

# Knowledge Management in Chemical Industry: Supplier Unit

Merlin Priya Jacob, Dr Kamal Shah, Aaditya Desai

**Abstract-** Over the last few decades, chemical industry is considered as one of the largest industries for emerging countries like India. All the products supplied to consumers on day to day basis are manufactured from the chemical industry. In order to manage information in large supply chain industries like chemical industry, knowledge management techniques are essential. Integration and collaboration among various departments in the supply chain can enable us to provide with information flow with a better clarity. 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 supplier units.

**Index Terms**— Chemical Industry, Cronbach's alpha, Correlation, Inventory, Knowledge Management, Supplier Unit, Supply Chain Management

## 1 INTRODUCTION

Chemical industry is considered as one of the major industries where the end products knowingly or unknowingly lead to the comfort of the mankind. For example: a pharmaceutical industry is a part of the chemical industry which supplies medicines that is essential for the survival of humans. Other end products that are used in our day to day lives like toothpaste, footwear, foam beds, melamine cutlery etc are originally processed or manufactured from basic chemical substances which is again a part of chemical industry. In this industry the chemical properties of the raw materials is used in combination with other substances to produce finished goods. This industry needs huge investment and it requires complex processes, precise quality checks, dedicated plants and equipments and also highly skilled manpower and implementation of safety practices where adverse effects on the environment is taken care of.

For the smooth functioning of the organization, effective and efficient supply chain management is required.

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. 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 researchers have 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.

## 2 LITERATURE SURVEY

Piramuthu [1] focuses on automated supply chain framework. The main aim was to rearrange the supply chain as per the dictates of order specifications. The paper mainly dealt with the methods of knowledge discovery. In particular the framework focused on modes of data collection in dynamic supply chain could be used to improve supply chain performance. Yoosuf Cader [2] 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. Mark S. Fox, Mihai Barbuceanu, and Rune Teigen [3] 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. Nancy C. Shaw, Mary J. Meixell, Francis D. Tuggle[4] focused on automotive industry particularly manufacturing unit and examined the result of manufacturers trade promotions and its effect on the chain of decisions in the supply chain and also on the use of knowledge

- Merlin Priya Jacob is currently pursuing masters degree program in engineering from Thakur College of Engineering and Technology, Dept of IT from Mumbai University, E-mail: mrlnjacob@gmail.com
- Dr. Kamal Shah is currently Head of Department of Research and Development in Thakur College of Engineering and Technology, Dept of IT from Mumbai University, E-mail: kamal.shah@thakureducation.org
- Aaditya Desai is working as a faculty of Information Technology in is currently Head of Department of Research and Development in Thakur College of Engineering and Technology, Dept of IT from Mumbai University E-mail- aaditya1982@gmail.com

management on ordering process of service parts and its effect on the automobile industry. Ryan Darby, Judith Bishop, Willem Cilliers[5] 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. Y. Gao, ZG Shang, A. Kokossis [6], 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 ontology to integrate regression and simulation.

### 3 OBJECTIVES

Review of literature was an important task that enabled us to analyze the importance of knowledge management implemented in various industries and how it has led to the overall growth of the organizations. However not much research is done on chemical industries. Several books and research papers were referred and devoted to the conceptual understanding of suppliers and the conceptualities related to the chemical industry. The reading has helped to get knowledge and understanding of chemical industry management to a great extent. 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 which in turn increases the demand for products.. 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 that 'Integration of knowledge management with supply chain management improves efficiency in supplier unit in areas of inventory, product handling, testing and certifications, customer satisfaction and training.'

### 4 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[7]. Likert scaling system was originally proposed by Likert 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 supplier 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 [9], a Cronbach alpha[8] coefficient over 0.7 implies respectable reliability.

In this study, Cronbach alpha coefficients of supplier units were 0.711 which was considered as an acceptable value for Cronbach's alpha.

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

### 5 FINDINGS

TABLE -1  
RELIABILITY ANALYSIS USING CRONBACH'S ALPHA  
FOR SUPPLIER UNIT

Variables	Questions	Cronbach's Alpha
Supplier Unit	05	0.711

TABLE -2  
 CORRELATION MATRIX FOR SUPPLIER UNIT

	Inventory	Product Handling	Testing and Certifications	Customer Satisfaction	Training
Inventory	1.000	.431	.453	.091	.269
Product Handling	.431	1.000	.521	.164	.278
Testing and Certifications	.453	.521	1.000	.504	.280
Customer Satisfaction	.091	.164	.504	1.000	.105
Training	.269	.278	.280	.105	1.000

## 6 DISCUSSIONS

### 6.1 Inventory

Inventory is found to be positively correlated to product handling as rules and regulations for handling the products are written in material safety data sheet and information is shared to all employees handling the inventory. Also information about all the ingredients present in the product is mentioned on the product labels. Also there is a provision for maintaining detail of all products and precautions to be taken while handling them by creating online portal that consists of a set of web pages that provides link for materials and their relevant explanations that will increase public access to information about chemicals.

Inventory is found to be positively correlated to testing and certifications. There are various Acts established by the government regarding testing and certifications to be conducted before dispatching the end products to the customers. An inventory contains the copy of the rules to be followed to ensure that the end products are proper and causes no harm to the humans or environment. Testing procedures are audited by third party and rules are applied on end products for evaluation and assessment of risks associated with the processing of the chemicals.

