

Knowledge Management in chemical industry: Manufacturing Unit

Merlin Priya Jacob

*Department of Information Technology
Thakur College of Engineering and Technology, Mumbai, Maharashtra, India*

Dr. Kamal Shah

*Department of Information Technology
Thakur College of Engineering and Technology, Mumbai, Maharashtra, India*

Aaditya Desai

*Department of Information Technology
Thakur College of Engineering and Technology, Mumbai, Maharashtra, India*

Abstract- Business organizations have become very competitive due to ever increasing needs of the customers. Knowledge management has become an important element in the supply chain industry over the last decade. Supply chain management in the chemical industry is very flexible to changing demands from the competitors. Integration and collaboration among various departments can enable us to provide clear information flow. Knowledge about supply chain can be classified as organizational and problem specific So we need to come up with techniques that will enhance the communication between various manufacturers and suppliers so that there is no information delay between them, and the end customer is satisfied with the product delivered on time. Knowledge management techniques can be used for the same. These techniques help in providing with expertise which will be useful in decision making of the organization and help the organization to improve its overall performance. Specific Knowledge management theories and constructs are identified as potentially contributing to theory and practice in supply chain contexts. The study focuses on the concept of integration of knowledge management with supply chain management (SCM) in chemical industry for manufacturing units.

Keywords – Chemical Industry, Correlation, Knowledge Management, Manufacturing Unit, Supply chain Management

I. INTRODUCTION

With the increasing demand for chemical products in supply chain industry is playing a very important role.

The chemicals sub-sector of industry in India as a whole (including pharmaceuticals) accounts for about 13% of the total output of the manufacturing sector, 13 to 14% in total exports and 8 to 9% in total imports of the country.

Managing knowledge in supply chains makes it possible for the smooth progress of innovation and creativity required to survive in the unpredictable business environment of today. Efficient and effective Supply Chain increases, if there is effective and efficient Knowledge Management. Management of knowledge is becoming a very crucial factor for the development of the organizations.

This research deals with two important aspects of KM: (1) knowledge acquisition and (2) knowledge application. The inclusion of the second aspect arises from the straightforward insight that knowledge acquisition without appropriate knowledge application does not add significant value to a firm Earlier research has looked at the impact of these two components of KM on organization performance separately This research takes an integrated view. Knowledge acquisition or creation relates to the addition of knowledge or correction of existing knowledge.

Some definitions of a supply chain are offered below:

A supply chain is the alignment of firms that bring products or services to market.[1]

A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves.[2]

The main aim of this project is to study the current working of the chemical industry and suggest measures on improving the efficiency and effectiveness of manufacturing units by using the concept of knowledge management so that the end products are delivered to customers on time without any hazardous effect on environment, health and also with proper implementation of safety measures by following strict rules and regulations.

The rest of the paper is organized as follows. Literature Survey is explained in section II. Objectives are presented in section III. Research methodology is explained in section IV. Findings and discussion are explained in section V followed by conclusion in Section VI.

II. LITERATURE REVIEW

In 2009, Y. Gao, ZG Shang, A. Kokossis [3], focuses mainly on integration of agent based systems in chemical industry. This paper mainly concentrates on development of user interface to improve the decision making of the organization. The researcher also describes how knowledge management will be useful in acquiring, integrating and correlating technical information in chemical engineering discipline. The interface was developed in Java and made use of ontologies to integrate regression and simulation. Yoosuf Cader [4] emphasizes on practice of knowledge management and marketing in the chemical and biotechnology industries. The Knowledge Management System model is focused on showing how customer oriented organizations use knowledge to market innovative products and services. Wu Chuni [5] focuses on a quantitative approach to investigate critical knowledge creation factors for supply chain performance. The research focuses on the important factors that are needed to facilitate different types of knowledge conversion process in order to achieve successful knowledge creation in a supply chain. Mark S. Fox, Mihai Barbuceanu, And Rune Teigen [6] concentrates on the use of own agent and co ordination technology to design distributed supply chains in lesser time for development and with reduced human resources. Piramuthu [7] focuses on automated supply chain framework. The main aim was reconfiguring the supply chain as per the dictates of order specifications. The paper dealt with the knowledge discovery methods. In particular the framework dealt with how data collected in dynamic supply chain could be used to improve supply chain performance. Ryan Darby, Judith Bishop, Willem Cilliers[8] emphasizes on appropriate and exact information exchange among different supply chain personnel. It mainly concentrates on supply chain collaboration and uncertainty can be reduced which helps in the development of the organization. Visualization techniques are being used to represent flow of information and knowledge among different supply chain partners thereby reducing the complexity.

