Chapter

Model of Tacit Knowledge Transfer in Lean Management Implementation in an Organization

Norani Nordin, Roshidah Mohamed and Naoshi Uchihira

Abstract

The increase in competition worldwide had driven organizations to face with new challenges. The situation had prompted the manufacturers to perform a variety of effective strategies such as the implementation of lean manufacturing system in their organization. In this study, the key elements in developing the lean tacit knowledge transfer within the organization were identified. In addition, this study also investigates the transfer of lean tacit knowledge, which involves the sender and the recipient of lean knowledge within the organization. Data were collected through a single case study for a period of 2 months in an automotive manufacturing plant in Malaysia. The results of the study found that the lean knowledge could be developed through a number of key elements. A model of tacit lean knowledge transfer was developed to help improve work performance during the implementation of lean manufacturing system. In addition, the development of the model can explain how lean knowledge was developed and transferred from one party to another in the organization. The existence of such a model could assist an effective lean manufacturing implementation with every organization should has a good lean knowledge and understand how to properly implement lean in the production process.

Keywords: lean manufacturing, lean knowledge, tacit knowledge transfer, case study.

1. Introduction

Changing the lean manufacturing is a radical process and not an easy task. A significant organizational change must take place within the organization in order to create the basis for lean to take hold. The lean transition process requires significant changes in the company's function [1]. There must be a form of sharable knowledge at an organizational level to ease the transition. In the comprehensive review of the literature by [2], two gaps were identified that required an understanding of sharable knowledge development processes. Both of these concerns dealt with the individual knowledge development and the methods of how an organization developed a sharable knowledge from individual knowledge to organizational knowledge.

Three domains that serve as the foundation of this study are: knowledge development, knowledge management driven by knowledge development and conveyance, and strategic change implementation (change management), primarily process innovation. To have a level of organizational knowledge is to say that knowledge was held

at the organizational level rather than individual level. At an organizational level, the organizational norms, behaviors, and viewpoints changed because of the developing knowledge process. Lean manufacturing has two fundamental elements, which are a systematic approach to process improvement by removing waste, and develop the people who work within the service to create a culture of continuous improvement [3]. The concern that becomes the foundation for this study is that there are many failures in lean manufacturing implementation. Each failure can be attributed in two difference causes, which include lack of understanding the concept of waste, and the fundamental issues of lean culture [4]. The problem addressed in this study is the lack of insight into the development and conveyance of tacit knowledge, which lead to the failure of lean manufacturing implementation an organization.

Therefore, the purpose of this chapter is to understand how the tacit knowledge could become sharable as organizational knowledge by proposing the model of tacit knowledge transfer in lean manufacturing implementation. The existence of such a model could benefit the company involved in the implementation of lean manufacturing system in their company. The implementation of lean manufacturing system will be more effective if every company had a good lean knowledge and understand how to properly implement lean in the production process.

2. Background of lean manufacturing

2.1 Introduction

Since year 2000, the lean concept has become more contingent and the scope has been extended to include the perspective of organizational learning. Some analysts, like Hines et al. [5] and Jorgensen et al. [6], thought that the lean concept has a greater change of progress and maturity in the future. Evolution can be compared to organizational learning through a phased process. Shah and Ward [7] believe that lean manufacturing is a multifaceted system. The lean system's integrated nature includes both individuals and process components. It is also linked to the company (i.e., internal) and components of the supplier and customer (i.e., external). In the analysis of the Toyota Production System, [8] points out that lean works on two main principles: "continuous improvement" and "respect for people." Many senior managers outside Toyota have ignored "respect for people" and misunderstood "continuous improvement" [9]. Lean manufacturing is rooted from kaizen or continuous improvement, which requires skills and a common way of thinking to systematically eliminate waste and improve the value of activities. The lean concept has therefore advanced to a stage that includes the management of knowledge creation, which aims to create a learning organization in which people are the soul of a lean process [10, 11].

