

Role of Knowledge Management in Network Based Manufacturing Activities

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Abstract: *The Manufacturing of parts and systems for Automobile, defense and Aerospace applications are complex in nature and require well planned coordinated approach. Most of the manufacturing methods followed in India are developed indigenously and some are technology acquired from developed countries as technologies know-how. Close interaction and knowledge sharing are vital. Knowledge Management KM plays a vital role in the field. The manufacturing knowledge needed for the realization of these hardware is available in our country but well spread all over. Networking and integrating all of these in single location shall require huge investment and become hotspot. In our country the outsourcing of manufacturing is being pursued as a part of 'Make in India' policy. As an innovative approach of knowledge management, networking of industries for their functions, consortium approach of realizing the systems and hardware are followed. The paper brings out the concept followed and network based knowledge management process adapted.*

Keywords: Networking, Knowledge Management, consortium approach, manufacturing, Industries, Firms

1. Introduction

Twenty-first centuries is undoubtedly the century of knowledge. The everyday usage of available advanced technologies in manufacturing industry, trade and business activities confirm that this is not only a phrase from the literature, but true reality. The globalization has brought many modern trends, and companies have the task to adapt them as quickly, easily and painlessly as they can survive in the competitive market. The vital strategic resource today is the knowledge – individual and organizational. By realizing the major value of intellectual resources, companies have begun to managerationally and improve them. Hence the importance of knowledge management as a concept of organizational knowledge, aimed at effective application of knowledge to make quality decisions.

Knowledge of a modern manufacturing enterprise often represents its highest value. This fact is already well recognised by many manufacturing companies, and a great deal of investment is put into the management of knowledge. It is well known that knowledge sharing within both large enterprises and networked small companies is still related to a number of fundamental as well as specific problems.

Knowledge is a blend of experience, insights, expertise, intuition, judgment that exist in the mind of the knower, while Knowledge management is the practice of creating, acquiring, capturing, sharing and using knowledge to enhance learning and performance in an organization. Institutionalization of knowledge management according to Meyer and Rowan (1977) is about, having knowledge acquisition activities that facilitate continuous acquisition of knowledge.

This according to Riege (2005) is because the commercial success and competitive advantage of enterprises is

dependent on application of knowledge to maximize on firm performance, competitiveness and innovation. It facilitates connecting the right knowledge to the right people at the right time for timely decision-making (O'Dell and Hubert, 2011). KM programs connect employees to one another, to knowledge assets and with those with know-how with those who need it. The major objective of knowledge management according to Wiig (1997) is to make the enterprise operate shrewdly and to make the best value of its knowledge assets.

The problem in manufacturing companies is very often that the knowledge is available, but it is not used either because it is not well structured, or because employees are not aware of its existence or trained properly to use it in their daily work. Communities of Practice are often built horizontally (e.g. over design departments of large companies) but rarely vertical (e.g. between planning and shop-floor areas, including employees with different levels of expertise etc.)

2. Knowledge Management- KM

Knowledge management facilitates developing competencies required in the innovation process (Du Plessis, 2007). Knowledge management practices influence innovation and Kianto (2011) established a correlation between knowledge management activities and continuous innovation. Knowledge, according to Lee and Yang (2000), is a foremost resource of innovation and creativeness in the organization. KM is a strategy that modern day companies need to embrace and adopt because it has great potential.

Knowledge sharing within an enterprise (e.g. among different areas, departments, plants, different players in a virtual company etc.) is related to a number of fundamental and specific problems such as acceptance by employees and motivation issues, ontology problems, correlation of different types of knowledge, treatment of experience based

and often incomplete and/or ill-structured knowledge etc. Management of tacit knowledge including its capturing, maintenance and sharing over different areas is still not efficiently solved in industrial practice.

Knowledge management efforts typically focus on organisational objectives such as improved performance, competitive advantage, innovation, the sharing of lessons learned, integration and continuous improvement of the organization. Knowledge management prevents staff from constantly reinventing the wheel, provides a baseline for progressive measurement, reduces the burden on expert attrition, makes visual thinking tangible, and manages effectively large volumes of information to help employees serve their clients better and faster, increasing company benefits with an effective knowledge management strategy, increasing efficiency, productivity and work smarter, improving innovation, reducing loss of know-how by capturing explicit and tacit knowledge.

