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Knowledge Management for Downstream Supply Chain Management of Indian Public Sector Oil Companies

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Abstract

Supply chain management is a complex process involving many processes in oil industry. Managing these processes is a challenging task in itself. Our focus is on Indian public sector oil companies, its processes and stakeholders throughout India especially the customers, retailers and depot managers. Our study will find whether Knowledge Management is helpful for these companies for improving its processes, better decision making and formulating a short and long-term strategy for business.

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Keywords: Knowledge Management (KM), Supply Chain Management (SCM), Public Sector Oil Companies, Software Engineering, Downstream Supply Chain Management (SCM)

1. Introduction

Knowledge Management has its roots in organizational learning and innovation. Successful managers have used intellectual assets and recognized their value. Forrester Research, IBM and Merill Lynch studies provide an estimate that 85 percent of a company's knowledge assets are scattered across the organization in the form of e-mail, Word documents, spreadsheets and presentations on individual computers.

Organizations have newly initiated the application of IT tools to facilitate the knowledge inside the organization. Knowledge management (KM) is a process that helps organizations identify, select, organize, disseminate, and transfer important information and expertise that are part of the organization's library where they are stored for recall.

2. Supply Chain Management (Scm)

Supply chain management (SCM) is defined by the Global Supply Chain Forum (GSCF) as "the integration of key business processes from end users through original suppliers that provide products, services and information which add value to customers and other stakeholders" [1]. Two main aspects are commonly considered in the study of the collaboration relationship in the Supply Chain: the first deals with the intensity of the relationships between partners whose considerations vary from simple information sharing to risk and profits information sharing; the second studies the extent of the collaboration across the Supply Chain[5].

Drawbacks of the Supply chain are as follows:

- **Trust and collaboration**: Trust involves a process where a company estimates the costs and rewards of either

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cheating or keeping the trust.

- **Global issues**: Global issues such as political concerns, currency risk, governmental concerns, production quality and infrastructure issues.
- **Outsourcing:** It concerns basically with make- or- buy decisions.
- **Many-supplier strategy:** This tends to decrease risk and increase costs.
- **Vendor Selection:** From whom to buy goods and services. Includes vendor evaluation, vendor development and vendor negotiation.
- **Difficulty in Demand Forecasting:** Demand and supply mismatches can lead to short and long term loss in sales and market share, excess inventories or unavailability of products.
- **Cost of reverse logistics**: Reverse logistics is the process of taking back products or package materials to avoid wastage. It can be costly and can create difficulties when managing supply chain life cycle.

The solution for this problem would be to create an application that handles the Supply Chain. At one end we have Supply Chain and at the other end, we have Knowledge Database and Artificial Intelligence tools to handle the problems. Supply Chain collaboration starts due to the low mutual trust between the partners. Later this may gradually increase and lead to a complicated and profound collaboration mechanism [3].

Collaboration in a Supply Chain has one common goal: to create a transparent and visible demand pattern that paces the entire supply chain [4]. Holweg et al. [4] says, to achieve more transparent information in order to reduce uncertainty in the environment, which is another of the goals of the collaborative processes in the Supply Chain. Supply Chain Management uses various business processes and companies which are of relevance to service customers: order fulfilment, customer service management and product development [2].

If an employee retires or leaves the organization, still his knowledge and experience (transcendental knowledge) is present in the Knowledge Database in the form of information. So if another employee replaces him, he will be able to continue from where the latter had left his work. Also the new employee will be able to grasp what the earlier employee had done in the organization just by referring to the Knowledge Base. Similarly for a Supply Chain Management, we too can have a Knowledge Database which will store data related to the same domain together. For this to be implemented properly, we need to keep a demand-driven business model instead of a supply-driven business model which totally focuses on the requirements of the customers.[6]

3. KNOWLEDGE MANAGEMENT (KM)

Nonaka (1991) [7] establishes that knowledge can be understood as the information flow among the resources within the company. Information flow can come about from the worker's experience or be a result of the physical document generation process (which, in our case, can also be understood as knowledge), where tacit knowledge may be most important because it is one of that is most unpredictably and uneasily expressed. [8]

More often than not, these partners do not like to share their private information completely. Therefore when knowledge/information must be shared, it must be managed in such a way that it develops over a period of time [9]. So, it is necessary that managers should not only be skilled in technical and operational areas, but should also develop relationships that favour the trust required to encourage information exchange.

