|| Volume 6 || Issue 5 || May 2021 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

A STUDY OF RISK ANALYTICS IN SUPPLY CHAIN (A DAIRY INDUSTRY PERSPECTIVE)

Kaustubh Thanawala

Research Scholar, Business Analytics, BITM, Pune, India
neve.kaustubh@gmail.com

Abstract: - **The Risk analytics in supply chain has gained wide attention among the academia and the business community in the present competition world. The aim behind this paper is to investigate and analyze the main risk factor associated with the dairy industry along with the focus on the risk in supply chain of dairy products and how to mitigate those risk. In the context the research paper described the risk and uncertainties of a dairy food supply chain case in India. The study involves all the stakeholders in the system to identify the potential risk for the entire chain and strategies to address the same. I mentioned the risk management process also to minimize the high risk and also mentioned the strategies at different level so as to increase the efficiency of the supply chain.**

The industry extend its business from rural area's to customer in the urban areas through the some process like pasteurizations and transportation. The supply chain in the dairy industry gets disrupted many times due to various vulnerabilities in the operations. The study in this paper describes the various types of risks occurred in dairy industry and how to find the solutions for that risk. In the findings sections I will explain the major types of risks occurred in the dairy industry and findings the strategies to minimize the risk.

Keywords: - *Risk Management, Analytics, Dairy Industry etc*

I INTRODUCTION

Starting from the ancient period to the till dated human had tried to make his living easy and subtle by removing uncertainties and minimizing risks. Today's business organizations are also no deviation in this regard. Dairy industry which plays a crucial role in agro-based economy of a country provides enough scope to the rural and sub-urban people to earn extra money in their leisure time so that why to find out the supply chain risk in dairy industry is must. Supply-chain risk management (SCRM) is "the implementation of strategies 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". Risk management is a proactive approach rather than reactive approach (Gray & Larson, 2008). The risk management process starts with identification of the risks and ends with the risk mitigation through the risk response development. Risk mitigation, avoidance, transferring, sharing and retaining are the various responses to deal with the risks in the organization. Milk and milk products are the important agro products in India. Based on the supply perspective, there are a great number of farmers who still depends on milk-producing activities for their livelihood. In the demand side, sometimes the demand is more than production and too much of shortage occurred in some cities and biggest reasons behind that is disrupt in supply chain. The main objectives of this paper have been to detect the potential risks in varying degrees for the dairy-food supply chain and investigating their impact at various stages of it. As per I mentioned in the preposition, " Managing Risk is must for smooth functioning of supply chain" and another one is " Managing risk increasing the productivity of supply chain" means to identify risk before any disrupt in supply chain, so it is much beneficial for production and positively effect on sales.

The supply chain management in dairy industry gaining the majors responses from throughout the world so that's why the supply chain and uncertainties management is must in the dairy industry. It is the most descriptive approach which entangles all the stakeholders in the system to make the product and the service available at lowest cost and with customer satisfaction.

If a single parameter of the supply chain gets violated, it affects the entire supply chain's flow. Though, the supply chain risks and uncertainties are quite clearly still in many cases a proper risk redresses mechanism seems to be lacking. The industries managing their risks efficiently are experiencing better supply chain performance. Of late, the research and development in this respect is gaining momentum and has become a top agenda for both researchers and practitioners. These research paper is tried to tell how to identify the risks from a dairy supply chain perspective being a part of the research. The data from samples stakeholders of the dairy food supply chain are collected on the basis of questionnaires. On the basis of the respondents response against the risks at various levels of the supply chain, they told me that which type of risk is as high, medium and low corresponding to their impact. Necessary strategies for dealing with the high risk factors have been suggested at the end so as to improve the efficiency of the dairy food supply chain.

The following section will focus on the brief understanding of the solution of Research Problem (Risk Management)

- **Risk Management process (Risk Analysis)** –

Risk in dairy industry are increasing day by days. All decision makers in the dairy industry now think about it and they are

planning for that also they makes some agendas in their meeting that how to overcome on the risk whichever happened many times. Risk Analysis is a process that helps you identify and manage potential problems that could undermine key business initiatives or projects. Understanding, identifying and assessing the risks based on probability of occurrence and severity of impact is a starting point for companies to develop effective risk management strategies.