Inventory and training are positively correlated as inventory is maintained by trained personnel and they are trained according to the chemical properties. They follow Globally Harmonial System (GHS) of classification of labeling. End products have separate storage area as per the classification of chemicals.

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

Training programs to staff are conducted on a regular basis and the knowledge is also shared with the new trainee staff.

### 6.2 Product Handling

Product handling is positively correlated to testing and certifications. The quality of end product is determined by the design of the equipment, intermediate stages of processing, in-process controls and validation of processes. The procedures are strictly followed as per the guidelines applied to them throughout the various stages of manufacturing of the end product. Strict guidelines are provided for testing of the end products. Quality assurance tests reports are given along with the product and acceptance of a product is based only on conformation of the given values by the in house quality control department. These procedures play a very significant role in improving the quality of the end product substance and only fresh end product is dispatched to the customers if the product is having a specific shelf life.

Product handling is positively correlated to customer satisfaction. Generally a same product is required by different industries for their application. Their requirement varies in pack sizes. Consumption pattern is also different. Big customers need the same material in huge quantity whereas small scale manufacturer's requirement is limited. To cater the needs of these types of customers, the logistics department has got specific plans and procedures to fulfill the needs of all. Normally bulk material is stored nearby the consumption region. There small packaging are made and dispatched to the customers as per the weekly and monthly schedule. All these activities are planned to enhance customer satisfaction. Training is provided to customers that explain the safe usage and handling techniques of the end products. Higher reliability of the end products also improves customer satisfaction. Periodic feedbacks are also taken from the customers to evaluate their requirement and systems and procedures are modified keeping customers in mind.

Product handling and testing and certifications are positively correlated to training. In any organization, viability and profitability depends upon effective handling of the available resources. Materials are to be carefully handled as per the requirement of the customers. To maximize this, organization requires trained manpower on all stages of the manufacturing process. Training sessions are held on regular basis for the personnel that are tailored to suit the requirements of the industry, and are based on the chemical substances they use. The workshops are interactive and include team exercises. Training is given to activities such as accurate measurement, inspection, testing, servicing, etc of the end product They are provided with a rule book containing the dos and don'ts. evaluation sessions are conducted to find out effectiveness of training. Certificates are given after successful completion of the workshop.

### 6.3 Testing and Certifications

Testing and certifications are positively correlated to customer satisfaction. Testing of the product ensures that all the products manufactured are of the same specifications. Testing ensures that proper rules and guidelines are followed during manufacturing process. This also helps to find out compliance with the product safety is followed before delivering the product to the end customer. The manufacturer of the product is responsible for drafting and issuing of the product certificate. The certification of the product is based on tests that are conducted on sample by the in house testing centers. Periodic third party audits are also conducted to verify the test values. All these measures will help customers in improving productivity and profitability whereby full customer satisfaction is achieved.

Testing and certifications are positively correlated to training. Proper training is necessary to handle sophisticated and latest testing equipments available to test the product. These types of equipments require proper calibration, periodic maintenance and housekeeping. Training the personnel includes giving the information about the type of equipment and the techniques to handle it. They are sent to the suppliers' laboratory to familiarize with the testing procedures. This will help in getting accurate results. Training is also provided to them in safe handling of the chemicals used for testing and also safe disposal of the tested chemicals. Training for testing the product are based on factors such as the quantity of the products used, risk of using the product and the precautions to be taken while using the product during spills or emergencies.

## 7 CONCLUSION

From the above analysis and discussions it can be concluded that all the variables declared for supplying unit like inventory, product handling, testing and certifications, customer satisfaction and training 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 supplier units in the chemical industry to a larger extent and suppliers will be able to deliver the end products to the customers on time with legal certifications on usage of the product and also without any wastage in inventory.

## REFERENCES

- [1] Piramuthu, S in "Knowledge-based framework for automated dynamic supply chain configuration." in European Journal of Operational Research, 165, 219–230,2003
- [2] Yoosuf Cader," Knowledge Management and Knowledge-based Marketing" in Journal of Business Chemistry
- [3] Mark S. Fox, Mihai Barbuceanu, And Rune Teigen, "Agent-Oriented Supply-Chain Management" in The International Journal of Flexible Manufacturing Systems", Boston, 2000, 165–188
- [4] Nancy C. Shaw, Mary J. Meixell, Francis D. Tuggle," A Case Study of Integrating Knowledge Management into the Supply Chain Management Process" in Proceedings of the 36th Hawaii International Conference on System Sciences ,2003
- [5] Ryan Darby, Judith Bishop, Willem Cilliers," Component Based Software Architecture for Supply Chain Management Systems"
- [6] Y. Gao, ZG Shang, A. Kokossis, Agent-based intelligent system development for decision support in chemical process industry, Expert Systems with Applications, 36 (8) pp: 11099-11107, 2009
- [7] Likert,Rensis ,"A Technique for the Measurement of Attitudes". Archives of Psychology 140: 1–55, 1932
- [8] Cronbach LJ, "Coefficient alpha and the internal structure of tests". Psychometrika 16 (3): 297–334, 1951
- [9] DeVellis, R. F. ,"Scale development: Theory and applications" (Vol. 26). Sage Publications, Incorporated, 2011