3. KM in Manufacturing Firms

Normally, 'knowledge industries' are defined as the industries resorting extensively to technology and to human capital. In the manufacturing industry, this concerns the high and medium-high technology industries, such as the pharmaceutical, power industry, aeronautic and space, construction, and electronic component manufacturing.

There are number of specific aspects requesting a consideration of KM for manufacturing enterprises, e.g.: (a) knowledge is centered around specific products, processes and technologies, (b) setting up of a unique knowledge management system for the whole (extended) enterprise (c) transition from traditional manufacturing to knowledge driven companies.

Preserving a company's skills and expertise, acquiring and disseminating knowledge, improving knowledge use to improve production – knowledge management (KM) is the management of the company's individual and collective knowledge. Companies are becoming aware of the fact that knowledge is a resource requiring explicit management method. If the knowledge is to be processed efficiently, storing knowledge, communicating, forging links and synergy between each individual's knowledge, and generating new collective knowledge are essential.

Promoting information sharing, motivating employees to stay with the firm, forging partnerships for knowledge acquisition – industrial companies are becoming increasingly aware of the need to manage individual and collective knowledge. The bigger the company and the stronger its affiliation with a high-tech industry, the more it is likely to roll out such policies. The advantages deriving from knowledge management are explained by company size, specialization or research & development efforts.

While, Sandhawalia and Dalcher (2011), argues that organizations should develop Knowledge Management (KM) capabilities into a state where KM practices are institutionalized and rooted into its business processes. Institutionalization of knowledge management means having

organizational practices and technological infrastructure that make possible continuous knowledge creation and use to create and sustain competitive advantage.

Management has to design an organization that ease and enhance knowledge creation. Muganda-Ochara et al, (2008) argue that it has to be a top-down approach, while Ray (2008) points out that, securing senior management commitment is fundamental. The management needs to develop the KM strategy with focus on achieving the business strategy. A company needs to create a culture of knowledge sharing and continuous improvement. Changes in organizational culture are necessary for instituting knowledge management (Bhatt, 2001). Another factor in implementing KM is to develop the right incentives and rewards to encourage employees to share and contribute to the knowledge base. Reward and incentives should be available for individuals who contribute to and use a shared knowledge base (Lee and Yang, 2000). The reward system should clearly state expectations from each employee and the benefits of knowledge sharing.

The firms have to react increasingly faster to keep their competitive edge and to be able to build on all or part of their past experience. They are becoming aware of the fact that competencies often rely on individuals or on tacit knowledge special to the company. They are concerned about the loss of skills caused by reengineering and the extreme mobility of their personnel within the company as well as getting out of the firm. For all these reasons, companies are striving to motivate their employees to stay with the firm. They are guaranteeing employees career mobility and increased pay. The firms are rolling out training courses and developing professionalism

4. Network based Manufacturing

Competitiveness of companies in a knowledge-based economic environment is determined by the efficiency of knowledge and intellectual capital management. The possibilities of network cooperation considerably broaden innovation potential of the companies. The Network consolidates intellectual assets, including knowledge, expertise, and people resources.

The study of network cooperation modes between small, medium and large manufacturing companies showed that integration can be accomplished in different ways. In these conditions the institutional aspect the management of knowledge and intellectual capital is of interest. The process of network formation has a heuristic nature. By its nature, a network is the structure formed on the basis of cooperation between companies in the process of creating a certain product. The scales of network structures essentially depend on the specifics of the core process for the creation of the end product. Networks intrinsically possess all the benefits provided by economic integration based on cooperation.

A conceptual model has to be evolved based on how a firm's network complement each other to enhance the possibility of efficiency and innovation. It is to be identified for critical innovation catalysts, awareness and motivation, innovation barriers, resource constraints, organizational

stability. The networking of the manufacturing firms has to consider resource potential, intensity of competitiveness, social interaction intensity, acquisition orientation and geographical orientation. The firm's likelihood of generating incremental and breakthrough innovations towards the overall progress is another factor taken into account.

