

# The Barriers to SMEs' Implementation of Lean Production and Countermeasures ——Based on SMEs in Wenzhou

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**Abstract**—Lean production (LP) in China has more than 20 years of development history, but few enterprises have made significant achievement, especially in the small and medium enterprises (SMEs). SMEs play a vital role in the economic growth of developing countries, and pushing effective implementation of lean production in SMEs is significant. This paper aim to analyze the barriers to SMEs' lean production practice based on the investigation of SMEs in Wenzhou and point out the countermeasures affecting effective implementation of lean manufacturing. Using a case study method approach, this paper examined the countermeasures how to carry out lean production effectively. The author concludes that SMEs should be provided from the following four organizational points of view, and they are the attention and involvement of senior managers, good communication platform, learning organization and the establishment of performance evaluation system.

**Index Terms**—Lean production; Enterprise reform; SMEs

## I. INTRODUCTION

Over the last decade we have witnessed that our organizations faced problems with regard to their effectiveness, speed of reaction, and flexibility. Consequently, Mass Production system is unable to cope with urgent or separate orders of production with special characteristics, because the preparation time of the production system is too long and very costly. Lean production had been generated and applied against this background.

Just as mass production is recognized as the production system of the 20th century, lean production is viewed as the production system of the 21st century.

Lean production is an assembly-line methodology developed originally for Toyota and the manufacturing of automobiles. It is also known as the Toyota Production System or just-in-time production.

Lean production involves never ending efforts to eliminate

or reduce 'muda' (Japanese for waste or any activity that consumes resources without adding value) in design, manufacturing, distribution, and customer service processes. Developed by Toyota executive Taiichi Ohno during post-Second World War reconstruction period in Japan, and popularized by James P. Womack and Daniel T. Jones in their book 'The Machine that Changed the World: The Triumph of Lean Production'[1]. And also it is called lean manufacturing.

In more detail, Harvard Business Review describes the implementation of Lean production:

By eliminating unnecessary steps, aligning all steps in an activity in a continuous flow, recombining labor into cross-functional teams dedicated to that activity, and continually striving for improvement, companies can develop, produce, and distribute products with half or less of the human effort, space, tools, time, and overall expense. They can also become vastly more flexible and responsive to customer desires [2].

In some cases before and after measurements have been performed, some examples are [3]:

- 1) Decrease of WIP (work in progress) by 90 % and FGI (finished goods inventory) by more than 50% through layout improvement and SMED activities;
- 2) Welding/assembly capacity increase by 50 %;
- 3) 43 % set up time reduction through SMED;
- 4) Decreased inventory level by two thirds.

Lean production has been in China for more than 30 years. A few enterprises have introduced Lean production and made significant achievement. But few small and medium enterprises (SMEs) have profited from implementing lean production. SMEs play a vital role in the economic growth of developing countries, typically accounting for over 90% of business establishments and about half or more of output and export shares. Their entrepreneurship, flexibility and responsiveness to change are essential driving force of economic development. The employment opportunities they create improve the livelihood of thousands of millions of poor people. In many developing countries, SMEs account for as much as 70% of the labor force. Unfortunately, SMEs fail much more frequently in market competition. Therefore, pushing effective implementation of Lean production in SMEs is imperative.

In Great Britain SMMT Industry Forum has been running a program for disseminating and implementing lean production, in mainly the automotive industry, with great success. However, most of the knowledge about lean production is tied

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up in larger companies and consultant/research actors and has not been spread widely to SMEs companies.

In Wenzhou, a coastal open city, private enterprise is well-developed, and most of them participate in international competition. In order to minimize the gap to the mature enterprises in developed countries or collaborate with them, many big private enterprises in Wenzhou have introduced lean production. CHINT Company, an electric industry leading enterprises in Wenzhou, has pioneered the reform of lean production. East Art Company the largest footwear foreign trade companies in Wenzhou also introduced Lean Production in 2005. And Aokang, Kangnai and other large-scale enterprises have begun the reform of lean production. But the concept of lean production is still relatively new to SMEs.

