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The connection between organizational learning and lean production

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Abstract:

By reviewing literature of organizational learning and lean production, the paper discusses the potential connection between these two concepts in terms of the opportunities for researchers and practitioners to operationalize the ideas of organizational learning through lean production and achieve continuous improvement of lean production through organizational learning.

1. Introduction

With the pressure of achieving better or world-class performance, much attention has been paid by researchers and practitioners to concepts or theories that could contribute to continuous improvement and improving customer satisfaction (Thawesaengskulthai, 2010). Lean production (Womack and Jones, 1996) which can be viewed as one of the most fashionable concepts in recent years focuses on adding customer value through effectively understanding customer requirements and eliminating non-value added activities (i.e. wastes) as well as smoothing both information and physical flows in the organization. Boyle et al. (2011) highlight that lean production becomes one of the dominant approaches in the field of operations management. However, it is argued by researchers that lean production is not a panacea (Bicheno, 2004). Some researchers suggest organizational learning enables firms to achieve continuous improvement and organizational effectiveness through various learning processes and methods (Hines et al., 2008). However, West and Burnes (2000) demonstrate that just applying organizational learning cannot guarantee the success of the organization. Employing one management concept such as lean production, or organizational learning, is insufficient to deal with issues in the business. Unfortunately, researchers and practitioners tend to view organizational learning and lean production as two distinct concepts (Flinchbaugh, 2008). As a result, although some organizations realize the importance of

applying these two concepts, they still lack a clear understanding of how these two concepts can be connected (Flinchbaugh, 2008). This paper aims to bridge this gap by exploring the potential connection between organizational learning and lean production. The research question is:

What are the potential connections between organizational learning and lean production?

The following sections will first review and analyze the literature of organizational learning and lean production, then discuss the connection between them including the typology of organizational learning and the way to be lean. The opportunities to operationalize the ideas of organizational learning through lean production and achieve continuous improvement of lean production through organizational learning will be discussed and finally the directions for future research will be concluded.

2. Literature review

2.1 Organizational learning

The early work of organizational learning can be traced back to Cyert and March (1963) who first point out the term "organizational learning". Argyris (1994) indicates that organizational learning can contribute to employee development through better information sharing, communication and empowerment. Nevis et al. (1995) believe that organizational learning is a reasonable way to deal with challenges from a global market such as organizational renewal and transformation. West and Burnes (2000) emphasize that organizational learning may be a significant factor for developing organizational competitiveness by overcoming internal weaknesses and external threats. To gain a more holistic understanding of organizational learning, the following sections will discuss the definitions, typology, process and issues of

organizational learning.

2.1.1 Definitions of organizational learning

Dodgson (1993) argues that although the field of organizational learning has received much attention, yet the most fundamental issue-the definition of organizational learning-is ignored by many researchers. By reviewing the literature of organizational learning, it shows that not every study gives a clear definition before analyzing the issues related to organizational learning. For those studies that provide definitions, it is found that most can be classified into three main groups according to their orientation: adaption-oriented (e.g. Cangelos and Dill, 1965), process-oriented (e.g. Argyris, 1976; Argyris, 1977; Fiol and Lyles, 1985; Levitt and March, 1988; McGill and Slocum, 1993; Nevis et al., 1995; Williams, 2001) and a combination of both (e.g. Dodgson, 1993). It is observed that there is no standard way to define organizational learning, but there are some trends that can be detected. First, the process-oriented definition dominates the literature of organizational learning. Fiol and Lyles (1985) provide different definitions for learning and adaption. They argue that learning focuses on gaining knowledge from past actions and looking into the relationship between past actions, the effectiveness of actions and the future actions, while adaption simply means making adjustments to the external environmental changes (Fiol and Lyles, 1985). Hence, it implies that learning is closer to proactive processes whereas adaption is closer to passive activities.

Second, organizational learning occurs at different levels. As mentioned by Cangelos and Dill (1965), organizational learning differs from individual learning as it covers the individual, subgroup and organizational levels. In addition, these three levels are not separate as there are interactions between them. Third, organizational learning is directed by goals and these should not be set by individuals, but it should reflect the strategic goals of the organization

such as better performance, improved competitive advantage (Williams, 2001). Finally, organizational learning is not a simple process and includes sophisticated activities and multiple resources. One of the most important resources is experience from both the internal and external environment (McGill and Slocum, 1993; Nevis et al., 1995).

