information on risks in your supply chain. Site visits – Site visits to supply chain partners allow you to collect detailed and less “filtered” information on risks. Information audits – Data system audits can reveal issues and trends from the past. It can show areas of the supply chain that have had poor performance in the past and are thus more likely to perform poorly in the future.

3.9. TOOLS USED IN RISK IDENTIFICATION

Risk checklists – a list of risks that are common for our environment. It may come from past experience or industry research. Cause-and-effect diagrams – a diagram that traces back the causes for events. Gantt charts – a bar chart showing the precedence and timing of activities. It can help identify the critical path, i.e. the most critical organizations and processes that would be bottlenecks if they experienced a disruption. (It can also be used later during Risk Assessment to determine the effect of disruptions at different points in a supply chain).

3.10. RISK ANALYSIS

In the previous subchapter, different approaches and tools to identify risks in the supply chain were described in this subchapter, some methodologies will be explained, which can support companies to analyze and evaluate these risks and identify the potential impact on the company.
Although risks can be much diversified and involve complex circumstances, Waters (2011, p 131) points out that there are two main factors to evaluate the risks:

- The likelihood of a risky event to occur
- The impact when the event does occur

Berg (2012, p 85) and Waters (2011, p. 129-130) describes the two main approaches to analyzing risks. The first one is the qualitative technique. This approach can be used, for example, when the likelihood of the events is very difficult to estimating such as a fire in the warehouse, or when the risks are being subjected to more expensive quantitative techniques.
Although this practice can be subject to different opinions, often the managers are to evaluate and estimate qualitatively well enough the situations and offer a low budget and faster answer. Possible tools are hazard matrices, risk graphs and risk matrices. Usually a qualitative analyze should involve:

- Description of the risk
- Impact and likelihood
- Scope (areas affected)

- Relationship to other risks

Another and more sophisticated approach is to use quantitative analyses. With this technique, the likelihood of the event and the impact should be quantified. Although it is really difficult to measure and evaluate the likelihood of such
complex scenarios such as a fire in a warehouse or earthquake, many probabilities from different events can be quantified or at least one appropriated approximation can be found. The main approaches to quantify the likelihood are
(Waters, 2011, p. 132-134):

- Use of theoretical and mathematical knowledge to calculate the exact probability of an event. This is the most reliable technique, but it can be difficult to use in real scenarios and complex operations.
- Use of historical data to see how often one event has happened in the past and predict its probability for the future. This approach can be interesting for situations such as the fire example (if taken in a large databank, including other companies).
- Use of the available data and predict the likelihood of an event by judgment. It is less reliable method, but can be used and put in a range of probability.

The other important feature of risk analyses is the impact on the supply chain. The consequence from each risk can vary from almost insignificant risks which will not bring relevant impacts on the supply chain to catastrophic events that might cause complete and irrecoverable damage to the chain. Therefore, managers should try to measure and attribute a possible cost (or gain) for each risk. This can be achieved by analyzing the operations involved by each risk and evaluating a possible range of damage caused by the risk.

3.11. RISK ASSESSMENT AND EVALUATION

Supply Chain Risk assessment provides management with an understanding of where the greatest risks may exist in order to prioritize resources for risk mitigation and management. Performing such assessments will involve clarifying the nature of the risk, understanding conditions that may lead to the event, knowing how frequently such events have happened or can

be expected to happen, and the potential impact of such events.

The team can then prioritize addressing the risks. Risk assessment is typically made up of two measures: Likelihood and Impact. Likelihood– measures the probability that the event will occur. The exact probability may be difficult to determine unless there is historical data that can be used to find the frequency of the event occurring. Alternatively an organization can use a subjective likelihood, or degree of belief, based on the opinions of experts. A time horizon is necessary to define the probability in a useful way (e.g., the likelihood that an event will occur in the next year or 50 years). Impact – measures the consequences on the organization if the event occurs. It can be measured directly, for example in terms of dollars. It can also be measured on a scale, for example from zero to one with zero being very little negative consequence and one being a very bad consequence. Methods for measuring impact include "what-if" simulations, financial models, and opinions of teams of experts. Impact may also be measured in terms of other SCOR metrics besides financials. Summary risk score – A summary risk score can be calculated for each risk by multiplying the Impact times the Probability to get an expected value of the risk. Then risks can be ranked by risk score. Also the risks can be shown on a map or graph. An example is shown below.