Risk Management plan depends upon few steps as described in Figure 1 below,

Risk Management Plan (Flow Chart)

The whole process starts with a problem definition and ends with the decisions taken to tackle the problems. The steps in the process are being discussed below,

1- Conduct the Risk Assessment Survey - A risk assessment is a method used to identify weaknesses which might prevent a business unit from achieving its goals and objectives. So to find out the how many types of the risk occurred in the dairy industry I conduct the survey for risk assessment so I can categories the risk in high, medium and low respectively.

2 – **Identify the Risk** - Risk and uncertainties are inevitable for any type of supply chain. Some of the risks are easy to detect and some are not. The identification process could start in many ways. It could be a survey where the stakeholders' opinions are taken and assessed, brainstorming, checklist or work breakdown structure at the organization level, etc. to generate exhaustive list of the problem areas. The risks are of two types – Internal risks and External risks.

3 – **Analyze the risk** - Any risk or uncertainty is basically related to two major factors viz. likelihood and the severity. Likelihood is nothing but the chance or the probability that the event occurs whereas severity is attributed the degree to which it causes damage to the supply chain. The risk impact values range from 1 through 10 under whereas '1' indicates a very High risk, the value '10' indicates low risk pertaining to a particular event. In this case, there can be 10 such permutations out of which the extreme left and the right values indicate 'very High' and very 'low risks' respectively and that's how I analyze the risk.

4 – **Development a Risk Management Plan** - The Risk Management plan meant to find a tentative solution for the risks and uncertainties. While creating the plan feasibility conditions of the same should be considered. There are risks with high, medium or low impacts based upon their impact values. The impact variability is quite subjective in nature and based upon the risk tolerance of the concerned organization. Based on these impact values, the risks and uncertainties are given importance in the supply chain to be addressed.

5 – **Implement and monitor the Risk** – Monitor the risk are implement the plan to mitigate or reduce the risks and uncertainties. But all the plans implemented might not work as expected indicating flaws thereto. In this case, the process needs to be thoroughly monitored and controlled and a suitable strategy again formulated to address the problems.

II LITERATURE REVIEW

Overview of some of the literature based on the supply chain and risk Analysis has been cited below to strengthen the study. The following discussion will focus on the issue and will try to avoid exaggerations. The dairy-food supply chain is highly a riskier business concern to deal with. No matter what the precautions taken, risks and uncertainties can't be ruled out from the industry.

Zsidisin in his study in the year (2003) had defined the Risk which is - Supply risk is defined as the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety.

Relevant Research –

1. **Pramod Mishra and Prof. B. Shekar (Macrothink Institute 2011)** have discussed about various types of risks in Dairy- product supply chain that The high risk areas are the crucial ones and need to be addressed soon while medium and low risk areas are not to be neglected at the same, The High risk areas like risks like fire, sabotage, accidents or bandhs (stopping of normal life by politicians or due to various agitations/protests) etc. could be attributed to hazard risks and Rearing of low milching cattle brings down the production and hence increases the cost of production, and the Pramod Mishra also discuss about the process and quality risk which is generally occurred and impacted on the sales.

2. As per the published paper in Bangladesh by **Mohammed Quaddus and Mohamamd Shamsuddoha in 2014**, So they

gave comprehensive idea regarding the main factors and variables of different risk issues associated with the dairy sector in Bangladesh. This is a qualitative field study approach, the researchers explored the possible risk mitigation strategies which will improve facts of contingency theory in expanding supply chain risk management in dairy industry. This study does not include any outcome after risk mitigation. It will be interesting to explore the sustainable outcome after applying the proposed mitigation strategies.

3. **Zsidisin (2003b)** suggests that managerial perception of risk from different perspectives is an area for future research. It is indeed important to understand what different people in an organization or across different organizations within a supply chain perceive about supply chain risks. Different perception about supply chain risks from marketing and from operations could pose a conflict in deciding what mitigation actions to choose in an organization.