One of the main barriers to its implementation is the misunderstanding of the real concept and purpose of lean manufacturing. Herron and Braiden [12] suggest that the reason for this misunderstanding is due to cultural differences during the implementation of the transition or translation of the lean concept. The concept's misunderstanding leads to several major problems, such as the piecemeal adoption of lean tools and techniques [13], the misuse of lean tools [12], and lack of lean culture development that supports lean production in the company [6].

2.2 Tacit knowledge in lean manufacturing

Lean manufacturing consists of a large number of practices and techniques. An analysis of 100 lean tools and techniques done by Bhamu and Singh Sangwan [14]

has shown that a large number of lean practices exist with multiple names, overlap with other tools, and even have different methods of implementation proposed by different researchers. Herron and Hicks [15] have classified lean practices based upon the types of knowledge embedded in the tools known as tacit and explicit knowledge. Explicit knowledge, such as statistical process control (SPC), failure mode and effect analysis (FMEA), single minute exchange of die (SMED), fool proofing or poka-yoke, and value stream mapping, are techniques that are well documented and relatively easy to learn from literatures. In contrast, tacit knowledge that include continuous improvement or kaizen, total productive maintenance (TPM), Kanban, 5S, standardized working, and policy deployment (hoshin kanri), are techniques difficult to implement without the right support. Transferring tacit knowledge takes a long time because it often requires a change in culture and substantial experience to be gained.

According to [16], 42% of the knowledge in an organization is stored in human mind, 26% is in the form of paper documents, 20% is in electronic documents, and 12% in the electronic-knowledge base. The knowledge in human mind is referred as tacit knowledge, which is the most important aspect that should be understood and realized by the company. Tacit knowledge has been classified into two dimensions, the technical and the cognitive dimension. The technical dimension can be viewed as expertise "at ones fingertips" and it encompasses information and expertise in relation to "know-how." The cognitive dimension consists of mental models, beliefs, and values, and it reflects the image of reality and vision of the future. This study focuses on the technical dimension of tacit knowledge in lean manufacturing. However, tacit knowledge is very difficult to transfer when compared to explicit knowledge. On the other hand, tacit knowledge can be able to help the company to succeed if they have the right approach in transferring the knowledge to other individuals in the company.

The development and transfer of knowledge can be referred to SECI (socialization, externalization, combination, and internalization) model, as shown in **Figure 1**. SECI model is the model of knowledge creation is developed by [17]. The model has been tested and applied in various empirical studies in the field of information and communication technology, education, banking, manufacturing, and many more.

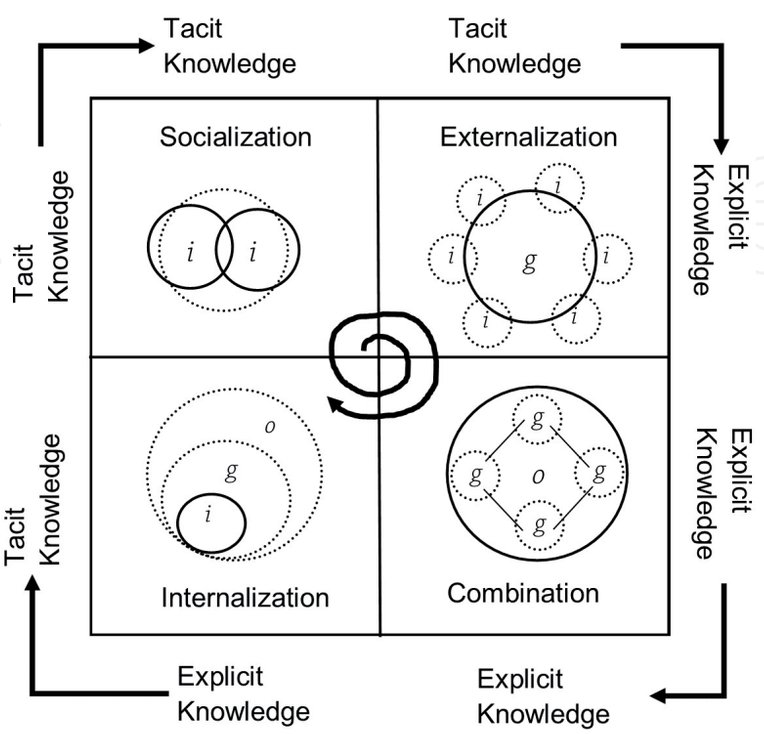

Figure 1.
SECI model of knowledge creation.