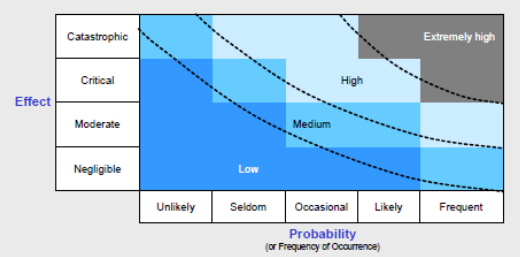


Figure 7 : Qualitative Risk assessment

3.12. TOOL USED IN RISK ASSESSMENT

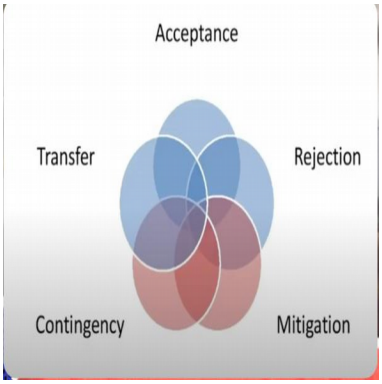
Failure Mode Effect Analysis (FMEA) – It is used to prioritize the risk using Risk Priority Number (RPN), which can be calculated from probability of occurrence, severity and detection of risk and also using Risk Score Values (RSV) in which Severity and Occurrence of risk is calculated.

3.13. OTHER METHODS FOR ASSESSMENT INCLUDE

• Fault tree analysis – This is a graphical technique that provides a systematic description of the combinations of possible occurrences in a system, which can result in an undesirable outcome. This method can combine hardware failures and human failures. The most serious outcome is selected as the “Top Event”. A fault tree is then constructed by relating the sequence of events, which individually or in combination, could lead to the top event. FTA is both a design and a diagnostic tool. As a design tool FTA is used to compare alternative design solutions and the resulting Top event probability. As a diagnostic tool FTA is used to investigate scenarios that may have led to the Top event.

• Event tree analysis – Event tree analysis (ETA) is an analysis technique for identifying and evaluating the sequence of events in a potential accident scenario following the occurrence of an initiating event. ETA utilizes a visual logic tree structure known as an Event Tree (ET). The objective of ETA is to determine whether the initiating event will develop 23 into a serious mishap or if the event is sufficiently controlled by the safety systems and procedures implemented in the system design. An ETA can result in many different possible outcomes from a single initiating event, and it provides the capability to obtain a probability for each outcome.

3.14. RISK TREATMENT



Acceptance = I Admire = New Market Sourcing for Cost Championship

• Rejection = I quite = It's too risky. No need to new sourcing. Company paying my salary & I am happy.

• Transfer = Let someone do it. Like Insurance or Our sourcing of activities or production. Higher the risk Higher the Cost.

• Mitigation = What are the things I can do to mitigate the risk once realized. Using PPE before entering Lab.

• Contingency = What are the things I can do to reduce the impact of the risk if happened. Supplier gone Bankruptcy.

Proceed to Plan B. The Next Supplier

Risk can be accepted or rejected if accepted it will be mitigated or have to take a contingency planing to add value in supply chain management.