The purpose of this paper is to analyze the barriers and countermeasures to effective implementation of lean production based on the investigation of SMEs in Wenzhou.

The rest of the paper is organized as follows. The next section analyzes the barriers to effective implementation of lean production based on the survey of SMEs in Wenzhou. Next, section 3 analyzes the SMEs' strategies in the implementation of Lean Production. Then in section 4 we verify the conclusions with the case of CHINT group.

## II. THE BARRIERS TO EFFECTIVE IMPLEMENTATION OF LEAN PRODUCTION

Implementation of lean production systems in China is proceeding slowly, however, even though the evidence is overwhelmingly in favor of its use to improve quality, increase productivity, and reduce delivery times. In order to make the major implementation problems clear, the author has investigated more than 100 SMEs in Wenzhou by the way of manager interviews and issue questionnaires. The involved SMEs are within electronics, clothing, glasses, leather, and abrasive processing industries. The question is as followed:

- 1) Did you know lean production?
- 2) What did you want to achieve with implementing Lean Production?
- 3) Why did you start to implement continuous improvements?
- 4) Did you study and compare yourself with other companies before the start of the improvements?
- 5) Does the company have a strategically goal that everybody knows about?
- 6) Do all workers know what they should do to support these strategically goals?
- 7) Is the work with contentious improvements well support of the board?
- 8) Are everybody committed with the lean work?
- 9) Has the work with lean production changed the way you have been working?

Through analyzing of the interviews and questionnaires we obtained the barriers to SMEs' implementation of lean manufacturing in the following areas:

### A. *Many companies have not heard of lean production because of knowledge-level constraints*

In China, the application of lean production is not universal. The major reason is that the research and application of lean production is within the university, academy of Sciences and a number of large enterprises. SMEs in Wenzhou are mainly concentrated in labor-intensive manufacturing industries. Labors' knowledge level is relatively low, and few managers and skilled workers experienced higher education. Only 40 managers in investigated enterprise have heard of lean production.

### B. *Misunderstanding of lean production*

Through investigation, we find that the misunderstanding of lean production enterprises evolves:

- 1) The implementation of lean production requires a large investment and is only suitable for large enterprises;
- 2) Lean production is only suitable for specific industries, not suitable for our business;
- 3) Lean production originated in Japan, and it is not suitable for our country;
- 4) Lean production is a technical which we can well learn as long as afford more money.

### C. *The staffs' resistance to lean production*

As a major business reform, the implementation of lean manufacturing will face resistance from two aspects. The first one is from the natural habit of internal people in company, such as bad personal habits, personal insecurity, and hesitation. For example, the implementation of 5S, which is foundation for lean production, requires not only workers to do their daily work, but also to make equipment and workshop clean, and constantly improve personal quality. These actions will break the previous personal habits, so that employees produce the sense of insecurity and resentment.

In addition, the right system which has long been established will be broken because of the organizational reform, and some manager in this company will hinder the implementation of lean production.

### D. *Implementing lean production mechanically without revision according to the environment of enterprise*

Lean production has gradually developed based on Toyota's specific environment, such as socio-economic and cultural backgrounds. According to the survey, many SMEs implements lean production without understanding the true means of it, and think it as a particular technology. So many of the applications of lean production could not acquire the desired effect, but had a negative effect.

## III. COUNTERMEASURES TO IMPLEMENTING LEAN PRODUCTION FOR SMEs

Despite the claims that lean production is a production system with universal application, questions remain about the extent to which lean production has been diffused in Japan (price, 1994)[4], the extent to which it has been transferred to other manufacturing industries (Kenney and Florida, 1995[5]; James-Moore and Gibbons, 1997[6]) and the extent to which it has been diffused by the Japanese outside Japan.

The picture of uneven diffusion across nations and industries and the evidence for the partial diffusion of lean production within firms and plants have led some scholars to dispute the real contents of the lean concept (Richard, 2002)[7], questioning whether it is a coherent production concept (Bartezzaghi, 1999)[8].