4. **Article published in International Journal by Iwan Vanany (2011)**, He focusing on risk management issues pertinent to manufacturing and supply chain management so overcoming on this he research/study on some methodologies like conceptual, descriptive, empirical, exploratory cross-sectional and exploratory longitudinal.

5. **Pramod Mishra and Prof. B. Shekar** published one more article on evaluating supply chain risk so in this article the researcher worked on the Risk Management Process and developed flow chart for the same.

Research gaps and look out of the study –

Risk Analytics in supply chain is a new concept and that why I will take some time to get fortified. After reviewing some literature I understand that the supply chain risk in Dairy industry is a very wide concept, so tried to find some new methods to reduced the risk in supply chain.

III RESEARCH OBJECTIVES:

Primary objective

1. Conduct a Risk assessment survey and identify the Risk
2. Analyze the Risk

Secondary objectives

1. Develop a Risk management plan for effective supply chain.

HYPOTHESES:

H0: There is no significance relation between Managing Risk and Effective Supply chain.

H1: There is significance relation between Managing Risk and Effective Supply chain

RESEARCH METHODOLOGY

- This research is all about to identify the risk in dairy industry and how to overcome on it.
- Responses are collected by a survey using a questionnaire as tool. The questionnaire was circulated as a Google form. The questionnaire consisted of 15 questions in total.
- The respondent of my questionnaire are the people who worked in the Supply chain/ Procurement in Dairy Industry.
- Statistical Package for Social Sciences (SPSS-IBM) is used for the analysis of
  the collected data. Multiple Regression Test is used to test first hypotheses.

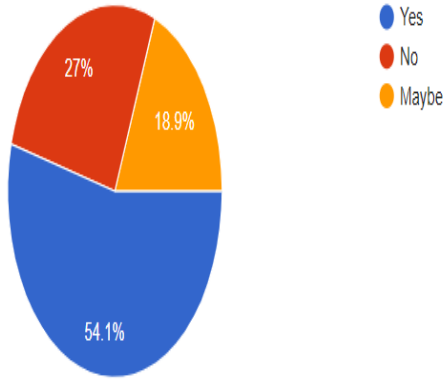
IV DATA ANALYSIS & INTERPRETATION:

Software used: MS Excel and SPSS

Statistical Tools/Technique used: Reliability Analysis, Multiple Linear Regression, Friedman Rank Test etc

Demographic Analysis

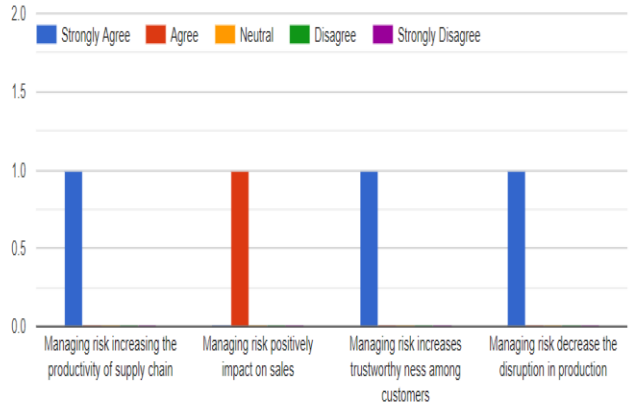
According to the survey whichever I conduct the pie chart given below shows that the 54% of People who worked in dairy industry are concern about the Supply chain risk and Managing risk also and approx. 19% Of people who think about it.



(Demographic Data)

Parameter 1 - Is your organization/business unit concerned about supply chain risks

2. According to the survey whichever I conduct, the graph given below shows that the all the respondents are aware about the Risk which is happened in dairy industry and they make a plan for Managing risk. All the respondents are strongly agree that the Risk analysis is must for smooth function of supply chain in dairy industry and managing risk positively impact on sales.



(Scale Question)

Parameter – 2 Please rate according to the level of satisfaction

TEST FOR DATA RELIABILITY –

Reliability Statistics

Cronbach's b.Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.847	.864	23

Case Processing Summary

		N	%
Cases	Valid	38	100.0
	Excluded[a]	0	.0
	Total	38	100.0

List wise deletion based on all variables in the procedure.

Cronbach's Alpha value of 0.847 determined using Reliability test shows the data collected during the survey has fairly high level of internal consistency.