Collaborative architecture based on a multi-agent coordination mechanism. Then, the knowledge management process is assigned to agents who are able to retrieve information for specific applications from databases, made possible by considering mechanisms that use intelligent queries. Furthermore, these agents are also able to process the information by storing, transforming and transporting it. Linking enterprise models, mainly those related to the enterprise environment in which the enterprise goals and strategies are considered to be the first step in the software development process, and which involve establishing a requirements elicitation, are presently becoming a very common research trend [10]

4. PROBLEM DEFINITION:

4.1 HYPOTHESIS FORMATION:

Step 1: Stating the Hypothesis

Null Hypothesis (H0): *"The use of Knowledge Management in operationalizing collaborative decision making in the*

downstream Supply Chain Management of oil companies in western region of Indian operations is not adequate"

Alternate Hypothesis (H1): *"The use of Knowledge Management in operationalizing collaborative decision making in the downstream Supply Chain Management of oil companies in western region of Indian operations is adequate"*

Step 2: Assumptions: The samples gathered for were uncorrelated and random.

Step 3: The testing of Hypothesis is carried out by performing the z-test. Calculate $Z_{cal.}$ Compare the values with the table values.

Step 4: Accept the null hypothesis or reject it.

4.2 Identification of Issues and Parameters: [8][9]

Sr. No.		Issues	Manager			Retailer			Depot Manager			Customer		
			High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
1		Goods Returned				√			√			√		
2		Availability of Goods				√			√			√		
3		Frequency with which the goods are provided to the customer				√			√					
4		Co-ordination between customers and retailers						√						√
5		Use of ERP		√				√			√			
6		Co-ordination between retailers and depot managers						√			√			√
7		Number of goods ordered per week						√						√
8		Sharing information			√			√			√			√
9		Use of electronic medium to record			√			√			√			√
10		Frequency for the use of smart phone applications	√			√			√					√
11		Frequency for the use of handheld systems	√			√								√
12		Frequency for the use of web portals	√									√		
13		Frequency of the customer complaints resolved			√			√						√
14		Quality of trainers						√			√			
15		Use of RFID	√			√			√					
16		Effect of Demand variability on sales of goods						√			√			
17		Use of GPS		√			√			√				
18		Use of electronic wireless sensors	√			√								
19		Stocking of goods is costly			√			√			√			
20	S1	Speed of order fulfillment						√			√			