Many scholars have analyzed the reasons of successes and failures of implementation of lean manufacturing in our country, many of them have pointed out that the result of implementation of lean manufacturing in our country is not satisfactory mainly due to that China and Japan's national culture and corporate culture is very different. But we believe that national or corporate culture differences are not decisive factors. As James P. Womack (2005)[9], the master of management, said that lean production can be applied to any of the different countries, regions, manufacturing plants and cultures.

Since there is no direct relationship between the qualities of lean production's implementation and culture, then what is the key factor affecting the effective implementation of lean production. This paper believes that the problem lies in that enterprises' managers in China do not know the real meaning of lean production. Many enterprises often show off their means of production, such as the U-shaped production unit, Kaizen, Kanban, 5S, etc. It seems that lean production will be achieved as long as the application of these means and tools in their enterprises. James P. Womack has given a connotation of lean production in the 'Lean thinking' that it means continuing methodical march from success to success and doing it the hard way by creating real and truly sustainable value for their customers, their employees, and their owners.

It is clear that the implementation of lean production is not only to introduce management methods and management techniques, but also to introduce the completely different management ideas and systems. Therefore, we believe that in order to carry out a thorough reform, that is, the effective implementation of lean production, enterprises would be provided from the following four organizational point of view, and they are the attention and involvement of senior managers, good communication platform, learning organization and the establishment of performance evaluation system.

#### *A. The attention and involvement of senior manager*

The implementation of lean production, as a major business change, is bound to face resistance from the two aspects. On one hand, it is the resistance from the individuals in enterprises, such as poor personal habits, personal insecurity, as well as thinking of some people. On the other hand, it is the resistance from the organization. Team working method, staff participation, pull-type production methods which lean production requires inverse to the original terms of system-to-business, management thinking and management methods.

In order to eliminate such resistances, senior managers must have a high-level awareness of changing in management, and firmly push forward the reform. Therefore, it is necessary to establish a leader team whose members have reputation, decision-making power, information, expertise and good interpersonal relationships to ensure a smooth change. The enterprises failed are often underestimated by their resistances to reform.

According the survey of Henry Johnson, an American management scientist, about 43% of respondents believe that the establishment of a strong leadership team is an important reason of the success of reform in enterprise [10].

#### *B. Good communication platform*

Good communication platform involves "networks" and "internal" platform.

Why has lean production not been spread widely to SMEs companies? One explanation is that, compared to larger companies, SMEs often lacks of resources and competence to develop and improve their production systems [11]. Another explanation is the "knowledge paradox" where the companies lack information on Lean Production and other improvement methods. One way to meet this has been to start networks together with other companies in order to learn and practice lean principles and methods. Bititci et al., (2004) stress that in collaborative networks, it is important for the participants to see value enhancement, internal or external (wealth and/or satisfaction). This creates a need for some sort of performance measurement in the network [12].

On the other hand, implementing lean production needs a effective internal communication platform. Lean production requires that all staffs participate in the enterprise reform, all staffs' thinking and action must be unified. But this is a continuing long-term process.

In this process, communication and exchange is the most important and perhaps the only way. And training is the best way of communication.

The implementation of lean production requires a lot of training including the training of advanced management ideas (such as lean production, full self-management) and training advanced management tools (such as 5S, Kanban, rationalization proposals, etc.).

Staffs that have uneven level of knowledge will have the same language in day-to-day learning and communication.

#### *C. Learning organization*

At home and abroad many manager realize that lean production is a set of simple management tools and systems, and in fact is a complex project that Toyota has founded through long-term organizational learning and continuous improvement.

There is no way that a big change as implementing lean production could be done over a night. The implementation has to be carefully planned, the understanding from the staffs has to grow and the top manager has to carry the plan quite hard without losing the employees trust or motivation.