Multiple Regression Test Results (Hypothesis Testing)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.710[a]	0.504	0.49	0.421	2.067

Predictors: (Constant), RiskManagement

Dependent Variable: Supplychainandsales

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	Sig.	95.0% Confidence Interval for B	Correlations	Collinearity Statistics	
	B		Beta		Upper Bound	Partial	Tolerance	VIF
1	0.428			0.037	0.828			
	0.558		0.71	0	0.745	0.71	1	1

a. Dependent Variable: Supplychainandsales

ANOVA[b]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	6.481	1	6.481	36.601	.000[a]
Residual	6.374	36	0.177		
Total	12.855	37			

Predictor – Risk Management

Dependent Variable – Supply chain and sales

- Multiple regression was run to predict dependent variable "Effective supply chain in dairy industry" from independent variable "Managing/Analyzing Risk in dairy industry ".
- 'R' value of 0.710 shows positive correlation between dependent variable – "Supply chain and Sales" and independent variable – "Managing Risk".
- Durbin-Watson value of 2.067 shows positive autocorrelation between dependent variable – "Supply Chain & Sales" and independent variable – "Managing Risk".
- Significance value of 0.000 (<0.05) shows that the the independent variable – "Managing Risk in dairy industry" significantly predicts the dependent variable – "Effective Supply chain in dairy industry".

Hence, null hypothesis is rejected and alternative hypothesis is accepted.
Therefore,

Managing Risk is must for smooth functioning of supply chain and increasing the productivity of supply chain.

Friedman Rank Test

The **Ranks** table shows the mean rank for each of the Risk which is occur in dairy industry, as shown below

	Mean Rank
Low milching cattle	4.44
Illiteracy of the milk producers	4.61
Logistical risks	4.43
Hazard risks	4.47
Delivery risks	4.6
Process/control/quality risks	5.39
Product shortages	5.75
Seasonal fluctuations in production	6.74
Non-remunerative price of milk	7.46
Incompatible price w.r.t quality	7.11

Rank Test

The Friedman test compares the mean ranks between the related groups and indicates how the groups differed, so as per this test i get the data like which is the high risk and which is the low risk compare to all, So I conclude that the low milching cattle, Logistical risk and Hazards risk is in the category of highest risks now a days in dairy industry, so I have to prepare the plan for managing this type of high risks compare to others as early as possible.

V RESULTS AND DISCUSSIONS

Findings:

The research is about to analyze the main risk factor associated with the supply chain of Dairy industry. The risk management plays the crucial role for effective supply chain in dairy industry.

It was found that there were many types of risk which is generally occurred in Dairy Industry, as per my analysis the Logistical Risk, low milching cattle and hazards risk these three types of risks are majorly occurred in dairy industry so this is the High type of risk so first task is to reduce such type of risk as early as possible and this must for the smooth functioning of supply chain.

As per my analysis I reject the null hypothesis and accept the alternate hypothesis, i.e there is a kind of relation between managing risk and effective supply chain, Managing Risk is must for smooth functioning of supply chain and increasing the productivity of supply chain.

High types of Risk in supply chain –

- **Hazard risks-**

The risks like fire, sabotage, accidents or bandhs (stopping of normal life by politicians or due to various agitations/protests) etc. could be attributed to hazard risks. This kind of risks, though applicable to BMCs and the production plant, still found to be a high risk area for the transport agencies too. The transport agencies who work for the out-bound logistics sake, selected through a bidding process. Once the products handed over to these agencies at the plant, the onus of these items are borne by them and any deviation in distribution lead to penalization. So these agencies are highly susceptible to hazard risks which not only result in penalisation rather lead to bring down profit and sometimes loss of lives during transportation.

- **Illiteracy of the milk producers** –

There is no proper correlation found between the cost of production and the illiteracy of milk producers still, in most of the cases it creates problem in understanding the intricacies of milk production as per the norms and standards fixed by the federation from time to time. This sometimes brings up cost of production and quality deterioration at their level. Lack of understanding of the business facts bring down bargaining power at the DCS level and hence get underpaid for their produce.