2.1.2 Typology of organizational learning

To understand organizational learning in a more structured way, researchers provide various typologies. Among them, Argyris' single-loop and double-loop discussion and McGill and Slocum's knowing, understanding, thinking and learning organization that can be viewed as the most widely accepted kinds of typology.

According to Argyris (1976), organization learning can be divided into two types: single-loop and double-loop. Single-loop learning considers the processes of finding out the errors within the organization and coping with them (Argyris, 1977). Double-loop learning refers to the process of questioning the fundamental mechanism of the organization such as organizational rules and policies (Argyris, 1977). The biggest difference between single- and double-loop learning is the aims of learning. The ultimate aim of single-loop learning is to ensure that the current program could be successfully carried out, while double-loop learning focuses on detecting the problems of underling rules and re-organizing the fundamental rules and policies (Argyris, 1994). Similarly, Fiol and Lyles (1985) use the term "lower level learning" and "higher level learning" to interpret Argyris's studies. They point out lower level learning is single-loop learning as it relies on some adjustment of part of the organization, and thereby, in this case, learning is piecemeal (Fiol and Lyles, 1985). Conversely, higher level learning is double-loop learning as it involves the whole organization to re-think its rules and policies and attempts to re-set them (Fiol and Lyles, 1985). Although it seems that double-loop learning or higher loop learning, is better than single-loop, or lower loop, learning, it does not

mean the organization should only rely on one of them. It is argued by researchers that in practice, the organization needs both of them and actually, in most cases, it is difficult to achieve double-loop learning. McGill and Slocum (1993) further develop the ideas of single- and double-loop learning and propose another typology to classify different kinds of organizations learning. The first type is named the knowing organization and is based on organizations efficiently repeating the way of doing business from other successful organizations (McGill and Slocum, 1993). The business models of these successful organizations are viewed as the best templates and the organization simply follows the model by setting up rules and policies.

The second type is named as the understanding organization. Its philosophy is built on the basis of the organization's strong values and beliefs. Organizations stick to the established organizational culture rather than considering changes (McGill and Slocum, 1993). Compared to knowing and understanding organization, the thinking organization starts to realize and detect the obvious and potential problems in the business actively, and attempts to deal with them immediately (McGill and Slocum, 1993). It reveals that all these three types of organizational learning occur in part of the organization with limited activities. However, the learning organization suggested by McGill and Slocum (1993) should enable the learning activities to diffuse in the whole organization with its philosophy of improving and developing every business experience. It indicates that the learning processes in the learning organization reflect the idea of double-loop learning.

As argued by Baily (1994), a well-structured typology can divide the complex concepts into well-ordered types with clear categories and dimensions. In the case of organizational learning, as it is a sophisticated concept and interpreted differently by researchers, these kinds of typology facilitate both researchers and practitioners to gain a clear understanding of the

essence of organizational learning; meanwhile, it can be used as a evaluation map for the organization to assess its learning status (e.g. single- or double-loop learning; knowing, understanding, thinking or learning organization) and thus the organization could detect the gaps between the current status and the ideal status which contributes to the further development of the organization.

2.1.3 Processes of organizational learning

In terms of the processes of organizational learning, various models and frameworks have been developed by researchers. For example, Huber (1991) suggests a four-construct framework to explain the processes of organizational learning by critically reviewing the relevant literature of organizational learning and organizational information processing. It demonstrates that knowledge acquisition (i.e. the process to gain information), information distribution (i.e. the process to share the obtained information and develop new information), information interpretation (i.e. the process to interpret the distributed information in a common language) and organizational memory (i.e. the process to store the information) are the core constructs and processes of organizational learning. However, Williams (2001) argues that the processes of organizational learning are not as simple as information transferring and transforming process as it is supported by beliefs and values from managers and employees. Therefore, he proposes a belief-focused process model for organizational learning with the emphasis on interactions between organizational strategy, culture, belief systems and decision making (Williams, 2001). Other examples of processes of organizational learning are shown in table 1.

