

# An Introduction to the Impact of Knowledge Management in Lean Manufacturing

## ---Based on the impact of knowledge flows

Xingsong He

School of economics and management, SouthWest Petroleum University, Chengdu 610000, China  
akoln\_427@163.com

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### ABSTRACT

With the advent of the knowledge economy, knowledge has become a very important resource and one of the core competencies of an organization. However, the current lean manufacturing implementation process in most companies focuses on the sequence of the production process without paying attention to the process of integrating relevant knowledge in the organization. This paper explores the application of knowledge management in the lean manufacturing implementation process, especially the impact of the key attribute of knowledge flow in the improvement process of lean manufacturing. Therefore, both knowledge management and data analysis have a very important role to play in the implementation of lean manufacturing in an organization. Enterprises need to continuously explore and practice and optimize lean production methods and techniques to improve their competitiveness and core value.

### KEYWORDS

Lean manufacturing; Knowledge management; Knowledge flow

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## 1. INTRODUCTION

The current world economy is characterized by multiple trends. On the one hand, globalization and the development of information technology have led to greater integration of the global economy and facilitated the growth of international trade and financial activities. On the other hand, emerging market countries have continued to rise, driving a new round of industrial structural change. With the accelerating trend of the global shift of manufacturing bases, the industrial structure and global trade pattern are also undergoing profound changes. The transformation and upgrading of traditional manufacturing industries and the rise of new technology industries have become the new driving force of the global economy, and at the same time provide opportunities for countries to cooperate and collaborate. Under this trend, China is gradually becoming an international manufacturing centre. From the perspective of global manufacturing centers, they can be divided into two categories: technology-based and cost-based. Technology-based manufacturing centers make use of advanced production technology to produce products that cannot be produced in other countries; cost-based manufacturing centers produce cheaper products by lowering costs (e.g. raw materials and labor costs) on the premise that the products have the same performance and quality. Under China's current national conditions and technology level, cost-based manufacturing enterprises occupy a major part of the manufacturing industry. But as China's economic strength and technological level increases, the low-cost advantage of Chinese manufacturing enterprises is disappearing. Although China still

has the advantage of relatively low labor costs, due to the recovery of the global economy, the pulling effect on the growth of demand for raw materials, as well as supply chain shortages and other factors such as raw material prices and due to the shortage of supply of fossil fuels, such as crude oil and natural gas, as well as the rapid development of emerging economies, the demand for ever-increasing resulting in the rise in energy prices, and the rate of price increases is much higher than the ex-factory price of the products of the increase in prices was much higher than the increase in ex-factory prices of products. This has led to rising production costs and eroded the low-cost advantage of China's manufacturing sector. Therefore, in order to build and maintain China's position as an international manufacturing center, the Chinese manufacturing sector needs to make the transition from low-cost raw materials and labor to efficiently managed low-cost, which is an urgent task at hand.

Lean Manufacturing originated at the Massachusetts Institute of Technology (MIT) in the United States, where they discovered a production model that was most applicable to modern manufacturing when they conducted their research for the International Automotive Programme (IAP). MIT conducted a large number of investigations and comparisons of Japanese enterprises and found that the production organization and management of Toyota Motor Corporation (i.e. "Just In Time") is a production mode aimed at reducing production costs, improving production efficiency and coordination, and eliminating waste, and is named Lean Production. Toyota has now replaced Ford as the world's second largest automobile manufacturer, and its profits are significantly higher than those of other enterprises in the same industry, especially when compared with Honda, which is also a Japanese automobile company. Among other things, Toyota's ability to achieve such high profits can be attributed mainly to its unique business philosophy and corporate culture. Toyota emphasizes the concepts of lean production and continuous improvement, thus working to improve production efficiency and quality. At the same time, its globally unified production and supply chain management system enables it to achieve efficient production and logistics management on a global scale. In addition, Toyota's good corporate culture and the training and motivation of its employees provide a solid guarantee for its efficient production and good product quality. This shows that the advantages of high efficiency and low cost brought by the lean production method are immeasurable.

The Chinese manufacturing industry has made great progress in lean production, especially in recent years. With the intensification of global competition and the transformation of the domestic economy, more and more Chinese companies are focusing on issues such as enterprise efficiency improvement and quality improvement, and the application of lean production concepts has been increasingly promoted and practiced. Currently, there are many Chinese manufacturing companies applying lean production methods to improve productivity and quality. For example, Huawei and Changhong have already adopted lean production concepts and methods in their production lines and achieved excellent results. In the automotive industry, companies such as FAW, SAIC and GAC are constantly promoting lean production. Companies including Suzhou Volvo and Shanghai General Motors are constantly promoting lean production methods to reduce costs, improve quality, and increase customer satisfaction.