III. OBJECTIVES

Review of literature was an exhaustive task which also helped us to understand the importance of knowledge management being used in various industries and how it has led to increasing the efficiency and effectiveness of the organizations. However not much research is done on chemical industries. Several books and research papers were reviewed devoted to the conceptual understanding of manufacturers and suppliers and the conceptualities related to the chemical industry. The reading has helped to get an in-depth knowledge and understanding of chemical industry management. Globalization is a concept which is ever changing and growing rapidly in spite of high energy cost. This in turn is increasing the demand of chemicals. Production rate is increasing at maximum, as large amount of products can be developed at a faster rate in contrast to the traditional methods like solar energy, natural resources etc.

Based on the above issues and challenges faced in the chemical industry the main objective of this study is 'Integration of knowledge management with supply chain management improves efficiency in manufacturing unit in areas of inventory, usage of dangerous chemicals, safety devices, personal protective equipment and maintenance staff.'

IV. RESEARCH METHODOLOGY

The methodology provides a basis for answering the research questions underlying the study. A survey is accomplished to collect data from participants to find out their attitudes, needs and opinions towards a specific area of interest. Survey results are then transformed into valid information in order to improve or enhance that area. It is also referred to as a research tool. It consists of a series of questions that a participant has to respond in a particular format. The participant has to select among the options given for each question.

The attitude measurement study that we are focusing on this study is the Likert Scale Technique. Likert scaling system was originally proposed by Likert[9] in 1932. This scale is generally used for a relatively small number of questions to understand a participant's behavior or attitude towards a question. The options involved in a typical five point Likert scale are: "Strongly Disagree", "Disagree", "Can't say", "Agree", "Strongly Agree". It helps the participant analyze the questions in detail to make good quality judgment. The number 5 was coded to the answer 'strongly disagree', the number 1 was assigned to the answer 'strongly agree'.

A set of 5 questions on Likert scale were chosen to conduct an analysis on manufacturing units.

A reliability test was conducted on Likert scales used in the questionnaire. The result of each of the coefficient alphas indicated satisfactory reliability. According to DeVellis Reliability Guidelines, a Cronbach[10] alpha coefficient over 0.7 implies respectable reliability.

In this study, Cronbach alpha coefficients of manufacturing units were 0.708 which was considered as an acceptable value for Cronbach's alpha.

Since the Cronbach's value for manufacturing units were higher than 0.7 it was seen as a good indicator of their reliability and high acceptability.

V. FINDINGS AND DISCUSSION

Table -1 Reliability analysis using Cronbach's Alpha

Variables	Questions	Cronbach's Alpha
Manufacturing unit	05	0.708

Table -2 Correlation matrix for manufacturing unit

	INVENTORY	DANGEROUS CHEMICALS	SAFETY DEVICES	PERSONAL SAFETY EQUIPMENT	MAINTENANCE STAFF
INVENTORY	1.000	.394	.261	.125	.207
DANGEROUS CHEMICALS	.394	1.000	.078	.130	.090
SAFETY DEVICES	.261	.078	1.000	.166	.349
PERSONAL SAFETY EQUIPMENT	.125	.130	.166	1.000	.184
MAINTENANCE STAFF	.207	.090	.349	.184	1.000

1. Inventory

Based on the correlation values it was found that inventory is positively correlated to safety devices. Inventory consists of safety devices to protect it from any untoward incidents. If the inventory is managed properly there is no room for waste. Proper inventory management saves time, money and space. It includes Fire protection is prepared for fire or other emergency that require quick evaluation. Dry Chemical Powder (DCP), CO₂, foam etc. are used in fire extinguishers. Fire alarms, emergency alarms, smoke detectors, wheeled fire extinguishers.

Proper warning posters are also used. Emergency exit markings, route maps, escape doors, automatic fire safety doors are implemented, automatic sprinklers, and spillage kits are used for collecting spillages. Dry chemical powder is also used for chemical fire like petroleum fire and CO₂ can be used for electrical fire. Inventory system is set such that if, in case there is any problem with the machinery, during maintenance of the inventory management.

Employers need to have a database of written processes and safety information before conducting any process hazard analysis required by the standards of the organization. It will help the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes involving highly hazardous chemicals.