Table 1 Examples of processes of organizational learning

Authors	Arguments
Shrivastava (1983)	1) The processes of organizational learning occur not only in the individual level but also in the ***entire organizational level***. It is a ***multiple level processes*** rather than a single level processes. 2) Organizational learning can be affected by both ***external and internal variables*** such as social, political variables. 3) The ***previous experience*** can be viewed as the most important source for organizations to learn from. 4) ***Institutionalizing*** is an important element of organizational learning processes in terms of building both informal and formal mechanisms of information sharing, control and planning.
Fiol and Lyles (1985)	1) Organizational learning does not simply mean the sum of individual learning as the ***learning system*** developed by the organization could affect both its current members and prospective members. 2) The processes of organizational learning are influenced by a number of ***factors*** such as culture, structure, strategy and environment. 3) The content of organizational learning is determined by two dimensions: one is ***changes in behaviour*** and the other is level of ***cognitive development***.
Levitt and March (1988)	***Experience*** plays an important in organizational learning. Experience can be divided into direct experience and experience of others.
Huber (1991)	The processes of organizational learning consist of four constructs: ***knowledge acquisition, information distribution, information interpretation and organizational memory***.

(continued)

(continued)

Dodgson (1993)	1) Individual learning is important for the organization but it is limited by individual's ability to present the complexity of reality and the processes of organizational learning are supported by the ***organization's cognitive system and memories*** which enable the organization to recognize and memorize the learnt values and norms over time. 2) One organization may have different learning processes and in a large organization, these processes can occur at the same time. 3) The processes of organizational learning should both be ***reliable and valid***. 4) The sources for organizational learning could come from both ***inside and outside*** the organization such as previous experience, customers and users.
Nevis et al. (1995)	1) The learning system includes three processes, namely, ***knowledge acquisition, knowledge sharing and knowledge utilization***. 2) There is no standard learning process and it ***varies*** between organizations. 3) Learning processes are largely determined by ***organizational culture*** and affected by a number of ***facilitating factors*** such as education, leadership, performance.
Crossan et al., (1999)	1) Organizational learning covers ***multiple levels***: individual, group and organization level and they are connected by both social and psychological processes. 2) Organizational learning is composed of four processes: ***intuiting, interpreting, integrating and institutionalizing***. These processes are linked by feedback and feed-forward processes.
Williams (2001)	1) The processes of organizational learning contain management decision making, belief systems, organizational culture, organizational mission and strategy and past experience. 2) Among these processes, ***organizational culture*** plays a central role. 3) To possess competitive advantages, organizations should manage these processes in a reasonable way.
Wang and Ahmed (2003)	1) Individual learning is important as it could be viewed as the start point of organizational learning. However, organizational learning is more than the sum of individual learning. 2) The processes of organizational learning should be considered in a ***specific context*** as it interacts with the whole organization and contextual factors rather than a simple or linear process.

Table 1 indicates there are different arguments around the processes of organizational learning, and therefore several points need to be discussed in detail. First, there is no distinct boundary between each process and in most cases; the processes are interacted with each other. In Huber's (1991) study, the framework for the processes of organizational learning are composed of structured processes. Wang and Ahmed (2003) believe that viewing the processes as linear stages fails to reveal the complexity of organizational learning as it engages with individuals and other organizational factors. Crossan et al., (1999) propose a 4I model (namely: Intuiting, Interpreting, Integrating and Institutionalizing) with the consideration of three levels (namely: individual, group and organizational level) to present the dynamic processes of organizational learning. It is argued that basically, the information is processed through a feed-forward flow from intuiting at individual level to institutionalizing at organizational level but as what the organization has learnt can affect the new learning process; there is a feedback process which flows from institutionalizing to intuiting (Crossan et al., 1999). They underline that it is not necessary for the information to go through every process, in some cases; the information could flow directly from intuiting to institutionalizing (Crossan et al., 1999). Furthermore, the belief-focused model built by Williams (2001) also reveals the interactions between different processes of organizational learning. Second, organizational learning is a multi-level and organizational wide process. It is agreed by many researchers that organizational learning covers at least three levels: individual, group and organizational levels. The individual level is the starting point of organizational learning as it is based on the learning processes of employees and managers (Wang and Ahmed, 2003). However, individual learning is shaped by psychological factors of each individual while organizational learning can integrate and institutionalize the learning