In Toyota production system, all staffs are good at learning and active thinking in the process of continuous improvement, which are much more meaningful than learning itself. Further improvements can be achieved when staffs have the ability to think effectively in the process of improvement. And good at learning is the essential feature of learning organization.

Learning organization emphasizes life-long learning, whole process of learning, total learning and team learning. In a learning organization, everyone must be involved in identifying and solving problems, so that organizations can continually improve and enhance its capacity.

Therefore, in order to learn from lean production, learning-oriented organizations must be set up in Chinese enterprises; and improving the organization's learning

capacity is very important. When the availability of such capabilities, lean production ideas and methods can be implemented effectively to make enterprises acquire and maintain its competitive edge.

#### *D. The establishment of performance evaluation system*

It takes time to establish a "lean" culture that also shows measurable effects. Measurement is important in motivating changes and improvement.

In order to maintain the staff members' motivation of implementing reform and make reforms not to be interrupted, short-term objectives need to be clear and correct for evaluation of the target. The implementation of lean production cannot be achieved overnight. It often needs a few months or even years to find out the effect of implementing lean production. The gap of the expected result and the actual results may cause negative evaluation of lean production. Therefore, it is important to find out the progress in implementing lean production, such as upgrading the product quality, reducing costs, increasing market share and customer satisfaction improvement. Such short-term victory will maintain staff members' passion and urgency.

But it should be noted that the performance evaluation must be targeted. This target includes two levels of meaning. On one hand, the assessment should be for each employee; on the other hand, the assessment should be for each specific business, such as the time and cost of procedures, the quality of products, etc. In Japanese and American factory, managers often select performance indicators, such as the defect rate to regularly monitor whether each worker achieve the target.

### **IV. CASE STUDY- LEAN PRACTICE OF CHINT**

CHINT Group is China's leading supplier of industrial electrics. In the last decade, CHINT has had an aggressively strategy in the international market, and by now has established 8 branch offices worldwide, and operate in over 70 countries through partner networks. CHINT has been widely accepted in world leading electricity companies and world-class projects. Cooperation projects has been established with industrial leaders, such as SIEMENS, GE, and KEMA, etc. In 2006, the total export volume of CHINT reached RMB 400 million (Euro 40 million). In the year of 2006, CHINT ranked 15th in the list of top100 Companies released by Forbes, which evaluated all private companies (both those listed as public and not) in China. CHINT was appraised No.1 in the Power Transmission & Distribution and Controlling Devices Sector in China machinery Summit. (The introduction of CHINT is from CHINT website.)

#### *A. The Background of the implementation of lean production in CHINT*

CHINT was founded in July 1984 in Wenzhou. In the last 22 years, CHINT has expanded from a home workshop of 7 workers to a leading manufacturer of electrical products, with eight specialized branches, over 800 specialized partners and 16,000 employees. Main products lines of CHINT cover the following categories: high, medium and low voltage electrical apparatus, power transmission and distribution equipments, measuring meters and instruments, electrical products for construction, automation control devices and automobile applications.

CHINT is one of the fastest growing companies in China, but there are a number of potential crisis in the developing process. Mr. Nan, who is currently Chairman of the Board & Chief Executive Officer of CHINT Group, said 'the increase in sales growth is inconsistent with the growth of efficiency; the domestic market is inconsistent with international market, and the growth of the international market is slow; high-end product's development is inconsistent with the low-end product's, and the low-end product's development has a slow growth. In addition, many production plants of CHINT reflect that there is not enough space for the expansion of scale of production in 2005.

February 2005, GE CHINT (Wenzhou) Electric Product Co., Ltd., is co-founded by GE Consumer Products & Industrial Products Group and Zhejiang CHINT Electrics Co. Ltd. Lean production had been implemented successfully in GE, and significant effects have been made. The cooperation with GE makes CHINT's managers find the huge gap of management level between CHINT and GE, and it gives CHINT the best Opportunities to learn lean production from GE.

At this point, with the rapid development of NM1 factory, it was confronted with many difficulties, such as crowding of production space, too many semi-finished products, long delivery, inefficient staff and a long time to switch products. However expanding the space of factory is not allowed by the reasons of restrictions on Industrial Zone, and it cannot be solved in a short period of time [13].

