Barriers to Adoption of the Lean Production System

Rozhan Othman
Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia
Email: dr_rozhan@yahoo.com

Abstract—There is considerable evidence of the difficulties companies faced their effort to adopt the lean production system. Various studies have identified various causes of these barriers in the adoption of the lean production system. This article presents Szulanski’s notion of stickiness of knowledge as a framework in understanding these barriers. It is argued that the adoption of the lean production system is an exercise in knowledge transfer. Various variables create stickiness that impedes this knowledge transfer. This paper presents various forms of stickiness that may be impeding success in lean production system initiatives.

Index Terms—lean production system, stickiness of knowledge, change management, leadership, Toyota production system, TQM

I. INTRODUCTION

The Lean Production System (LPS) literature suggests that the failure rate of LPS initiatives is quite high. Estimates are that between 50-95 percent of LPS initiatives do not fulfill their goals [1]. This paper argues that this issue can be better understood when LPS adoption is analyzed as a knowledge transfer process. Ref. [2]’s notion of knowledge stickiness will be presented as a framework in understanding these failures [3].

The lean production system (LPS) has its roots in Toyota and is one of the management practices associated with Japanese management. Even though the LPS is considered as the model that many automotive companies try to emulate and adopt, some authors point out that the adoption of the LPS is not always easy nor successful[4]. The transfer of LPS know-how is not easy because there are aspects of the transfer of LPS knowledge that can be sticky. Ref. [2] uses the term stickiness to refer to the difficulty in transferring knowledge from a source to a recipient [3]. Because of the stickiness of knowledge the knowledge continues to get stuck at the source. He explains that stickiness of knowledge can be due to characteristics of the knowledge, characteristics of the source of knowledge, characteristics of the recipient of knowledge and characteristics of the context. It is argued here that the success of LPS initiatives is also affected by these sources of knowledge. This paper will attempt to theorize on the effects of knowledge stickiness in LPS initiatives.

II. LITERATURE REVIEW

A. Lean Production System

The lean production system operates on a logic that is the opposite of the mass production system. Whereas the mass production system relies on the use of buffer stocks and huge inventory to ensure continuity of the manufacturing process, the LPS seeks to reduce inventory as part of the effort to reduce waste and cost[4]-[5]. The LPS emphasizes cost reduction by eliminating waste in seven areas. These are transportation cost, overproduction, inventory, waiting time, motion, rework and defects[6].

Shah and Ward argue that the LPS consists of a set of complementary techniques that jointly operates to create the desired outcomes [7]. A fragmented approach that involves using a few LPS tools will have a limited impact, if any. They argue that LPS outcomes will be realized when the various techniques are implemented as a bundle of practices. Evidence from the European experience shows that piece meal implementation of LPS techniques tend to have a limited effect in the adopting organizations [6]. Ref. [7] proposes that the LPS bundle consists of four key components. They are just-in-time (JIT) inventory management, total preventive maintenance (TPM), TQM and human resource management. These four involves components are inter-related techniques that jointly create the desired outcomes in LPS implementation.

There is considerable variation in how companies implement the LPS techniques. Organizations that initiate LPS programs need to recognize the three levels of implementation. They are lean thinking, lean principles and leanness [8]. Lean thinking is about recognizing that LPS is an operational philosophy that centers on reducing waste and adding value. Adopting lean thinking requires a willingness to change processes and routines to enhance reduce waste. The lean principle is about the tools used to execute the lean principles. In addition to the LPS bundle mentioned earlier, LPS implementation also includes other tools such as the use of visual display, production smoothing, production on demand, supplier rationalization[4], [9]-[12].

B. Lean Production System

Even though studies show the positive result of LPS programs, there are also numerous studies that document various problems encountered in implementing LPS[11].

Manuscript received July 2, 2014; revised September 18, 2014.
[13]-[15] found that among the causes of failure in LPS initiatives are weak leadership, financial constraints, low workers’ skills and culture [16]. They found that the quality of leadership affect the success of LPS implementation. For LPS programs to be successful, leaders have to take a long-term view, provide the necessary resources and manage it as a change management process. This includes managing changes to the SOPs and work organization. They also found that poorly led LPS initiatives sometime disrupt and undermine the very process they are supposed to improve.

Other studies found enhancing workers’ capabilities through skill development is important for LPS success. In addition to skills development, having internal expertise on LPS is also important for the success of LPS initiatives [4].

Transforming a conventional organization into an LPS takes time and effort. As such, it requires commitment of adequate financial resources. Among the causes of failure in LPS implementation is when the funding for the initiative is given on a short-term and ad hoc basis. The allocation of funds signals the importance top management attach to the LPS initiative and conversely the lack of adequate funding signals low importance.