results including behaviour, norms or values from individuals by its own cognitive systems and memories, and thereby, even when individuals leave the organization, the organization could remain with their learning results (Shrivastava, 1983; Hedberg, 1981). Finally, in view of the discussions made by researchers, it is worth detecting which elements are crucial to the processes of organizational learning. It is confirmed by many researchers that experience is the most critical source for organizational learning. Levitt and March (1988) point out that experience can be directly from one's daily work and indirectly from others' work. However, external resource is also a significant source for learning. For instance, customers are the ultimate users of products or services, so their feedback can directly contribute to product design and service improvement (Levitt and March, 1988; Dodgson, 1993). Third parties such as business consultants are a valuable source. Consultants work with different organizations with professional and objective perspectives, and thus their suggestions to the organization are more likely to detect the potential problems and re-structure the organization in a reasonable way (Scarbrough, 2003). Moreover, organizational culture which shapes the behavior of employees plays a central role in the processes of organizational learning. According to Beyer (1981) and Pfeffer (1981), organizational culture represents the shared beliefs and values of employees and managers and it could largely affect the organizational cognitive system and behaviour. This argument is supported by Williams' (2001) study which indicates that organizational culture is linked tightly with stakeholders' belief. Nevis et al. (1995) refer to it as a climate of openness and reveal that it is more likely for those organizations with open and friendly culture to increase the accessibility of the information. The third critical element is strategy as it determines vision and mission of the organization and therefore, influences the organization's learning capacity (Burgelman, 1983; Fiol and Lyles, 1985). The fourth element is leadership. As agued by Williams (2001), it is more likely for the organization to possess competitive advantage if the processes of organizational

learning are well managed by leaders, e.g. clarifying organizational goals, deciding the proper strategy to achieve these goals and offering valid and reliable information of implementing strategy and other plans. Apart from the mentioned elements, the engagement of employees and managers is another critical element. As proposed by many researchers, organizational learning should embrace the entire, rather than part of, the organization and thus it requires employee involvement. Arthur and Aiman-Smith (2001) indicate that suggestions from employees can contribute to the success of organizational learning.

2.1.4 Issues of organizational learning

Although many studies of organizational learning have been done, there are still some issues. It is commonly criticized by researchers that the ideas of organizational learning are too theoretical and lack a guide of practical or operational processes. As observed from the literature, many models developed by researchers are based on conceptual analysis rather than empirical studies (e.g. Fiol and Lyles (1985); Huber (1991); Nevis et al. (1995); Williams (2001)). Flinchbaugh (2008) criticizes that organizational learning is good at creating “great thinkers” instead of “great practitioners”. The immediate result is that managers may realize the importance to encourage learning activities but they do not know what exactly should be done for their daily work (Nevis et al., 1995). Moreover, it lacks detailed and practical tools or techniques to operationalize organizational learning. As it is difficult for managers to operationalize the ideas of organizational learning, it may be less likely for employees to understand and accept it. Another issue of organizational learning is that it is difficult for researchers or practitioners to ensure the effectiveness of organizational learning. Managers may promote organizational learning by increasing learning activities such as inviting professional individuals to give a lecture, educating employees through more training courses, encouraging communication between managers and employees, but simply

increasing the number of learning activities cannot guarantee the organization is learning the right thing in the right way. Some researchers point out that learning from customers is a good way to build effective organizational learning (e.g. Dodgson, 1993). However, it is observed that most studies place emphasis on learning from internal resources rather than customers.

2.2 Lean production

The origins of lean production can be traced back to the 1950s. It was initially known as the Toyota Production System (TPS) which was famous for its efficient and effective operations system, sometimes referred to as a Just-in-Time (JIT) system. Compared to other management methods, such as mass production or mass customization, lean production focuses on two core concepts: value (i.e. customer value) creation and waste (i.e. any activity that cannot add value) elimination (Womack and Jones, 1996). According to Warnecke and Hiiser (1995) and Hemmant (2006), the essence of lean production is using less resource (i.e. material, staff, time) to do more work (i.e. producing efficiently). Ballard (1999) believes that the organization can benefit from lean production as it could remove or at least minimize non-value adding activities in a holistic way. Womack and Jones (1996) point out that there are five principles of lean thinking, namely: specifying value, identifying value stream, flow, pull and perfection (see table 2). To understand lean production from a more comprehensive perspective, the following sections will address the definitions of lean production, the way to being lean, critical success factors for lean implementation and the issues of lean production.