Low Milching Cattle –

Main problem among the milching cattle is the reproduction based problem, mainly anestrus, repeat breeding , long calving interval, low milk performance and mineral deficiencies. In such cases proper heat detection, feeding balanced rations and mineral supplementation, protection against thermal and ecto and endo parasitic infestation can help avert the problems. The production performance of a dairy farm is viable if cows calve every year and produce milk for at least 300 days with high production efficiency. Proper recording of the body weight gain, physiological activities and milk production can help in judging the performance of individual animals. From this one can identify the poorly producing animals and undertake the remedial measures in time. The animal which do not respond to improved feeding and management should be removed.

Strategies to minimise high risks

The high risk areas are the crucial ones and need to be addressed as early as possible to improve the efficiency of the supply chain. The other risks are not to be neglected at the same time. The dairy-food supply chain is highly a riskier business concern to deal with. No matter what precautions are taken, risks and uncertainties cannot be ruled out of the industry. Some way or the other they come into picture and disrupt the flow of the supply chain. But most of them can be prevented from happening with proper risk redressal mechanism and awareness. So please the refer the table below in which I can mentioned the types of risk and root cause of risk and how to overcome on that risk.

(High Type of Risk and strategies to minimize the risk)

Demographic Data Analysis –

As per the survey whichever I conduct there are types of variable "Effective supply chain" and "Managing risk" which is dependent and independent variable respectively, so I prepared some questions on dependent and independent also so I find in analysis this there is significant relation between these two variable. As per the demographic data the 73 % of People who worked in dairy industry are concern about the Supply chain risk and these respondents are aware about the Risk which is happened in dairy industry and they make a plan for Managing risk. All the respondents are strongly agree that the Risk analysis is must for smooth function of supply chain in dairy industry and managing risk positively impact on sales.

Reliability Test and Multiple Regression Test -

The value of Cronbach's Alpha is 0.847 which is determined using Reliability test, shows that data collected during the survey has fairly high level of internal consistency.

Multiple regression was run to predict dependent variable "Effective supply chain in dairy industry" from independent variable "Managing/Analyzing Risk in dairy industry ".

The value of R is 0.710 shows very positive correlation between dependent variable – "Supply chain and Sales" and independent variable – "Managing Risk", so we finds that there are strongly significant relation between these two variable.

The Durbin-Watson value is 2.067 it also finds that positive autocorrelation between two variable.

The Significance value is 0.000 (<0.05) shows that the the independent variable significantly predicts the dependent variable**.**

Discussion –

According to the survey and my respondents opinion the risk management is must for smooth functioning of supply chain in dairy industry, The Risk analysis is the process that involve identification of threats and measuring their effect on security of an organization.

The Research problem –

1 – Why supply chain Risk management is important in dairy industry ?

Supply chain risk management is a mechanism, which aims at mitigating the negative impact of disturbance and tries to manage certain risks within supply chain. As per my research it is a process of identification of risks and mitigation of them through outcome development, so as per my research I find out the how many types of risks are generally occurred in dairy industry and how much disruption occurred because of them and make a risk management plan for reduced the risk.

Sr.No.	High Risk	Root Cause	Strategies to minimize the risk
1	Low milching cattle	Extreme price of high milching cattle	Subsidized high yielding cattle supply and loan facilities, feed management
2	Logistical risks	Bad conditioned roads, vehicle break down, non-cooperation of retailers, perishability	Proper warehousing, training and education to staff, coordination among stakeholders
3	Hazard risks	Accidents, political turmoil, road blocking, bad conditioned roads	Proper training to staff on disaster management, precautions to minimize risks
4	Illiteracy of milk producers	Poverty, family influence, lack of interests to learn	Providing education and training on regular intervals at the DCS level
5	Non-remunerative price of milk	Lack of quality, policy issues	Hike in price, educating the milk producers to yield quality milk with optimum feeding
6	Demand unpredictability	Lack of experience, forecasting knowledge, non-coop. with PP	Education and training to the retailers, collaboration with production plant

2 – **The disruption in production and supply chain**.

Managing risk increases the productivity of supply chain and control the disruption rate.

3 – **How to prepare the risk management plan**.