All these studies have suggested that the SECI process has improved the performance and achievement in the organizations. The selection of SECI model in this study is in the ground that SECI model is the most popular model in the creation of knowledge, and this model could give the clear description of the development and transfer of knowledge.

3. Research method

One Malaysian automotive manufacturing company, Company A was chosen for the case study. The company is selected based on the criteria which have been set. The criteria are: (1) the company must apply lean, (2) must have lean department or unit, and (3) included in Malaysian Automotive Institute (MAI) database. The data collection was prepared by first contacting the company to be studied to gain their co-operation, explained the purpose of the study, and recorded the key contact information. A semi-structured interview guide was developed upon a common case study protocol inferred from the review of literature. The interview protocol was developed to probe the development and transfer of lean tacit knowledge during the lean implementation process. To explain the process of the data collection, **Table 1** shows the measures taken in the overall research design in detail.

The same interview protocol was used for triangulation purposes to improve the reliability of research. The need for triangulation stems from the ethical need to confirm the validity of the obtained data. The subjects of the interview are questioned about their actual experiences. For each respondent, an interview was conducted for about 2 h. The respondents were the key employees in the company directly in the lean manufacturing. **Table 2** provides a summary of the respondents' background.

Method of data collection	Data obtained	Data analysis
Interview	Transcript of each interview	Thematic analysis Cross-comparison analysis between wweach respondent
Site observation	Observation notes Checklist	Content analysis
Documents	Written documents (newsletter, past progress report)	Content analysis

Table 1.
Data collection and data analysis.

Respondent	Position	Working experience	No. of years working in Company A
A	Company Manager	5 years	5 years
B	Assistant Manager	21 years	9 years
C	Technical Assistant—Operations Department	20 years	9 years
D	Supervisor—Operations Management	17 years	8 years

Table 2.
Respondents' background.

4. Results and discussion

4.1 Lean manufacturing implementation in Company A

Company A is established since 1992 in Selangor, Malaysia. The company started to grow their business by opening the other three factories in Gurun, Kedah (1996), Tanjung Malim, Perak (2007), and Bukit Beruntung, Selangor (2012). Company A expanded the business in designing and producing automotive plastic and metal components. In addition, the company is also the supplier to two Malaysian car producers, which were Proton and Perodua.

Company A started to implement lean manufacturing system since 2009. This implementation was under supervision of a team known as Lean Improvement Team which was created in each factory. This team was responsible in the lean manufacturing system implementation in their factory on an ongoing basis. Furthermore, the team is the main resource in identifying the opportunities to enhance the production productivity by applying the lean thinking system.

All the lean implementation approaches started from discussion with the employees who directly involved in solving the problems in the chosen area or department. The team also conducted meetings to discuss matters relating to the implementation of lean improvement every week. The aim of the meeting is to ensure the goals and targets set could be reached within the specified time.

The Lean Improvement Team is also responsible in delivering information of lean manufacturing concept to other employees. These information were relayed through various ways such as meeting in small groups, through social networks and training. The aim was to ensure all the employees truly understand the lean concept until the company reaches to the high level of effectiveness.

However, the implementation of lean manufacturing in Company A was limited due to financial reasons because it involved sending the team members to relevant trainings with external experts in lean manufacturing system. Therefore, the authors have come to the conclusion that Company A was not comprehensively a lean company, as it did not receive a full support from the top management in the lean manufacturing implementation. Even though, the Lean Improvement Team has been working hard to improve the company's progress in lean manufacturing system, the team members need to enhance their knowledge, especially in advanced lean manufacturing tools and practices.