Ref. [5] points out that the LPS requires a culture that is based on a new way of thinking and a holistic approach in seeking improvements. Successful LPS initiatives are found in companies that have a culture emphasizing proactive improvement. A culture supporting open communication is also important [4], [16]. Taichi Ohno points out that top management must communicate clearly that change and improvement is a compelling issue and cannot be ignored [1]. They argue that transforming the culture is probably the most challenging aspect of LPS initiatives.

III. STICKINESS OF KNOWLEDGE

Ref [2] made an important contribution to our understanding of the problems encountered in knowledge transfer when he proposed a number of variables as causes of stickiness of knowledge. Stickiness due to characteristics of knowledge include causal ambiguity and unprovenness of the knowledge transferred. Stickiness can also be due to characteristics of the source of knowledge. These include a lack of motivation on the part of the source to transfer the knowledge and the source being seen as not reliable. The recipient of knowledge can also contribute to stickiness in the transfer of knowledge. This can be due to the recipient’s lack of motivation, low absorptive capacity, and lack of retentive capacity. Stickiness can also arise because of the context of the knowledge transfer. Context characteristics include arduous relationship and barren organizational context.

Causal ambiguity can arise because the efficacy of knowledge is based on a partial understanding of the causal mechanism creating the outcomes. Unprovenness is when the claimed usefulness of knowledge is not supported by evidence. As a result, recipients may harbor doubt about the value of the knowledge and the source of the knowledge may have difficulties explaining the value of the knowledge transfer [3].

Knowledge transfer also becomes less effective when the source of the knowledge fear losing ownership of the knowledge or fears losing competitive advantage [3]. Lack of motivation can also arise when the source does not see any benefit or reward in transferring the knowledge. Recipient may doubt the source’s expertise or mastery of the knowledge and may challenge the validity of the knowledge transferred.

Recipients in the transfer process may lack motivation to accept knowledge when the knowledge is perceived as alien and potentially burdensome [3]. Even when the recipients welcome the new knowledge, they may not have the absorptive capacity to assimilate and use the knowledge. Absorptive capacity in accepting new knowledge is related to the prior learning that has taken place in the organization [17]. Low retentive capacity is when an organization is not able to transfer and integrate the new learning. This can be due to the inability to understand the needed changes to the organization’s processes and SOPs to implement LPS. As a result, the effort to adopt LPS is not sustained.

Knowledge transfer typically involves embedding the knowledge in the recipient organization [3]. This usually involves adapting the knowledge through a process of gestation and evolution. An organization’s coordinating mechanism, expertise, structural arrangements are among the variables shaping the context of an organization. When these variables are unable to facilitate the gestation and evolution of the acquired knowledge, the context is said to be barren. Arduous relationship is said to exist when the knowledge transferred has many tacit elements and is more difficult to understand and consequently difficult to transfer.

Earlier research has made important contributions to our understanding of the problems in LPS adoption. Ref. [2]’s notion of stickiness of knowledge has the potential to add to this understanding by presenting a multidimensional conceptualization of the barriers in the transfer and consequently adoption of LPS know-how. This paper proposes that stickiness also operates in the transfer of LPS knowledge. It can manifest in a number of way.

IV. STICKINESS IN LEAN PRODUCTION SYSTEM ADOPTION

Stickiness in the transfer of knowledge in LPS initiatives can be due to various causes. The knowledge on LPS itself can be a source of stickiness. The problem of causal ambiguity can be seen in the evolving understanding of LPS itself. When Toyota’s production system first came to public knowledge in the 1970s, much of the understanding at that time centered around the kanban system, consensus in decision making, workforce flexibility and continuous improvement [8]. A fuller picture is only beginning to emerge relatively recently. Even the term LPS itself is used quite recently. Ref. [14] point out that the term LPS was first introduced...
by Krafcik only in 1989 and commonly used only in the 1990s [8].

The literature on LPS also indicates that there are considerable differences in the way LPS is understood and practiced [7], [11], [16]. Some organizations are only interested in only certain aspects of LPS and adopt only certain LPS tools. Those taking this approach do not have a systemic view of LPS. The impact created by such LPS initiatives will be limited. On the other hand, LPS initiatives that adopt the full bundle of LPS techniques are more likely to experience a positive impact. Thus:

Proposition 1:

The impact of the transfer of LPS knowledge is positively related to the number of LPS practices bundled into the LPS initiative.