However, most enterprises in China are still encountering certain difficulties in promoting the lean production method, especially in the manufacturing lean production process, knowledge management faces a number of problems and deficiencies:

- 1) Difficulty in transferring knowledge: Manufacturing is an industry with a complex production process, where knowledge and experience on the production line may change within a shift and the mobility of employees is high, making it difficult to transfer knowledge to each other across shifts and employees.
- 2) Knowledge fragmentation: Manufacturing production knowledge exists in a wide variety of information forms, such as process documents, standard procedures, operating instructions, training materials, quality reports, etc., but this information is often dispersed among different departments and personnel, resulting in fragmented knowledge that is difficult to integrate.

3) Insufficient knowledge deposition: The manufacturing industry changes rapidly, with production patterns and processes changing from one production cycle to the next, but many companies do not have sufficient mechanisms to record and deposit production history, thus limiting the ability to deposit knowledge and making it impossible to use previous experience to solve similar problems.

4) Inadequate application of knowledge: Although many enterprises have a wealth of production experience and knowledge, they are often unable to apply it to new production processes or new product development, leading to inefficient use of knowledge and thus wasting the resources and assets already available to them.

With the advent of the knowledge economy, knowledge management continues to rise to the top of the agenda. Enterprises are beginning to focus on their knowledge assets as the core competence of the modern enterprise, emphasizing the full use and sharing of knowledge to create value and achieve sustainable development. In the field of lean manufacturing, knowledge management is equally important. Manufacturing companies need to collect and integrate various production-related knowledge in the process of continuously optimizing production, improving efficiency and quality, to achieve rapid learning and accomplish production goals. Knowledge management systems can provide shared management, learning and training resources to enable better transfer and application of this knowledge. To be at the forefront of the knowledge economy, enterprises must put in more effort to develop paths and strategies that are compatible with the knowledge economy, build knowledge management systems, and improve productivity, save costs and achieve sustainable development through continuous innovation and sharing.

## **2. STATUS OF RESEARCH IN RELATED FIELDS**

### **2.1. Status of Research in Lean Manufacturing**

In 1985, the Massachusetts Institute of Technology (MIT) in the United States of America initiated a research project on the "International Automotive Initiative", which revealed the strengths of Japanese manufacturing companies, especially Toyota. A comparative analysis of the Western mass production method and the Japanese Toyota production method led to the naming of the Toyota production method as the Lean production method [1]. Toyota has produced the innovative and reformative Toyota Production Method in its manufacturing process, which has been very successful in terms of quality, cost, efficiency, production and after-sales maintenance. The success of the Lean Production Method is that it integrates management ideas from various fields such as industrial engineering, quality management, supply chain management and human resource management to meet customer needs in a more efficient way than traditional production methods, while reducing costs and improving the competitiveness of the organization.

Lean manufacturing methods proved to be more than just an ordinary improvement project, and its importance was increased. Manufacturing organizations then began to experiment with implementing holistic lean manufacturing systems to achieve more sustainable results. However, most lean manufacturing system implementations still fall short of expectations. Some scholars have thus pointed out that many companies focus on the visible elements of lean production systems, such as methods and tools, and tend to change the layout and processes of their production activities. However, the key factors for sustainable success of production systems are usually related to the inclusion of human sociality rather than technology alone [2, 3].

When implementing lean manufacturing, companies are not only improving their technologies, but also considering the impact of social factors on the overall optimization process. A lean manufacturing enterprise can be viewed as a "socio-technical" system, where the technical system refers to the technical means used to implement the lean manufacturing method, and the social system includes people (employees), organizational structure and corporate culture. Lean techniques can only

be effectively implemented if the appropriate corporate culture values and organizational structure are put into practice by the employees.

Currently, traditional production management methods can no longer meet the needs of modern lean production. Therefore, some scholars have begun to research new management methods to meet the challenges of lean production. "Lean thinking" and "tools for lean production", which are closely related to lean production, have been widely studied and applied. Lean Thinking is the foundation of Lean Manufacturing and emphasizes the involvement of people and the improvement of work processes to find and eliminate waste. Tools for achieving lean production include process mapping, value stream mapping, 5S, Kaizen, etc. Interdisciplinary research has become an important factor in driving lean manufacturing. Lean production covers all aspects of the production process and requires a diversity of expertise to be involved in the actual production of products. Lean production research increasingly focuses on the role of people. People are the core and driving force of lean production, so employee involvement and motivation are especially important in this production model.

Through the above summary of the development of lean production methods, lean production has now formed a more complete system and accumulated a wealth of knowledge. This knowledge has been applied in enterprises, and practical results have shown that the implementation of lean production methods can largely eliminate waste and improve enterprise efficiency [4, 5]. However, due to the serious lag in the application of new knowledge, enterprise employees can not quickly learn about this knowledge, let alone absorb and use it. Therefore, it is necessary to do relevant research on how to accelerate the utilization of this knowledge.