4.2 Understanding of lean manufacturing concept

To understand the lean manufacturing system know-how is an important element in implementing lean effectively in Company A. In an effort to ensure employee involvement and motivation, understanding of the thinking behind the implementation of lean is very important [18]. **Table 3** shows the understanding and interpretation of the respondents in lean manufacturing system. It shows that lean manufacturing system has different dimensions and meanings in the context of each respondent.

4.3 The development and transfer of tacit lean knowledge

The knowledge and skills in lean manufacturing gained had prompted them to apply lean manufacturing system to increase the productivity in the company. The respondents' knowledge and expertise of lean were developed and transferred from the number of activities or approaches such as lean training, case studies, simulations, industrial visits, and database sharing.

Respondent	Lean manufacturing system is
A	• A systematic production system. • Activities which could reduce seven wastes, reduce cost, and facilitate task monitoring and handling. • An efficient operation.
B	• A system for fixing the manufacturing operations. • A system to fix production processes from the material demand to customers' product delivery.
C	• A system to reduce seven wastes in production.
D	• A way to reduce seven wastes. • Reduce cost.

Table 3.
Respondents' understanding and interpretation of lean manufacturing system.

4.3.1 Lean training

Lean training is one of the common activities to develop lean tacit knowledge. According to the respondents, they acquired the information and knowledge related to lean from training conducted by MAI and their customers. As mentioned by Respondent A;

> *I started attending lean training in year 2010. At that time, the program was under the MAI and the facilitators were from Proton and MAI lean experts.*

Whereas, Respondent B revealed that he developed the lean knowledge and skills from lean training conducted by the Company A's customer;

> *My first exposure on lean manufacturing system was from Perodua. At that time, Perodua organised a lean training to ensure all its vendor able to improve quality products through the implementation of lean. Second, I also participated lean training organized by Proton. The company invited a number of representatives from all its vendors to join a lean training in Shah Alam. The training involved consultants and experts from outside. Through the training, made me know to some extent about lean manufacturing.*

At the same time, Respondents C and D only gained knowledge lean through training conducted by Respondents A and B after their lean program organized. Such knowledge has led them to begin seeking about the implementation of effective lean operations. From the exposure given, Respondents C and D began to move actively in looking for ways the implementation of lean effectively through discussions and meetings with Respondents A and B.

4.3.2 Case studies

Case study is another approach to develop lean tacit knowledge. Respondent B revealed on how case studies were conducted;

> *Case studies did appear to be tedious and difficult. We were taught to see the problems that arise and frequently occurred. If there are some problems, we were taught on how to solve them. In order for us to fully understand the concept of lean manufacturing system, we tried to solve the program again and again.*

According to the respondents, case studies performed were also related to the Value Stream Mapping (VSM), where they were assigned to study their own factory. During the period of case studies, they were often monitored and assisted by the consultants who were experts from Japan in solving the problems that arise.

After conducting case studies, Respondents A and B confessed that their understanding and skills in lean manufacturing system improved tremendously. Then, they started to see the benefits of implementing lean system in the company. This was mainly due to the coaching done by the lean experts who taught them to solve problems according to lean approaches. When asked about how the lean experts trained them, Respondent A stated:

> *They (Japanese experts) taught us and showed all the photos of what to do and what is not right. Everything which is not right, was corrected immediately.*

Respondent B:

> *The lean experts came every two weeks from morning until afternoon to help us solve problems that occurred in our factory. From there, they gave advice and showed us the right approach lean manufacturing system.*

Understanding and learning directly in the operation helped them to better understand and apply their knowledge in implementing lean manufacturing system in their company.

4.3.3 Simulation approach

Another method in developing lean tacit knowledge among employees in Company A is simulation. Respondents A and B mentioned that in lean trainings, one of the approach employed by the lean experts was game simulation. The main benefit of the simulation tools is that the trainees would be able to experience different responses and actions to a real life situation. This could increase their understanding in the actual implementation of the lean.