The problem related to the motivation of the source of knowledge largely depends on how the background and interest of the source of LPS knowledge. For instance, the capabilities and competence of the consultants employed to help implement the program can affect the transfer of LPS knowledge. The different levels of involvement and guidance given by the consultant will affect LPS adoption. Some consultants are mainly trainers who are mainly involved in conducting courses on LPS. The recipients of the knowledge have to figure out on their own how to implement the LPS approach. Even when the consultants are involved in the implementation, they may still be seen as unreliable if they are seen as not having enough experience, or are not able to adapt to local or industry specific requirements.

On the other hand, the source of LPS knowledge would be more motivated to transfer the knowledge on LPS when the success of the recipient will provide direct benefit to the source. This is the case when the transfer of knowledge is done as a part of the source’s vendor development program. Companies like Toyota make considerable investment in enhancing the capabilities of their suppliers to support their LPS program [18]. In addition to training, the source of knowledge will also audit the quality management system of the supplier and their achievement in these audits is critical for winning contracts from the source of knowledge [19]. It is therefore proposed that:

Proposition 2:

Stickiness in the transfer of LPS knowledge is lower when the source of knowledge is a major customer transferring the LPS know-how as a part of its vendor development program than when the source is an independent consultant.

Proposition 3:

Stickiness of LPS knowledge is lower when source of knowledge has extensive prior experience in LPS implementation than when the source has limited experience in LPS implementation.

Recipient’s lack of motivation can arise when the LPS implementation is mandated by non-customer external parties e.g. as a pre-condition for receiving assistance or grant from the government. In some situations, the adoption of LPS can be required or recommended by industry association. On the other hand, recipient motivation to acquire the knowledge on LPS would be higher when the program can provide a direct benefit to the recipient. This is typically the situation when the source of knowledge is also a major customer that requires LPS adoption as a part of their vendors’ capabilities development or as a pre-condition in awarding a contract. In such a situation, the recipient will gain the benefit of adopting LPS. This improves the chances of a successful LPS initiative. It therefore argued that:

Proposition 4:

The stickiness in the transfer of LPS knowledge is lower among adopters whose motivation for adopting LPS is to fulfill the requirement of a major customer than those who did it to fulfill the requirements of non-customers.

Lack of absorptive capacity can arise due to a lack of prior learning. Absorptive capacity is related to the level of investment in training, level of intra and inter-organizational knowledge flow and the amount of research activities done [17]. For many organizations, prior learning from training activities is a component of their absorptive capacity. High prior investment in learning provides members of an organization with a broader knowledge base and this aids the absorption of new knowledge. This is consistent with evidence showing that a prerequisite for the successful implementation of LPS is workforce skill level. An example is the NUMMI project which started their LPS initiative with spending considerable amount of time training their employees in LPS techniques [11].

Evidence from Europe shows that developing internal expertise on LPS is important for successful LPS implementation [8]. This is achieved through training programs to develop internal subject matter experts. Training familiarizes employees with various tools for improvement, improve their problem solving skills and in some situations will enable them to carry out changes to their work. All these are a part of the prior learning that can develop the ability of an organization to absorb the LPS knowledge [20].

The lack of management commitment to skill enhancement impedes SMEs ability to adopt LPS[16]. The amount of training an organization does indicate the value it attaches to new learning. In addition, it also signals the emphasis the organization attaches to continuous improvement. Likewise, prior experience in introducing improvement techniques can also enhance the absorptive capacity to accept LPS knowledge in an organization. It is therefore argued that:

Proposition 5a:

Organizations with high prior investment in training have a higher absorptive capacity and experience less stickiness in the transfer of LPS knowledge compared to those with low prior investment in training.

Proposition 5b:

Organizations with prior experience in introducing improvement techniques have a higher absorptive capacity and experience less stickiness in the transfer of
LPS knowledge compared to those without such prior experience.

LPS initiatives falter because management fails to understand the needed internal realignment to apply LPS knowledge [16]. This happens when the necessary changes in the SOPs are not carried out. As a result, the LPS techniques are simply imposed on the old system, processes and procedures. This makes them ineffective. Changes to the existing system can include simplifying processes to reduce wastage and developing processes to integrate with suppliers and customers. Even plant and office layout may need to be changed to reduce space requirement and time taken for moving parts and output between activities and workers.

Low retention becomes a major barrier when an LPS initiative is treated as mainly a training program and with the main responsibility for trying the LPS tools delegated to middle level managers. These managers often do not have the necessary authority to transform the organization. The cross functional coordination needed to change procedures and improve processes and ultimately reduce waste could not be done. As a result, the knowledge on LPS could not be applied in the work place. Thus, it expected:

**Proposition 6:**
The retentive capacity in the transfer of LPS knowledge is higher when management takes steps to realign processes to suit with LPS techniques than when process realignment is ignored.