3.15. RISK MONITORING AND MITIGATION

Once areas of risk have been identified, an organization needs to monitor their internal and external environment. This helps them to predict when risky events are becoming more likely. It also helps to identify new risks and is tightly linked to the best practice of Supply Chain Risk Identification. Supply Chain Operation References focus on supply chain metrics enables Supply Chain Risk monitoring. Real time metrics and periodic reports give decisions maker's knowledge upcoming risks. Statistical analysis of key metrics can reveal trends. Visibility into supplier and customer metrics increases the ability to monitor. Reports on risk monitoring can be combined with existing management reviews and meetings. Monitoring can also include monitoring qualitative sources of information such as news or weather reports to identify events that are precursors to risks. In the Plan step, an organization can plan methods for monitoring Source, Make, Deliver, and Return risks. These methods may include specific metrics to monitor and "watch-out" lists of precursor events. It may also include monitoring the environment external to the organization's supply chain.

• Deliver risk monitoring can be done with customer service metrics.
• Make risk monitoring can be done automatically through an organization's data systems such as an ERP system.
• Source risk monitoring is enhanced with visibility into suppliers' metrics.

It is important to monitor indicators that would appear early in a risk event or, better, even before it occurs by indicating an increasing likelihood. If monitoring only reveals a risk well after its first occurrence, it will likely be too late to adequately respond to it. Monitoring can also be used to test the effectiveness of risk controls. If a plan to mitigate or prevent a risk has been implemented, monitoring can check to see if the corresponding metrics show no signs of the risk occurring. Five operational strategies for managing disruption risks are given below:

Table 1: Operational strategy for managing disruption risk

Diversify Supply	Source product from multiple vendors/facilities so that a problem at one vendor/facility does not affect the entire Supply.
Backup Supply	Have an emergency supplier (or logistics provider) that is not normally used but that can be activated in the event of a Supply problem.
Manage Demand	influence demand to better match the actual supply by, for example, adjusting prices or offering incentives to encourage Customers to purchase products that are less supply-constrained.
Strengthen Supply Chain	Work with suppliers to reduce the frequency and/or severity of supply problems.

3.16. RISK MITIGATION STRATEGIES

• Multiple sources of supply: - having multiple sources of supply for a raw material reduces the impact of one source failing to deliver materials.

• Strategic agreements or partnerships with suppliers: - strategic agreements with suppliers can lead to continued service in the event of capacity constraints.

• Collaborative Planning Forecasting and Replenishment (CPFR): - by sharing demand and fulfillment data with supply chain partners, there is a reduced risk of unforeseen demand swings or supply shortages.

•Joint product design and delivery: - designing products with suppliers reduces the risk of material non-performance or material shortages.

• Quality:- This is one of the major concerns for managers in different fields and segments. As companies have pursued this broadened supply chain strategy, the ability to manage quality risk has become more challenging. Effective supply chain quality risk management (SCQRM) is the key for mitigating the quality risk issues and helping the company to face challenging scenarios.

Quality risk management is a very complex subject, the Q9 Quality Risk management (2006), Tse (2012) and Sparta Systems Guideline (2016) provide a very useful and well explained papers in order to achieve a better-quality risk
management. Some of the best practices are:

I. Increase visibility in the supply chain.
II. Invest in infrastructure and increase the communication with the suppliers.
III. Establish clear measurement programs.
IV. Use tools such as Failure Mode Effects Analysis (FMEA), Fault Tree Analysis (FTA), Hazard Analysis and Critical Control Points (HACCP), Hazard Operability Analysis (HAZOP).
V. Make quality risk management as part of integrated quality management, development, materials management and production.