The cooperative interaction within a network is very much essential. The basis for assessment of the impact of cooperation is the discovery of the primary mechanisms which implement cooperative interactions. A similar analysis of the mechanisms for the whole complex of small enterprises is required. Within the network of manufacturing firms, the specific nature required to be considered are (a) optimum utilization of each firm within the network (b) interaction of information and vital knowledge among the firms (c) long term cooperation among the firms and an assurance of commitments of activities (d) the use of technological transfer on preferential terms for the network participants (including franchising elements), as well as research and development cooperation.

The networking of manufacturing firms, as explained earlier, is based on the effectiveness of the output in terms of quantity and quality from the firms and the innovative measures incorporated. The geographical location and mutual belief among the firms involved in the network are the main factors. Among the various possibilities of networking of manufacturing industries, the following five different methodologies are generally recommended depending upon various constraints. A schematic presentation of the network is given in Fig 1

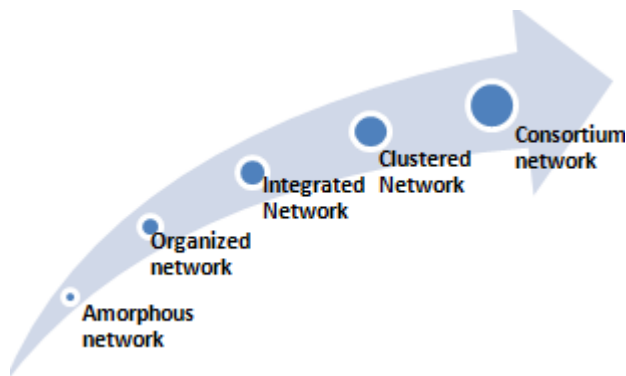


Figure 1: Knowledge based network-manufacturing

(1) Technocrat based network/Amorphous network: This is one of the simple and earlier adapted methodology of networking. Different knowledge worker function independently and non-existence of knowledge management procedure. The main method of knowledge transfer in those networks is replication, legal as well as illegal. Moreover a lot of cooperation connections were informal, networks did not have a clearly defined architecture, and a great number of network participants did not have clearly defined boundaries. The intellectual property and knowledge copy right are not considered here, by which the precious knowledge acquired earlier are not properly stored for future use.

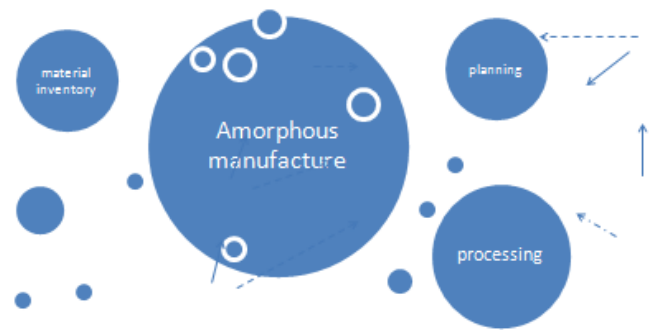


Figure 2: The amorphous network

(2) Organized Network: A well organized and planned activities in manufacturing firm is more systematic and functions in a routine manner. Here, each activities in manufacturing sector are broken down and grouped with respect to their functions. All the groups shall function independently and they are separated by means of functions, like programme planning, material management, inventory control, manufacturing departments based on activities, inspection and quality control, and packaging, supported by services like commercial and housekeeping and plant and facility maintenance. Knowledge management follows with data storing, data sharing and data audit. The schematic set up of the network is given in Fig.3

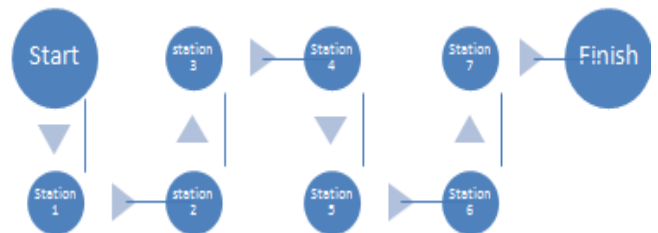


Figure 3: Organised network based manufacturing set up.