Perhaps the most profound variable affecting the barrenness of a context in LPS initiatives is the leadership ability of the organization. A study of LPS initiatives in SMEs found that low managerial know-how and the lack of vision and strategy impedes LPS implementation [16]. The leader’s ability to understand the implication of embracing LPS and lead the organizational transformation in implementing LPS can make or break the initiative. For instance, implementing TQM is a part of LPS. However, implementing TQM is not easy and requires considerable time, resources and effort. Leaders sometime underestimate this and assume that implementing TQM is easy [20]. The lack of a theory of planned change in LPS implementation is one of the void areas in the knowledge on LPS [8]. Low leader commitment and low managerial know-how is also reflected in the lack of financial resources allocated to LPS programs. This is reflected in situations where financial allocations are given on an ad hoc basis on a per program request. It is therefore expected that:

**Proposition 7a:**
Knowledge stickiness due to retentive capacity in the transfer of LPS knowledge is lower when management treats the initiative as a change management effort than when it is treated as a training program.

**Proposition 7b:**
Knowledge stickiness due to barrenness of context in the transfer of LPS knowledge is lower when management treat the LPS initiative as a long-term effort and makes a long-term commitment of the necessary resources to support the effort than when it involves short-term activities and ad hoc allocation of resources.

The knowledge transfer literature argues that organizations should adapt the transferred knowledge to suit local institutional variables such as culture, customer preferences and local regulations of the recipient [2]. However, Jensen and Szulanski argue that knowledge source and recipient are usually not able to assess a priori the changes and adaptation that needs to be done to the acquired knowledge. Instead, they found that pre-transfer adaptation increases knowledge stickiness [2]. They therefore argue that knowledge transfer should be done first and recipient should adapt it as they apply the knowledge. This highlights the importance of understanding the transfer of knowledge as an iterative process involving changes to the context as well as adapting the acquired knowledge to the local conditions. In other words, making a barren context more fertile to the transferred knowledge often requires adapting the knowledge as well as contextual variables post-knowledge transfer. Thus, it is argued that:

**Proposition 7c:**
Knowledge stickiness due to of barrenness of context in the transfer of LPS knowledge is lower when management treats the LPS initiative as requiring managing post-transfer adaptation to suit the context than when it involves simple imitation.

A barren context can also exist in the form of a culture incompatible with the improvement orientation inherent in LPS. A culture of encouraging employee involvement in decision making is an essential part of LPS implementation [7]. Employee involvement is important is necessary to support learning and adaptation during the knowledge transfer. It is also important to tap into the creative input of employees. For improvement to take place, employees need to able to question current performance and challenge their assumptions [18]. This becomes the norm at work only when employees only feel compelled to engage in critical thinking. This critical mindset in turn creates the momentum that sustains a strong improvement orientation in the organization. Yet, receptiveness to high involvement may not be present in all organizations. It is therefore agued:

**Proposition 8:**
Knowledge stickiness due barren context in LPS implementation is lower in organizations that encourage high employee involvement than in those that have low employee involvement.

The above discussion describes how knowledge stickiness that impede LPS adoption. This understanding enables LPS adopters to better plan their initiatives and minimize the risk of failure.
V. CONCLUSION

Presenting the problems relating to LPS adoption as being rooted in knowledge stickiness provides a deeper understanding of the barriers and enablers of LPS implementation. It provides a framework for understanding of LPS adoption as a knowledge transfer issue instead of just the application of techniques. It opens a new angle of enquiry in the research on LPS adoption that includes addressing the various aspects of human motivation, contextual variables, nature of the knowledge transferred and the complex nature of change process that should accompany LPS adoption.

It is hoped that this discussion will enrich the theory on LPS adoption and provide better guidance to practitioners on how to make LPS implementation more effective.

REFERENCES


Rozhan Othman has been in academia for more than 30 years. Prior joining MJIT he had served at Universiti Putra Malaysia, Universiti Kebangsaan Malaysia, University Brunei Darussalam and the International Islamic University Malaysia. He teaches mainly at the master and doctoral levels. He has published numerous journal articles, bookds and papers. He has provided consultancy services to organizations in and outside Malaysia. He earned his BBA and MBA from Ohio University and his PhD from University College Dublin. He is a member of the Academy of Management and a member of JICA Alumni Malaysia.