Therefore, NM1 factory urgently needed a change in space tension and to implement lean production. Fortunately, in February 2006, NM1 factory became a pilot to implement Lean Production in CHINT.

#### *B. The effect of implementation of lean production in CHINT*

The NM1 factory has achieved remarkable results after the implementation of lean production in February 2006. The figure followed is from CHINT journal [14].

First of all, by the end of September 2007, NM1 factory has completed seven DZ15 lean production lines. As a result, the staff of each line has decreased from 26 to 23; the production period has been shortened from 4-day to 20 minutes; Work-in-process has been reduced from 1.3 million to 453 units; 306 square meters has been saved.

Secondly, in September 2007, NM1 factory has finished transformation of 2 NL18 lean production lines. As a result, the staff number of each line has decreased from 23.5 to 21; the production period has been shortened from 1.5 days to 20 minutes; Work-in-process has been reduced from 4000 reduced to 80; 40 square meters has been saved.

Thirdly, by the end of March 2008, 16 lean product lines have been combined in NM1, such as DZ20, DZ20L, NM10, etc. and nearly 600 square meters has been saved.

At present, Circuit Breakers of NM1 series have exceeded 300 million RMB and 200 million units in annual sales.

In addition, CHINT has achieved higher reputation through the implementation of lean production. Many enterprises come to CHINT for learning the experience of implementation of lean production. The successful implementation of lean production in CHINT has also made a lot of enterprises generate the desire to implement lean production.

### C. The successful experience of the implementation of lean production in CHINT

#### 1) Promoting reform through "Phoenix Project"

Through cooperating with GE, Mr. Nan realized that there were only 5% similarities between CHINT and GE. As a result, shortly after the cooperation with GE, Mr. Nan put forward the 'Phoenix Project', that is, through the implementation of lean production, making a series of reforms in the company. Mr. Nan also actively involved personally in the creation of the learning organization.

Mr. Nan said that he must let everyone in CHINT experience such a management revolution. Although they will suffer the pain, but have not experienced 'death', they would have experienced "rebirth" hope.

#### 2) The exchange of management experience, to create an atmosphere of reform

The implementation of lean production ranges from drawing up strategies to the specific job responsibilities in all aspects of business operation. The people in CHINT believe that they must do a good job in every aspect of business to finish the management revolution.

In order to implement lean production successfully, they launched a 'CHINT Forum' for the exchange of management experience from time to time and to create an atmosphere of reform.

#### 3) The establishment of an effective evaluation system to measure the effectiveness of lean production

For the implementation of lean manufacturing enterprise, it must be concerned whether or not the staff's ability is improved, their processes and operations are becoming increasingly sophisticated, and all the members concerns about reducing waste. Therefore CHINT developed detailed technical standards for various positions.

In addition, CHINT also encourage staff to take the initiative to explore the problems of production process, management structure, and staff capacity; advocate staff to make reasonable proposals.

With performance standards, CHINT also put forward the slogan of 'allowing more employees to become millionaires and even multi-millionaire'.

Each year they produce 10% of excess reward and 5% ~ 10% of new products reward to reward staff.

## V. CONCLUSIONS

Through questionnaires and a case study, this research suggests two major findings.

Firstly, that few SMEs implement lean production is because that many companies having not heard of lean production; misunderstanding of lean production; the staffs' resistance to lean production; implementing lean production mechanically without revision according to the environment of enterprise.

Secondly, the implementation of lean production is a revolutionary reform of all the processes and work habits in enterprise. In order to enable reform of the implementation of lean production successfully, SMEs should take actions of the attention and involvement of senior manager, the establishment of effective communication and learning platform, and establishment of the performance appraisal system.

This study has one limitation, which in turn form areas for future research. This study does not analyze the factors of government and supply chain member to SMEs. Future research should examine this two factors effect and take measures according them.

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