## **2.2. Status of Research in Knowledge Management**

Knowledge management (KM) is a management theory based on the idea of intellectual capital, which aims to improve organizational performance and innovation by collecting, integrating, sharing and applying internal and external knowledge. Knowledge management as the application of enterprise core competitiveness has received more and more widespread attention. More and more enterprises have begun to practice KM and achieved success, making the significance of KM in practice further recognized and affirmed. The key issues of knowledge management, such as knowledge innovation, knowledge sharing, knowledge process and knowledge transfer, have become the hot spots of research. Many scholars are committed to exploring how to improve the knowledge innovation ability of enterprises, promote knowledge sharing and process, and how to optimize the efficiency of knowledge transfer. The value and impact of knowledge management and its role on enterprise performance have also become the focus of research. Through different perspectives and approaches, researchers have tried to understand the impact of KM on firm performance and the role of the value of KM in the firm. The increasing research on KM shows that KM is becoming one of the important components of the future competitiveness of enterprises. Enterprises should recognize the importance of KM for their long-term development, and actively apply and continuously improve the practice of KM in their enterprises.

Davenport states that knowledge belongs to the knowledge holder, and in companies, knowledge can be embedded in documents as well as in the organization [6]. Knowledge depends on the person who owns it. Gensicke defines knowledge as "information that is based on interpretation in the context of the recipient's experience and expectations. Knowledge is a prerequisite for purposeful action" [7]. The implementation of KM is important for constructing and organizing corporate knowledge. Nonaka defines KM as "the process of continuously creating new knowledge, disseminating it widely in the organization, and rapidly embodying it in new products/services, technologies, and systems" [8]. Therefore, KM is a process of creating, disseminating and embodying knowledge.

Knowledge management is a diverse management concept. Among them, enterprise processes, information technology, knowledge bases and individual behaviors are important elements that constitute KM. Enterprise processes are the steps and rules for applying knowledge to actual business

activities. Knowledge management requires combining enterprise knowledge objects with processes in order to capture valuable knowledge resources in the course of operating business. Information technology is one of the most important ways of sharing and transferring knowledge. Technologies used for KM can be email, instant messaging, social media, knowledge management systems (KMS), expert systems, etc., which make information more accessible and shareable and help facilitate knowledge transfer. Knowledge base refers to the knowledge assets that are collected, organized and stored in an enterprise. Knowledge bases are critical to knowledge management because they provide the means by which a company's employees can access the knowledge they need. Individual behaviors are the activities of individuals that utilize knowledge, learn and create new knowledge at work. Knowledge management needs to encourage individual employees to actively learn and share what they learn. Therefore, enterprise processes, information technology, knowledge bases and individual behavior are all integral parts of KM. Through their combination, companies can share and transfer knowledge to improve organizational performance and innovation.

According to Wang Zongtuo, knowledge management is a systematic project, and the function of this system is determined by the task of knowledge management. With the continuous deepening of the research on knowledge management theory, knowledge management has begun to be continuously applied to various fields [9]. Zhou Jiehan and other scholars constructed a knowledge management system for the manufacturing industry and put forward a number of issues to be noted when implementing knowledge management in the manufacturing industry [10]. Qian Yadong did research on the development of knowledge management systems to support enterprise collaborative design, provided different knowledge management tools for different business processes, and proposed to fully consider the impact of social factors [11]. Pan Xing and other scholars believe that it is not enough to study only the knowledge sharing process in manufacturing knowledge management, and it is also necessary to introduce knowledge-based research on the integration of product design and manufacturing. In summary, we can find that knowledge management has been widely used in manufacturing enterprises, but these knowledge management only involves only the product design and manufacturing process, and not specifically for the implementation of lean production and the corresponding knowledge management process [12].

### **3. KNOWLEDGE MANAGEMENT IN LEAN MANUFACTURING SYSTEMS**

In today's information age, organizations have access to a wealth of information and knowledge about implementing lean manufacturing systems. Due to the complexity of lean transformation, most organizations hire consultants to support and train their employees. The key to implementing knowledge management is not in acquiring knowledge, but in integrating it throughout the organization. In order to describe this particular process, this paper makes a relevant study starting from the concept of knowledge flow.

#### **3.1. Knowledge Flow Structure**

In lean manufacturing, knowledge flow is very important and it can be described as "knowledge transfer between nodes" where nodes can be team members or roles [13]. Roles are a very important part of the lean manufacturing system, through which knowledge flows, responsibilities and tasks can be described, thus making the knowledge flow easier and more efficient.

Roles are characterized by the fact that they are not bound to a specific individual [14] and are described through their tasks, responsibilities and decision-making authority [15]. The roles that are suitable for the implementation of a lean manufacturing system are top management, steering committee, project managers, shop floor managers and employees. These roles are matched with the tasks, responsibilities and authorities in the implementation of lean manufacturing system.