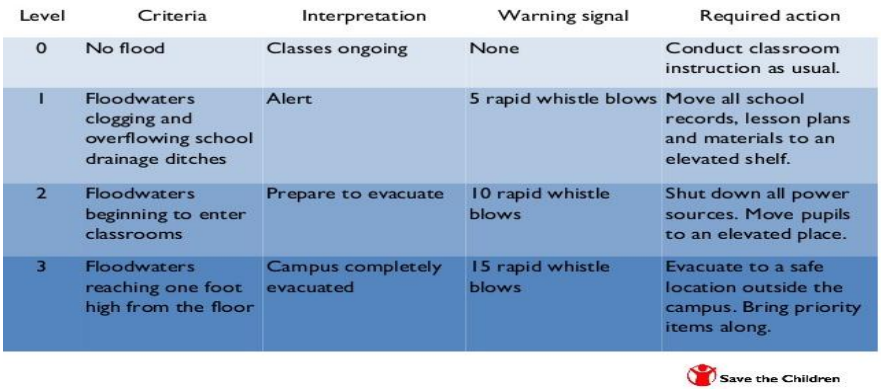
• Insurance:- Insurance has fundamental importance for risk management. It provides a powerful tool against very unlikely risks, but which could have a major impact on the supply chain. The main idea is to transform the high uncertainty loss (high variance) into an affordable fixed cost. This enable the normal flow of operations and reduce the variance, protecting the company against strong financial losses following a supply chain disruption. Companies can seek insurance for protection against: natural catastrophes, such as hurricanes, earthquakes, flooding or fire; or even against internal peril such as machinery breakdown (Dittmann , 2014, p. 7-8)

• Rationalize product range:- To reduce the number of products or invest more in the products that make the most profit. A company might reduce significantly its exposure to risky spots by rationalizing its product’s range. It might be an easier and more profitable approach to focus on some core activities or less risky ones. Risks can be very diversified, complex and from different sources. Although, supply chains also vary significantly in complexity and size, the actions taken by companies to prevent risky events can be very similar. This chapter illustrated and explain some of the best practices provided in the literature for achieving a resilience supply chain. The main idea is to support companies by its initial actions against different risks on SCRM (Waters, 2011, p. 167).

3.17. CONTINGENCY PLANS

Contingency plans have fundamental importance against external risks. These are usually outside of the manager and companies' control and can not be influenced by the company. A contingency plan is a protocol or course of actions designed to help a company by responding effectively to an unexpected event that might harm the supply chain (Waters, 2011, p. 158). Therefore, contingency plans are elaborated preventively and come into effect after a risky event actually occurs. Prepare protocols and actions to manage a situation before it occurs can prevent managers to commit mistakes and safe precious time on responding these events, as illustrated in the Figure 8. The main benefits of these plans are:

- Minimizes Loss
- Prevents Panic
- Assure the Continuity of Work
- Increases Credit Availability



Level	Criteria	Interpretation	Warning signal	Required action
0	No flood	Classes ongoing	None	Conduct classroom instruction as usual.
1	Floodwaters clogging and overflowing school drainage ditches	Alert	5 rapid whistle blows	Move all school records, lesson plans and materials to an elevated shelf.
2	Floodwaters beginning to enter classrooms	Prepare to evacuate	10 rapid whistle blows	Shut down all power sources. Move pupils to an elevated place.
3	Floodwaters reaching one foot high from the floor	Campus completely evacuated	15 rapid whistle blows	Evacuate to a safe location outside the campus. Bring priority items along.

Figure 8. Example of a contingency plan (Cabalquinto, 2015).

Contingency plans cover different range of risks, such as: environmental catastrophes, geopolitical instability, cyber-attacks, terrorism or supplier and partner instabilities.

CHAPTER-4
ANALYSES AND FINDINGS

4.1. INITIATIVE TAKEN TO MANAGE RISK IN KFIL

I have taken following initiative during my professional period at KFIL to control and manage the supply chain risk.

- I have set multiple vendors and suppliers to supply the same goods to control supply risk and shortage of raw metatarsals.
- Vendor development strategies has been taken to improve supplier skill in oder to minimize the supply risk.
- Vendor elevation process has been initiated to identify wicked suppliers and eliminate them.
- initiated to meeting between concern department weekly basis to identity the problem as the problems are invite to a risk.
- Opened a risk register to writeup the risk history to identify the probability of risk and consequence.
- Re-arranged the contract terms to control the supply risk.
- Initiated to correction of master data in ERP and input all date category wise to control the risk in process and avoid bottlenecks.
- Implemented the Failure Mode Effect Analysis (FMEA) – It is used to prioritize the risk using Risk Priority Number (RPN), which can be calculated from probability of occurrence, severity and detection of risk and also using Risk Score Values (RSV) in which Severity and Occurrence of risk is calculated.