Table 2 Lean principles

Lean principles	Description
1. Specify value	Value should be identified by end customer rather than shareholders or senior managers (Womack and Jones, 1996; Hines and Taylor 2000).
2.Identify the value stream	Evaluate the total value stream for each product or product family with the assistant of mapping tools (Womack and Jones, 1996; Rother and Shook, 2003; Bicheno, 2004).
3. Flow	Making the product flow smoothly requires linking all the value-added steps in a tight sequence without any interruption, backflows, waiting or scrap (Womack and Jones, 1996; Spear and Bowen, 1999; Bicheno, 2004).
4. Pull	The information flows from end customer to raw material suppliers (Womack and Jones, 1996; Bicheno, 2004).
5. Perfection	Firms should rethink their improvement to find out where is the next improvement opportunity (Womack and Jones, 1996; Bisson et al., 2000; Liker and Morgan, 2006).

2.2.1 Definitions of lean production

The lean production is interpreted and defined differently by different researchers. Basically, there are three sets of thinking: tool-based thinking, operations system-based thinking and management philosophy-based thinking. Some researchers view lean production as a mixed set of tools including 5S, TPS, JIT etc. and thus, the main task for researchers and practitioners is to minimize waste by developing a proper way to select and apply these tools (e.g. Achanga et al., 2006; Faisal et al., 2006). However, many researchers criticize this and argue that solely focusing on deploying lean tools cannot reflect the essence of lean

production. Lean production is more than tools application or waste reduction and more attention should be paid to the value creation aspect. Hence, some researchers prefer to define lean production as a kind of pull system which is designed to produce in accordance with customer orders at a low, or ideally zero, inventory level, and thereby, the main task for practitioners is to ensure that the whole system is operated and maintained efficiently and effectively by multi-skilled managers and operators (e.g. Sadhwani et al., 1987; Ormsby et al., 1994; Smith et al., 2003). Further, a few researchers argue that lean production is neither a set of tools nor a kind of pull system. It should be considered as a kind of management philosophy which guides organizations to continuously add value to customers and reduce waste (e.g. Brown & Inman., 1993; Mazany, 1995; Ramaswamy et al., 2002, Hines et at., 2008, 2011). As a result, the main task for practitioners is to embed lean thinking in the organizational culture and direct all the employees' behaviour toward continuous improvement. Some researchers point out that these definitions do not compete with each other and propose the combination of two or three sets of thinking. It is difficult to simply label these definitions of lean production as "right" or "wrong"; it largely depends on the purpose of one specific study or programme. Viewing lean production as an operations system or management philosophy could provide more opportunities for both researchers and practitioners to gain in-depth and holistic understanding of lean production.

2.2.2 Journey to be lean

As there are different understandings and interpretations of lean production, many arguments, models and frameworks of lean implementation are developed by researchers. One typical way to being lean is relying on the application of one or several specific lean tools such as Kanban system, 5S, Total Productive Maintenance (TPM), and mapping methods such as Process Activity Mapping (PAM) and Value Stream Mapping (VSM) to improve operational

processes and eliminate or minimize waste (e.g. Ahmed et al., 2004; Witt, 2006; Kotani, 2007; Lee-Mortimer, 2008; Kobayashi et al., 2008; Bayo-Moriones et al., 2010; Woehrle and Abou-Shady, 2010). It is criticized by some researchers that only adopting one, or several, lean tools cannot satisfy the needs of five lean principles (Rich et al., 2006). In order to fulfil the requirements of lean principles and achieve perfection, Rich et al. (2006) propose a model named "the house of lean". They demonstrate that "the house of lean" should be built based on some basic and widely used lean tools including 5S and visual management. To ensure the robustness of "the house", they suggest that the walls should consist of quality control, system maintenance and the ideas of pull system (Rich et al., 2006). Additionally, to direct and involve managers and employees, they argue that the ideas of lean production should be embedded in the factory policy and the measures for assessing employees' performance should be adapted to lean production (Rich et al., 2006). Although the "house of lean" model integrates different lean tools with performance measurement and factory policy in a logic way with emphasis on continuous improvement, it still falls into shop-floor based and efficiency oriented-thinking.