4.3.4 Industrial visits and information sharing

In addition to lean training, case studies, and simulation games, industrial visits to successfully implemented lean companies and sharing a database relating to the implementation of lean is also other ideas used in developing and obtaining knowledge of lean manufacturing system. It is revealed by the respondents as below:

Respondents A:

> *We went for gemba to watch new working situation and the way they work. During the gemba, we saw a different view. If a system is well organized, people could see it and able to understand the process. So we were able to see some good examples and try to implement it in our company.*

Respondent B:

> *I watched what other vendors did. For an example I went to Perodua. I received a database and documents on the technical information on lean manufacturing implementation and kept them. I also watched how the operators (in other vendors) did the tasks. If I saw good approaches, I applied them in our factory.*

Respondent C:

> *I went to visit other factories and watched them performed Kaizen and Kanban. From there, I tried to search new ideas to implement in the factory.*

4.3.5 Internet resources (videos)

Rapid technological developments led many individuals find information quickly and fast. Undoubtedly, Internet resources are also a resource for the sender to acquire knowledge and skills in applying lean manufacturing system in the company. A variety of lean techniques and practices available from YouTube make learning lean system more easily attained and implemented by individuals within the company. This situation was disclosed by Respondents A, B, and D on how they develop knowledge and skills in the implementation of lean.

Respondents A:

> *I learned how to apply Kaizen through examples from the Internet by watching videos. I also watched how other factories did. Usually the videos described the process very details and step by step. Then, we applied the techniques and processes in our factory.*

Respondent B:

> *After we watched the videos on lean activities, we will do some benchmarking on our factory. Then, we will take some suitable approaches or techniques to put them into factory operations.*

Respondent D:

> *When the top management requested us to carry out Kaizen, I searched the internet and watched how other factories did Kaizen in their production. From there I got the idea. From the idea, I will add my own ideas and carried them out in the factory.*

Learning through a variety of methods is the most effective action in developing lean thinking culture in the organization. Knowledge and skills of lean manufacturing are important to ensure that the company continues to be successful in implementing an effective lean manufacturing system. According to [19], skills, knowledge, and experience of the employees are necessary for effective lean manufacturing implementation across the company.

4.4 Model of tacit knowledge transfer in lean manufacturing system implementation

The success transfer of lean tacit knowledge is very important in a company in order to enhance the understanding of lean manufacturing concept and culture among the employees. From the information obtained, the authors have developed a model of tacit knowledge transfer in lean manufacturing system implementation as a guide to assist manufacturing companies in Malaysia in developing the tacit lean knowledge in their companies, such as continuous improvement or kaizen, total productive maintenance (TPM), Kanban, and 5S.

Figure 2 shows the developed model based on the case study conducted. For the transfer of knowledge to be successful, the sender and the recipient must be willing to participate in the knowledge transferring process. There are two dimensions

involved in the transferring process, such as externalization to internalization. Both of these dimensions have their own distinctive elements in developing and transferring the lean knowledge.

From the sender, the dimension involved is the externalization. The sender should be an individual who is knowledgeable and skillful in tacit lean knowledge before transferring the knowledge to the other employees in the company. Therefore, the sender must clearly demonstrate, summarize, and translate the tacit knowledge that he obtained to comprehensible information, known as explicit knowledge.

For the recipient, the dimension observed is internalization. This process involved the transfer of lean knowledge, which is sharable from explicit knowledge to tacit knowledge. Internalization refers to the application of knowledge in real situation. Through internalization, a clear knowledge will be converted to the tacit knowledge of an individual and then developed as the basic knowledge of the organization [20]. According to [17], the process of internalization involved "learning by doing" in order to create the employee's tacit knowledge.

Therefore, to effectively transfer the tacit knowledge of lean manufacturing, such as Kaizan, 5S and TPM, organized lean activities should be arranged. The lean activities have three steps, which are lean training, practical, and continuous assessments, as shown in **Figure 3**. These steps are in continuous loop until the company has achieved the organizational basic lean knowledge.