4.2 CONCEPTUAL MODEL FORMATION

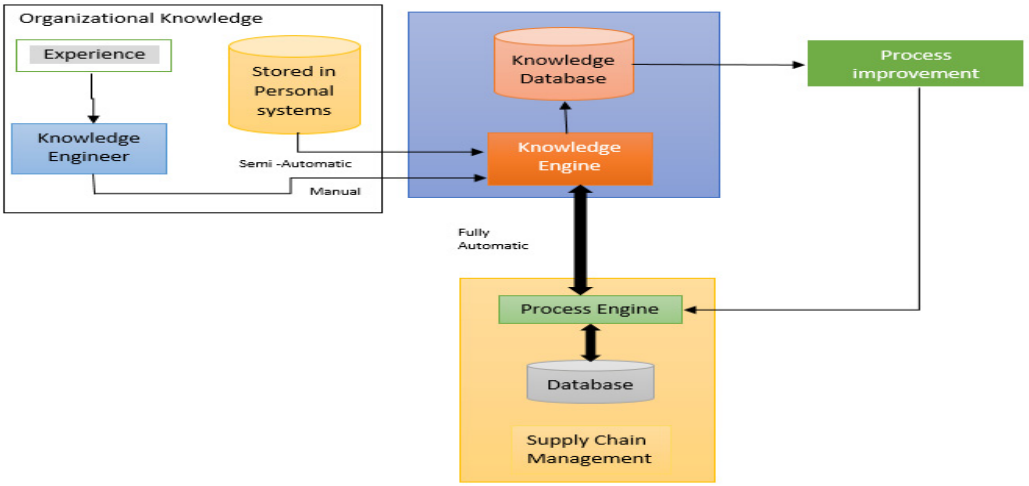


Fig 4.2 Conceptual Model formation

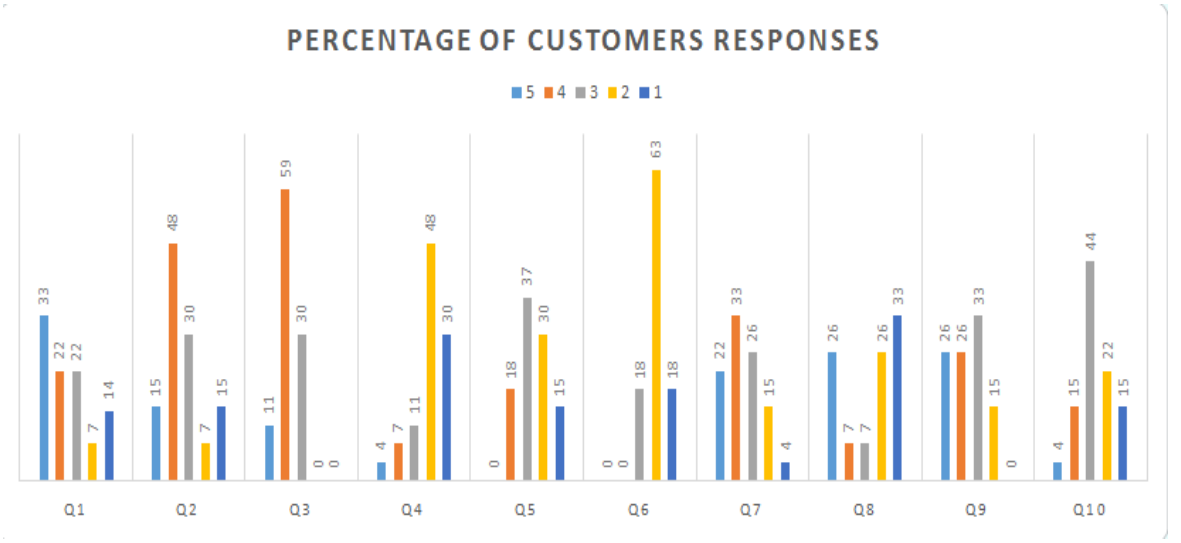
As we know, Knowledge is basically of two types namely, tacit and explicit. Tacit knowledge is experiential and need to be converted in to a digital form before it can be actually put to use. Tacit knowledge includes, experience of a person, skills, etc. Explicit knowledge on the other hand is in the record form and can be directly recorded in digital form. In our model presented above, the organizational knowledge again is tacit and explicit. That is the reason we need to convert the experience of a person in to a digital form by recording the experience gained by the person in audio/video format. Also we can maintain a centralized problem solution database where we can make it available to other users who are facing similar problems. This database is nothing but your knowledge database or knowledge base.

Before storing the actual information in the knowledge base, the knowledge engine will filter out all the irrelevant information coming in from the tacit and explicit knowledge in the organization. Tacit knowledge needs to be recorded and converted in to digital form manually the process needs human intervention. On the contrary, explicit knowledge needs little or no human intervention to convert in to appropriate information. The second part of the model includes Supply Chain Management Cycle. At one end of the SCM cycle, it is connected to a process engine. This process engine extracts information from time to time and sends it to the knowledge engine for extracting knowledge from the information provided. This in-turn is stored in the knowledge database.

The knowledge engine can be called as the “heart” of the knowledge management process. This is because it pumps in relevant knowledge into the knowledge base from time to time. The process improvement phase receives this share of relevant knowledge which in turn is passed on to the process engine of the SCM cycle. E.g. For demand forecasting process, information about goods sold per week, per month, etc. is provided to the knowledge engine. The knowledge engine will segregate the knowledge out of the information provided, which in this case would be the trend of sales for a particular product during a certain time of the year. This knowledge is stored in the knowledge base where it is accessed by the process improvement phase. The improvement suggested could be increase or decrease in the quantity of the product for a particular time of the year, which is then incorporated in the SCM cycle by the process engine of the SCM process.