To strategically address lean implementation, Hines et al., (2008) develop "the sustainable lean iceberg model". It indicates that lean implementation is more than shop-floor management as it is driven by the transformation throughout the entire organization. It highlights that the organization needs a coherent strategy with clear vision, proper and flexible assessment system; suitable leaders with foresight and strong capability to communicate with shareholders and engage employees; and multi-skills employees with passion and proactive behaviour to facilitate lean implementation (Bennis, 2003; Tittemore, 2003; Mann, 2005; Nag et al. 2007; Johnson et al. 2008; Hersey et al. 2008; Hines et al. 2008, 2011). Thus, the implementation of lean tools and process management techniques is guided

by the organization's strategy; supported by the leaders and operated by employees (Hines et al., 2008). Furthermore, they propose that the trend of lean transformation is from surviving to thriving and sustainable lean implementation should be extended to the entire supply chain (Hines et al. 2008).

2.2.3 Critical success factors for lean implementation

Based on investigating previous studies, Hines et al. (2008) summarize the elements for lean implementation consists of both visible and invisible aspects. It is suggested that the visible elements are lean tools and process management activities while the invisible ones are strategy, leadership and engagement of people (Hines et al., 2008). By reviewing the literature of lean production, it is found that many studies have focused on visible elements (e.g. Ward and Zhou, 2006; Kumar et al., 2006; Czabke et al., 2008). However, only focusing on lean tools or process management cannot guarantee the success of lean implementation. Lucey et al. (2005) argue that it is difficult for the organization to sustain the benefits from shop-floor improvement as it often lacks employee engagement and support from senior management Hines et al. (2008) employ the term "enabling elements" to reflect the importance of strategy, leadership and engagement of people in lean implementation. Similarly, Achanga et al. (2006) summarize that leadership and management strategy, financial capability, employee's expertise and skills and organizational culture as critical success factors for lean implementation.

2.2.4 Issues of lean production

Although many researchers have presented the success of lean implementation, there are still some issues. Firstly, unlike other fields (e.g. finance or organizational behaviour or marketing) which have their theories, operations management, including lean production, is atheoretical

(Schmenner and Swink, 1998). It may be argued that lean production is fundamentally supported by five lean principles, but these principles are much closer to practical issues rather than theory development. For example, most studies of lean production fall into the adoption of lean principles in different environments and the focus of these studies relies on the use of lean tools and techniques rather than developing the theory of lean. To enhance the foundation of lean production, there is a need for researchers to investigate the combination of lean production and other organization theories. Secondly, it is criticized by some researchers that lean production concentrates on shop-floor improvement and thereby lacks strategic vision (Hines and Taylor, 2000).

3. Discussion

To explore the connections between organizational learning and lean production, the following sections will discuss and analyze how these two concepts can be linked and integrated from both theoretical and practical perspectives.