(3) Integrated network based manufacturing set up: The manufacturing activities are integrated based on the flow process or based on the grouping of technology. However the integration and interlinking of activities are done based on smooth flow of knowledge across different human resources in top down approach. Normally knowledge workers will function as the focal point for coordination of the activities and conversion of tacit knowledge will be codified by means of training and documentation. The schematic set up of the organization is given in fig 4.

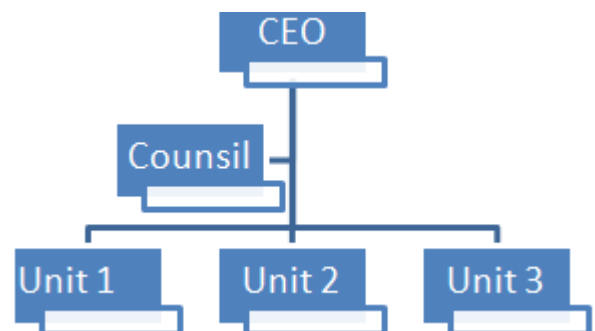


Figure 4: Integrated network based manufacturing set up

(4) Clustered Network: Most common models of the structured networks are vertically and horizontally integrated

companies. Horizontally integrated companies, which have common business profile, build their knowledge management system on the principles of a competency building approach. Such type of networks is characterized by the tendency to vertical integration. Without a large enterprise, which could assume the core functions, the special subdivision is formed. This subdivision assumes the functions of the parent company. In this network the system of knowledge and intellectual resources management is developed and all the companies of the cluster implement a common innovation policy. This cluster gradually undergoes the process of transformation into a corporation. The schematic picture on clustered network approach is given in Fig 5.

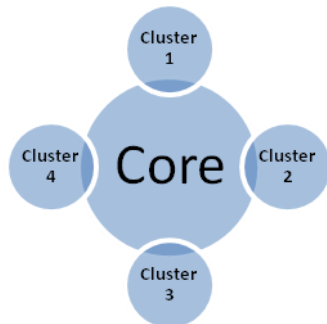


Figure 5: Clustered network

(5) Consortium based Network: This type of manufacturing activities is restricted within very few firms based on sharing of the knowledge and expertise acquired by individual firm. The criteria for selecting the firms are depending upon the expertise, knowledge and facility available. Mainly the entire activity tasks are broken down into smaller tasks and suitable work center are located and identified after extensive evaluation. Interlinking of the activities and

sharing of the knowledge are critically analyzed. The process planning and documentation of the activities are worked out. While identifying the work center, the sharing of their organizational knowledge and organizational culture are taken into account. Once the tasks are finalized, techno commercial aspects are worked out. One work center A may be knowledgeable in particular manufacturing activity and the firm may have Organization knowledge embedded in their system and another firm B may have their expertise in different activity and they may have different organizational culture. Integrating the knowledge with proper audit and sharing, the complex systems could be manufactured. This calls for meticulous planning and coordination. Also, stringent quality control & inspection of the hardware are essential. Typical schematic flow of manufacturing tasks is given in Fig 6. The thick line indicates the critical and sensitive tasks carried out at prime manufacturer. The boxes indicate completion of few major activities. In the flow scheme, manufacturing center 1 is having knowledge and org. culture in some activities, and center 2 and center 3 have knowledge and org. culture in different stream of activities. But the manufacturing sequence demand crosses flow of hardware so that the knowledge is shared and their embedded knowledge is better utilized. Hence, a consortium of knowledge has to be followed for effective management of resources in the case of manufacturing of complex hardware and systems. The major nodal points of work center in the process flow are indicated as A-B-C-D-E-F. These work centers carefully analyze and monitor the activities for their robustness, integrity, and knowledge sharing performance, so that they are completed in shorter time.