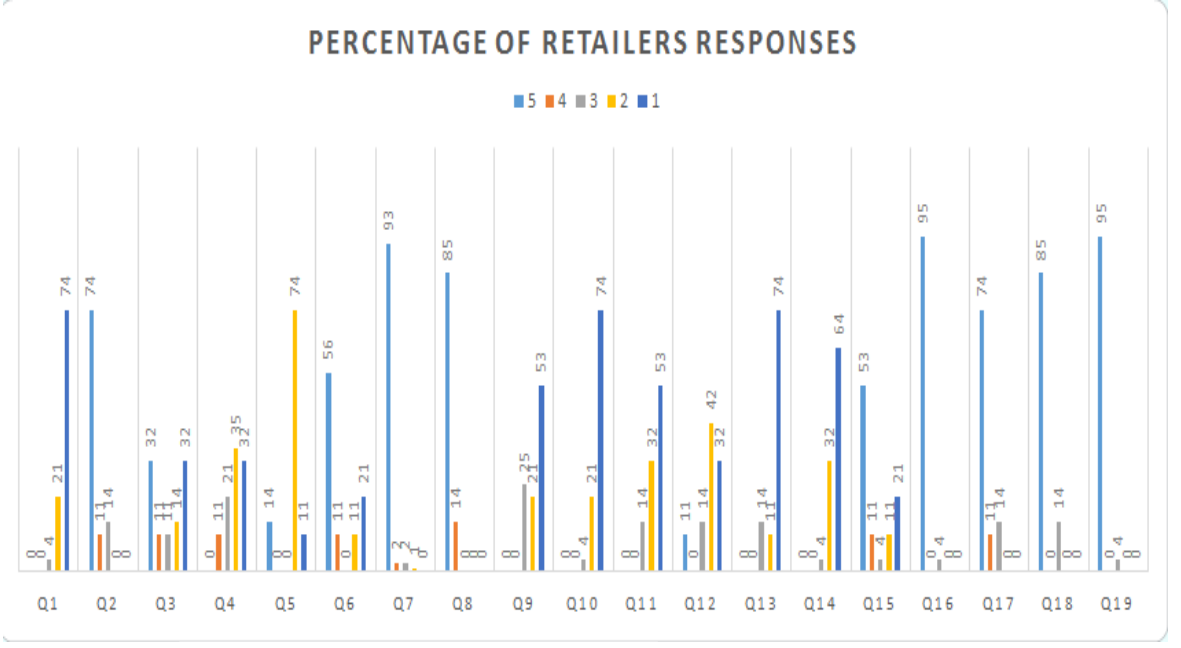
5. RESULTS AND DISCUSSION:

5.1 SURVEY RESULTS FOR CUSTOMERS:



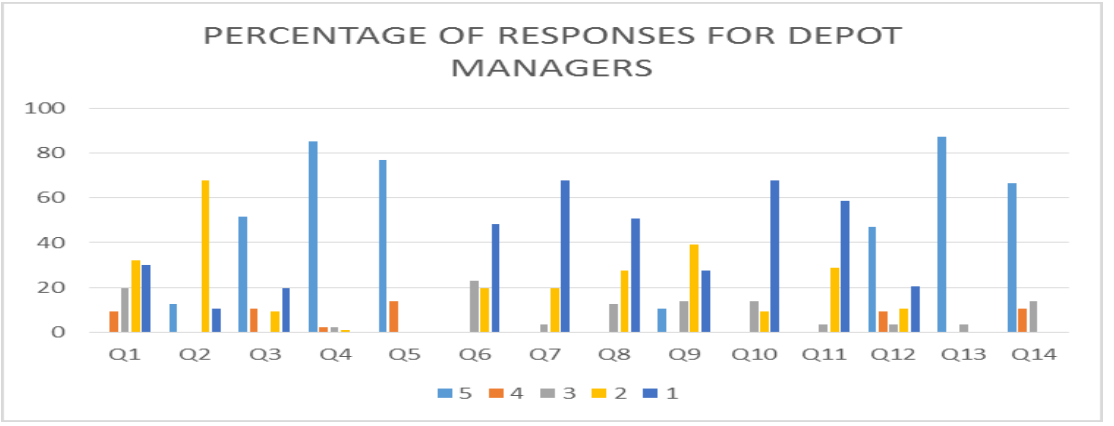
5-Very High, 4-High, 3-Moderate, 2-Low, 1-Very Low

5.2 SURVEY RESULTS FOR RETAILERS:



5-Very High, 4-High, 3-Moderate, 2-Low, 1-Very Low

5.3 SURVEY RESULTS FOR DEPOT MANAGERS:



Following are the values of the parameters identified and observed during the questionnaire survey:

1. N = Number of goods returned and the price of each product. **N=1 (Average).**
2. C_{RL} = Price of each product x No. of goods returned **C_{RL}=325 (Average price in Indian rupees).**
3. N_n=number of times you were not able to provide the product and the reason for the same. **N_n=1 (Average).**
4. N_r=number of days taken to resolve the complaint. **N_r=1 day (Average)**
5. T_{avg}=Time taken on an average (in minutes) to provide a product or service. **T_{avg}= 5 minutes.**
6. T_Q=No. of minutes waiting in the queue for service. **T_Q=4 minutes (Average).**
7. N_p= No. of days taken to resolve the problem faced by customer. **N_p=1 day (Average).**
8. T_M= Time taken for the product to reach from depot to retail. **T_M=1 day (Average).**
9. TCWM = Time placed - Time received. **TCWM=15 hours (Average).**
10. T_{CD}=Time to dispatch-Time required to deliver. **T_{CD} = 10 hours (Average).**

6. CONCLUSION:

The reliability tests on customer and retailer data samples confirm that the data is uniform throughout. The results of the survey and the mapping graph of the issues and parameters suggests that the hypothesis formed is correct. Analysing the results we can now conclude the Knowledge Management in downstream supply chain management of Indian public sector oil companies helps in collaborative decision making for long term and short term issues. The issues that are identified will be bridged by focusing on solving the issues.
Following were the results of the questionnaire analysis:

Highly Critical issues:

i. Goods returned
ii. Availability of Goods
iii. Frequency with which goods are provided to the customer
iv. Co-ordination between customers and retailers is low
v. Use of ERP is low
vi. Sharing of information is low
vii. Use of electronic medium to record is low
viii. Frequency of the customer complaints resolved is low
ix. Stocking of goods is costly
x. Speed of order fulfillment

Moderately Critical issues:

i. Use of electronic wireless sensors is low
ii. Frequency for the use of handheld devices is low

Low Critical issues:

i. Use of GPS is low
ii. Demand variability

From the issues identified, the literature survey carried out, the personal interviews carried out, the questionnaire analysis made, we ascertain that the level of Knowledge Management implementation in downstream Supply Chain Management of Indian oil companied is significantly low.

7. FUTURE SCOPE

The study done in this paper will enable us to move in the direction of using Knowledge Management as a guiding tool in any other sector like retail, FMCG, manufacturing, etc.
Further study can be carried out to resolve the gaps that are identified and various other newly emerging techniques like Business Intelligence and Data Mining can be used for analysis purpose but at a smaller operational level.
Understanding of the Knowledge Management in downstream Supply Chain Management in oil sector around the world was carried out in the literature survey through case study analysis of various case studies in Supply Chain management, Knowledge Management, web sites of various oil companies like Exxon, Shell and British Petroleum.

Identification of critical issues was carried out through literature survey, annual reports and case study analysis in Stage I and through personal interviews with top level management, survey carried out with middle level management and operations level management of Indian oil companies in Stage II. Top level management included the Regional Head, Directors, Vice Presidents, the middle level included the Supply Chain Manager, Depot manager and the operations level includes, the Retail manager, Operations manager and Transportation manager.

The investigation of the issues identified in Stage I and Stage II led to the formation of the Hypothesis which was tested using questionnaire analysis. All the issues identified are from the Indian oil industry perspective.

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APPENDIX:

Findings of the interview:

The Indian public sector oil companies have clientele from Defence to Railways to Cars to Various industries using machines. BPCL has about 500 different products in about 70 cities in India.

1) The processes followed in Indian public sector oil companies are well documented. The processes are designed by deciding on the processes during meetings at the higher levels.

2) If a new requirement is made for a process, it is discussed by conducting a meeting before implementing the process.

3)It may not be possible to implement the processes as they are decided in the meetings possibly due to the on-going evolution of the processes and technology that is used.

4) One common problem faced by Indian public sector oil companies is of the transfers of people working on a project. The oil sector being a public sector majorly, the transfers are often after every 2 years period. For solving this issue, Indian public sector oil companies uses an internal software called "Solution Manager" which collects details of the projects that are carried out by an individual during a period of time. This also helps to raise issues if any, present in the organization and possibly solutions to the problems.

5) There are three ways when we look at handling the SCM:

i) System-driven approach

ii) Process-driven approach

iii) Person-driven approach

Out of the above three, BPCL uses the System-driven approach as a guideline for implementing their SCM. Thus the system generates requirements for the organization by considering the demands from different vendors and the market.

When making a decision over which vendor should be given priority when supplying the products, the decision is made by the SCM- ERP based solution. Priority is given to the vendors who have a good history of purchasing and a good rapport with BPCL.

6) A product may not sell for 90 days, 180 days, 365 days or no sale for 5 years.

For the problem of "Reverse Logistics", a software called "Collaborative Demand Planning" is used. This software enables to monitor the demand at various locations across the country. All the regions in the entire country are interconnected and sharing of information is done.

If in a particular region the demand for a certain product is high but the supply is falling short, in that case the decision to move the product from some other location where the demand for the same product is less is done by the software.

Also if a region is having excess stock, it may be given to the region where the demand can increase possibly in the near future. This decision also is taken by the respective software and the territory head actually implements it.

7) Another software specifically used for Demand Forecasting, is "Business Intelligence Warehousing". Depending on the trend in the market, the demand for a particular product may increase, this trend is depicted by this software.

8) Indian public sector oil companies follow ISO standards and feedback from the customers is given priority. Customer feedback is given great importance and queries from the customers across the country are received via the official website of Indian public sector oil companies. Any other suggestions or complaints are discussed and decision over them are taken.

9) If the demand for a new product arises, the product requirement is given to the Research and Development Team. Proper testing, chemical analysis, etc. is done by the R&D team.