The objective behind this research is to find out the risk in dairy industry and supply chain risk in dairy industry so I prepared survey for that and asked to respondent that they are know about supply chain risk and its outcome so now a days many organization are keen about it and they are work on how to overcome the risk and how to forecast the risk which will happen and they prepared the risk management plan for that, u can refer the fig 1.1 that I mentioned above in this figure I explained all the steps that how to make plan.

4 – **Find out which types of risks occurred in the dairy industry and categories them into high to low.**

To find out the solution of this problem I asked my respondent that how many types of risks are generally occurred in the dairy industry and supply chain of dairy industry so Low mitchling cattle, Logistical risk and hazards risk are mostly occurred in dairy industry and this are the high type of risk so for that we have to prepare the management plan as soon as possible and overcome on it because the disruption level is high of this types of risk.

As per the survey and I personally observed in the research some solutions for the risk handling at a ground level which ever as below –

1. Keep reserve stocks to avoid shortage and try to implement first in first out process to keep the quality.
2. Appoint the proper educated vender so automatically the logistic risk will reduced.
3. Streamlining every department of whole process with a supervisor to supervise whether everything goes as per SOP.
4. Remove bottle necks for multiple forecasting approaches.
5. To maintain the proper diet of Buffalo's so the milching problem will not occur.

Recommendation –

1 - Focus more in implementation of automation to reduce human error in dairy industry.

2 - Pull effect and by using forecasting methods for demand and sales

Limitations of the study –

1 – The sample size is much less for data collection, because the respondents of my questioners is only the people who worked in supply chain field in dairy industry.

2 – The maximum people who worked in dairy industry are illiterate.

3 – Now a days because of Covid-19 Pandemic I unable to visited the dairy industry.

VI CONCLUSIONS –

The dairy-food business is the riskiest business compare to other. There is no matter how much we precaution takes but risk and uncertainties can't be control completely but somehow we can manage this risk and reduced the disruption. As per the research I conclude that the high risk areas are the crucial ones and need to be addressed as early as possible while medium and low risk areas are not to be neglected at the same time. The effective supply chain management always provide for hygienic measures throughout the process by adhering to the proper food value requirements. So finally research conclude that Risk analysis is essential for improve the productivity and sales and the Risk management is must for smooth functioning of supply chain in dairy industry.

REFERENCES

1. George A. Zsidisin* - Department of Marketing and Supply Chain Management, The Eli Broad Graduate School of Management, Michigan State University, N362 North Business Complex, East Lansing, MI 48824-1122, USA
2. Mishra, P.K. and Raja Shekhar, B. (2012) 'Evaluating supply chain risk in Indian dairy industry: a case study', Int. J. Decision Sciences, Risk and Management, Vol. 4, Nos. 1/2, pp.77–91.
3. Pramod Kumar Mishra (Corresponding Author) and Prof. B. Raja Shekhar School of Management Studies, University of Hyderabad, Impact of Risks and Uncertainties on Supply Chain: A Dairy Industry Perspective, Journal of Management Research ISSN 1941-899X 2011, Vol. 3, No. 2: E11
4. Rahul S Mor, Arvind Bhardwaj and Sarbjit Singh - A STRUCTURED-LITERATURE-REVIEW OF THE SUPPLY CHAIN PRACTICES IN DAIRY INDUSTRY, Journal of Operations and Supply Chain Management | FGV EAESP
5. Tasnuba Nasir , Mohammed Quaddus, Mohamamd Shamsuddoha - Dairy Supply Chain Risk Management in Bangladesh: Field studies of Factors and Variables, Jurnal Teknik Industri, Vol. 16, No. 2, Desember 2014
6. A R Daud, U S Putro1 and M H Basri , Faculty of Animal Husbandry, Universitas Padjadjaran, Indonesia, Risks in milk supply chain; a preliminary analysis on smallholder dairy production,Livstock research for rural development 27 (7) 2015

BIOGRAPHIES

Kaustubh Mahesh Thanawala

I am an enthusiastic Data Science Student, now I am pursuing MBA from Sri Balaji University, Pune in Business Analytics Specialization and about Graduation I am an Instrumentation engineer and have a one year of experience in Sales and marketing.