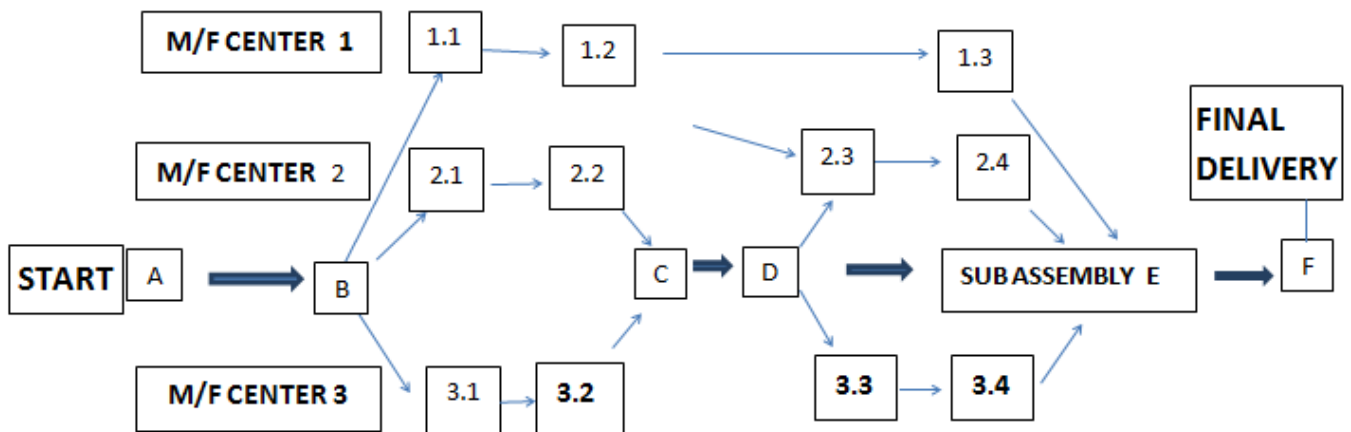


Figure 6: A scheme of Consortium based network in a typical manufacturing set up

5. Effectiveness of network based Knowledge Management in manufacturing sector:

In the advanced trend in manufacturing sector, knowledge based technology is the need of the hour rather than skill based technology. The sector looks for information well processed, documented and automated. A common data base derived from the technology, skill and organizational culture are stored in the manufacturing firms which are considered as valuable asset of an organization. In coming days, the value of any firm is assessed based on the wealth of

knowledge captured and stored in the respective field rather than the capital machinery, manpower and the firm's reputation possessed by the one. This is what going to bring innovation either in product or process and competitive advantage over others in the field.

The penetration of microprocessor in the field of information technology and computerized automated processing coupled with artificial intelligence enable the technological growth to peak. Towards this growth in networking of knowledge and optimum utilization of the acquired knowledge are very

much essential to avoid reinventing of the wheel. One should make into note that network based manufacturing is not sharing of the firms capacities alone. Here the knowledge is shared and utilized in optimum manner. The cross flow of knowledge is audited and documented as an articulable form as a part of knowledge management process.. The network based manufacturing helps in production in shorter time meeting quality standards in cost effective manner. In future, the dependency of skill based technology will be replaced with knowledge based technology. Human resources involved in manufacturing activities need not be skill based or semi skill based but need to be flexibly skilled and have to be knowledgeable and self-empowered.

6. Conclusion

The research paper brings out the role of network based manufacturing adapting knowledge Management methods. Of different network methods followed in this field, consortium approach of manufacturing is found to be more effective and innovative. Towards this identifying the firms having adequate knowledge and skill and similar organizational culture are very much essential. Also the matrix of the process and the flow of knowledge have to be worked at. The manufacturing process for a typical and complex system, the consortium based networking of manufacturing is considered to be highly advantageous.

As we are marching towards the second machine age, technology revolution and knowledge management helps in reduction for the need for skilled worker. The gap between explicit knowledge and tacit knowledge shall be narrowed down by the optimum knowledge management by networking technique.

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