Inventory influences personal protection equipments. It means use of clothing, helmets, goggles or other garments or deices required for human safety to protect the wearer's body from injuries. Hazards prevention by PPE include physical, thermal, chemical, bio hazards, dust, soot, or other air borne particulate matter. It works as a barrier between user and worker environment.

Normal PPE used are:

- goggles or glasses - eye protection
- aprons - body protection
- hairnets - hair protection and containment

- safety boots - foot protection
- respirator - fumes, infection protection
- helmets- falling material
- ear plugs- for excessive noise

Minimum two pairs of all the above mentioned equipments are mandatory and it is to be kept on accessible area or at the entrance.

Inventory and maintenance staff is related as inventory is maintained by staff and they are trained according to the chemical structure. They follow Globally Harmonial System (GHS) of classification of labeling. Manufactured goods have separate storage area as per the classification of chemicals.

1. Flammable liquid- flash point is greater than 93°C which is classified according to flashing and boiling point.
2. Flammable solid-this is the one which is highly combustible and that causes fire through friction.
3. Self reactive substances-they are thermally unstable liquid and solids likely to undergo thermal decomposition even without oxygen or air
4. Substances corrosive to metals, catalysts, surfactants, additives etc.

Training programmers' to staff should be conducted on a regular basis. Information should be communicated by creating placards, labels, SDS hazard statement and precautionary statement. Communication should be consistent with each other to reduce confusion. All these information should be provided in local languages.

2. Dangerous Chemicals

It was found that dangerous chemicals are positively correlated with personal protection equipment. It is mandatory to use the equipments like hand gloves, gumboots, safety goggles, helmets, aprons by employees who handle dangerous chemical like acids, alkalis and solvents. In case of any untoward incident these employees will be protected and this will not affect the day to day operations of the organization. This ensures the productivity of the organization.

It was also found that dangerous chemicals are positively correlated with maintenance staff. An effective training program will allow employees to fully participate in the training process and to practice their skills or knowledge. There is a well defined disaster management plan including evacuation, giving first aid within the golden hour, shifting injured to the hospital. There is also availability of disaster control room manned 24/7 which will co ordinate with the top management, local authorities, hospitals and police. Also it is mandatory for chemical handling units to operate an occupational health centre where trained paramedical staff are available to treat the person immediately in case of any accident. OHC are provided with the information of all chemicals used and also antidotes to overcome any emergency.

3. Safety Devices

It was also found that safety devices were positively correlated to personal protection equipment. For example use of vulcanized fiber or fiberglass and fitted with a filtered lens, and welding shields gives protection to eyes from burning that is caused by infrared or intense radiant light and they also protect both the eyes and face from flying sparks, small pieces of metal that are scattered and fragments of slag that are produced during repairing, welding and cutting operations. Also filter lenses are present to have a shade number appropriate to protect against the specific hazards of the work being performed in order to protect against harmful light radiation.

It was found that safety devices were positively correlated to maintenance staff. Maintenance of the equipments include activities such as inspection, testing, accurate measurement, fault detection, cleaning, servicing, lubrication, repair etc. during maintenance staff should use appropriate tools, including personal protective equipment. Also the supervisor should be informed in cases of unforeseen incidents instead of trying to save time by using shortcuts. It is the duty of the maintenance staff to maintain the site neat and clean, machinery, resources and environment free of hazards.

4. Personal Protection Equipment

It was found that personal protection equipment was positively correlated to maintenance staff. Staff should follow proper rules and regulations regarding the usage of personal safety equipments. If the rules are not followed at workplaces while dealing with dangerous chemicals heavy fines are imposed on them. Safety helmets are used where there is a risk of objects falling from a height.

- Face protection masks and eye goggles are essential where particles (red hot or otherwise) are moving around the atmosphere at a great speed;
- Ear plugs are used where there are high levels of noise;
- Breathing apparatus, such as compressed air equipment are used in areas where there is a shortage of oxygen, or where there is contamination of air by substances that are hazardous to human health;
- If reflective clothing rules are implemented people working in the room can be seen easily with good clarity.

VI. CONCLUSIONS

From the above analysis and discussions it can be concluded that all the variables declared for manufacturing unit like inventory, dangerous chemicals, safety devices, personal safety equipment and maintenance staff influence each other very much in a positive manner. Thus if these variables are taken together into consideration ,efficiency and effectiveness of the organization can improve the growth of manufacturing units in the chemical industry to a larger extent and manufacturers will be able to deliver the end products to the distributors on time without any hazard or accidents and also without any wastage in inventory.

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