Among these roles, the role of Lean Manufacturing System Specialist is the key node where they can provide valuable advice and experience throughout the production process to help the organization to better implement Lean Manufacturing. By flowing knowledge between these roles, companies can better manage and utilize knowledge resources to increase productivity, reduce costs and improve product quality.

### **3.2. The Role of Knowledge Flows**

Knowledge flows play an important role in lean manufacturing. Lean manufacturing emphasizes treating every part of the production process as a value stream and improving productivity and product quality by eliminating waste. Knowledge flows play an important role in lean manufacturing by helping organizations identify and eliminate knowledge waste in the process.

First of all, knowledge flow can promote cooperation and sharing among teams and better realize collaboration in the production process. Knowledge flow can integrate the knowledge resources of an enterprise so that each team member can quickly access the knowledge they need to better accomplish their tasks.

Second, knowledge flow can help companies better understand the production process, to identify potential problems and opportunities for improvement. Knowledge flow between nodes in the production process can help team members better understand the entire process and pass on potential problems and opportunities for improvement to other members in a timely manner.

Finally, knowledge flow can promote innovation and increase the competitiveness of an organization. In the ever-changing market environment, enterprises need to continuously acquire new knowledge and technology from outside in order to meet consumer needs and maintain competitive advantages. Through knowledge flow, enterprises can quickly acquire new knowledge and technologies and apply them innovatively in the production process, thus improving their competitiveness and sustainable development.

### **3.2. Knowledge Flow Improvement Process**

During lean implementation, knowledge needs often accompany problem solving, and people follow a logical, step-by-step problem solving process and use it continuously, creating a knowledge flow for lean implementation in the organization. This process includes the whole process from identifying the problem, analyzing the problem, developing the solution, implementing the solution, as well as continuous reflection and improvement, in which the flow of knowledge is consistent throughout. During the knowledge flow process, team members continuously exchange, share and integrate experiences and knowledge. Through the knowledge flow, the enterprise can better respond to the complex production environment and market changes, improve productivity and product quality, reduce costs, and thus improve the competitiveness and sustainability of the enterprise.

In the implementation of lean production, improvement is the foundation. In the process of knowledge exchange and organization in the improvement process, people need to use various knowledge management tools as well as with the help of professionals in order to obtain and organize valuable knowledge. This knowledge will be organized and argued in a certain way, and finally a satisfactory solution will be obtained. However, the end of this process does not mean the end of the knowledge flow of the improvement project. The knowledge needs to be further archived, organized and put into the knowledge base of the enterprise for use.

The review and archiving of knowledge is a very important step in the process where internal or external experts review the submitted and organized knowledge to ensure its validity and usefulness. Once the expert suggests changes, the knowledge submitter will make changes based on the approval and resubmit it again. Eventually, the reviewer will judge the knowledge to be reasonable and allow it to enter the knowledge base of the organization only when the quality and usefulness of the

knowledge is considered high. This is an important process in the implementation of Lean Manufacturing, through which an organization's knowledge base can be effectively supplemented and updated to ensure that the organization's production activities are better supported and guided.

## 4. SUMMARY

Knowledge management does have an important role in lean manufacturing. The core goal of lean production is to reduce waste, improve efficiency, and create maximum value with limited resources. In this process, knowledge becomes a very important resource and one of the core competencies of an organization. However, at present, the lean production implementation process in most enterprises focuses on the sequence of the production process without paying attention to the process of integrating relevant knowledge in the organization.

In practice, enterprises need to convert knowledge into productivity and improve productivity and quality by managing and sharing knowledge. In terms of knowledge management, enterprises can use specialized tools and technologies to capture, organize, share and apply knowledge. For example, companies can create knowledge bases, training courses, FAQ libraries, etc. so that employees can get the information they need faster and apply it better in practice.

This paper explores the application of knowledge management in the implementation of lean manufacturing, in which the attribute of knowledge flow is a key part of the improvement process in lean manufacturing. In enterprises, there are countless characteristic attributes that affect the lean production process, and the understanding of the key characteristic attributes among them varies between different types of enterprises. How to extract effective key feature attributes for different enterprises is one of the future research contents.

As for the extraction of key feature attributes, this needs to involve areas such as machine learning and data analysis. Enterprises can analyze a large amount of production data, combined with the concepts and methods of lean production, to find out the key characteristic attributes that have the greatest impact on product quality, production efficiency, etc., so as to make targeted improvements. This requires companies to have certain data analysis and modeling capabilities, while ensuring the quality and authenticity of the data in order to draw reliable conclusions.

In short, knowledge management and data analysis have a very important role in the implementation of enterprise lean production. Enterprises need to continue to explore and practice, and constantly optimize the methods and techniques of lean production to improve their competitiveness and core value.

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