4.2. ON EMERGENCY SOURCING TO MANAGE SUPPLY RISK OF KFIL

As a supply chain manager I have taken more challenge to mitigate the different type of risk and applied above strategies an example as below:

Last year 2020 ice cream sales was very disrupted due to covid situation and poor demand. So that the lot of inventory are laying in KFIL holding. In this year'21 Management had decided to stored inventory at minimum level. In that case inventory people are storing RM, PM as per actual or 10% less than the forecast provided by the sales department.

Sales volume of February’21 March’21, April’21 was less than 20% of the forecast but from first week of may it have been increasing almost double. We came to know from store people that we have risk of the shortage of different customized packaging materials from local source like ice cream containers, cartons and some raw material through import like skimmed milk powder (SMP). Eid Vacation are knocking and local suppliers will keep close their factory during eid vacation. In this situation supply of material will be interrupted. We will be unable to meet the market demand and loss the revenue. We have also loss the opportunity of sales. Competitors will be taken the advantage and we also lost our potential customer. Supply chain people of the organization will be liable and sufferer for this shortage.

As a supply chain manager i have accepted this risk and started to find the ways to over come the risk. In that case we have arrange the meeting with key supplier's and requested them to open their factory and continue the PM production and supply. First time supplier not agreed and shown the labor shortage issue and some others issue. we have requested again by the ultimatum or negative reinforcement and positive reinforcement as well like if you require labor support we will provide and if you need advance financial support we will provide as well. Finally suppliers agreed to open their factory during eid vacation and continue the production of PM and supply. we over come the local MP shortage. To mitigate the shortage of RM through import we are starting to source the SMP from local supplier and starting to sampling. Sample SMP of BRAC dairy has been passed. we have made a contract with BRAC for our required qty of SMP and finally problem solved. We meet the full market demand.

CHAPTER-5
CONCLUSION & RECOMMENDATION

5.1. CONCLUSION

Most of the supply chain executives acknowledges the importance of supply chain risk management, it is clear that most of the companies still have difficulties by facing these risks and taking the necessary actions. In other cases, managers might not feel motivated because of the lack of incentives for risk management.

This dissertation started by reviewing the literature and introducing the main concepts of risk and supply chain in one simple and direct way. These are important as background-knowledge, once they are the basis of supply chain risk management. After that the concept of supply chain risk management was presented. This also presented the main risks in the supply chain, explained different tools for SCRM and the main steps for handling these risks: risk identification, risk analyses, risk mitigation, and risk control. This content can support companies to have a better understanding on the topic and to possibly get to know some different tools and approaches.
Than, the main concept of resilience in supply chain and the most importance practices to improve the chain against different kinds of risks were presented some best practices. here are many methods available for assessing the risk management in the supply chain and to create solid and resistant supply chain. As result, this dissertation presents one easy-understanding review of the available literature regarding to supply chain risk management and one guideline with some of the best practices accepted within the literature in how to improve companies' supply chain resiliency.

I believe the results of this dissertation are reliable, once I focused on well know researchers and big companies papers, who has proven expertise on this field and are able to present the topic applied in real business environment. I hope this dissertation will support different companies by providing different ways and perspectives of handling risks in the supply chain.

5.2. RECOMMENDATION

Finally I have recommended to KFIL to increase the monitoring and review the matter of risk again and again as the risk is uncertainties and new risk may come like covid-19.

Whole world are facing a big environmental risk for this. Supply chain people have to find the solution to over come the all risk to running business smoothly.

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