As shown in **Figure 3**, the first step of lean activities is lean training. During the training, the recipient is exposed to the concept and application of lean manufacturing. The purpose of training is to create the basic knowledge of lean manufacturing to the recipient, especially for the new workers. The lean training could be done either directly (training, meetings, simulation, and case studies) or indirectly (coaching and informal discussion). An effective training should be conducted in a small group and performed regularly, so that the knowledge and understanding of lean manufacturing is transferred to the recipient.

The second stage in the transferring of tacit knowledge of lean manufacturing is through "learning by doing." In order to strengthen the understanding of the recipient, practical training is very important. The sender can describe lean manufacturing in detail and clear by demonstrating the lean practices, so that the recipient or workers could perform what they have learned in real working environment. An example of learning 5S or Kaizen, the concept of learning by doing could be done on ongoing basis.

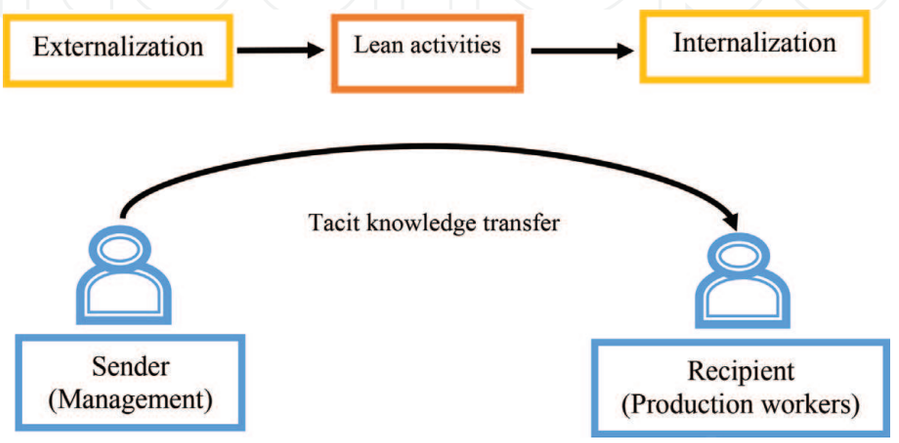

Figure 2.
Model of tacit knowledge transfer in the implementation of lean manufacturing.

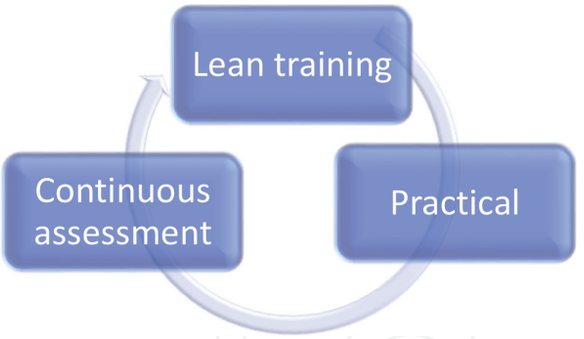

Figure 3.
Steps of lean activities.

The final step is the assessment after transferring the lean knowledge to the recipient. The purpose of assessment is to ensure that the recipient understands and is able to apply the knowledge learned. According to [21], the most important element in knowledge is through migration, identification, development of knowledge, and followed by evaluation and implementation. The transfer could be more effective if the assessment could be done continuously either individually or in group within the company. Hence, the new knowledge could continue to grow and become the fundamental knowledge of the company.

5. Conclusion

Based on the findings, the effective transfer of lean tacit knowledge plays an important role in ensuring the level of successful implementation of lean manufacturing system in a company. The right approach of lean tacit knowledge transfer able to increase the ability of employees toward effective lean thinking. However, in order to be able to transfer the knowledge, the senders need acquire the lean knowledge to be competent. Therefore, this study has identified five approaches such as lean training, case studies, simulations, industrial visits and database sharing, and Internet resources (videos). A model was also developed to guide the manufacturing companies, especially the lean implementation team, on how the tacit knowledge of an experienced individual on lean manufacturing can be transferred or shared to other employees. Hence, the implementation of lean manufacturing will be more effective, if every company has a good lean knowledge and understands on how to properly implement lean in the production process.

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