3.1 The connection between the typology of organizational learning and the journey to be lean

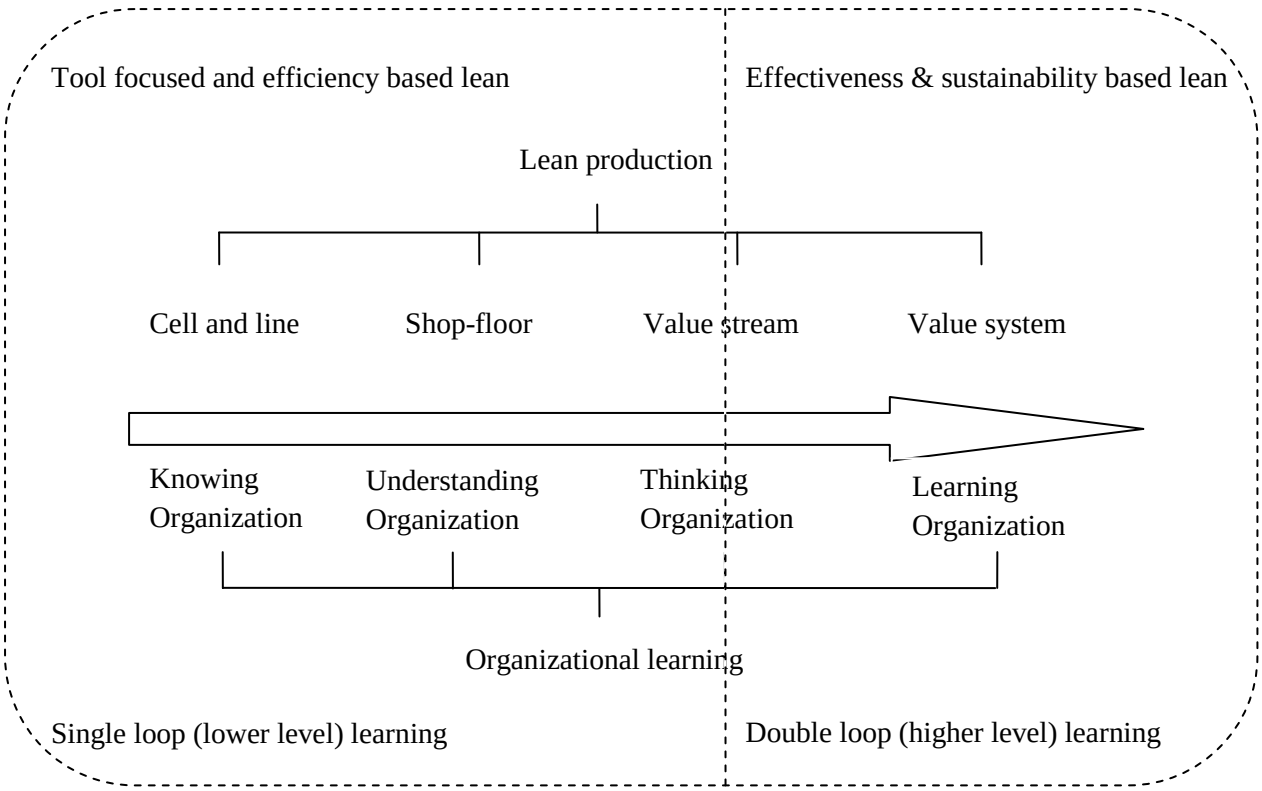
Single-loop, or lower level learning, intends to identify and overcome the errors in the organization, allowing the current program to operate smoothly. In the case of lean this may be linked to a focus on tools and waste elimination. This approach to lean implementation pursues high efficiency of current operations system rather than high effectiveness. It concentrates on how to produce more products in a short lead time with fewer resources. The likely result is that managers or employees are encouraged to adopt several widely used lean tools to cope with the problem in the current system. According to Spear and Bowen (1999) and Spear (2004), many organizations solely focus on imitating Toyota's tools and tactics

rather than its underlying operating principles. For example, employees may be trained to adopt Total Productive Maintenance (TPM) and thereby, the machines can be operated in a good condition without interruption. The organization could also re-design the layout of the plant by adopting the idea of cellular manufacturing, and thus, the product could flow from the first process to the last more quickly and smoothly. The main contribution of this approach, as stated by Spear (2009), is to enable lean organisations such as Toyota to turn chaotic push into self-pacing pull and process improvisation into repeatable standards.

Compared to single-loop, or lower level learning, double-loop, or higher level, learning evaluates the underlying policies or rules of the organization and expects to re-build the organizational rules or policies in a more reasonable way. In this case, this idea is closer to effectiveness and sustainability approach to lean implementation. The "sustainable lean iceberg model" implies that more attention should be paid to re-building the organizational strategy and culture as well as increasing employee engagement rather than simply adopting lean tools. It provides the opportunity for managers to review and re-think the current policies and rules which support the implementation of current strategy and set the new policies or rules which support lean implementation. For example, the organizational strategy may focus on making profits by producing in a high productive way. However, in the lean case, the managers could change the strategy to focus on customer value. Hence, the organization could re-design its operations system from a customer value adding perspective and provide what the customer actually requires.

Hines et al. (2004), from their review of the lean production literature, point out that the evolution of lean production follows McGill and Slocum's (1993) typology of organizational learning. They argue that the ideas of lean production have developed from shop-floor management to value system based thinking and from imitating best practice to contingency

based thinking. This development enables the organization to transform from a knowing organization to learning organization. It is suggested the turning point of single and double learning comes along with the idea of the value stream which focuses on detecting and enhancing the core value adding processes (Hines et al., 2004). It enables managers and employees to recognize and re-think the underlying production philosophy (i.e. mass production or mass customization or pull system) of the current production line or operational processes. However, in the value stream stage, as some organizations limit their focus to the use of lean tools to solve QCD (i.e. quality, cost and delivery) based issues, it is argued that it is less likely for these organizations to sustain the benefits from piecemeal improvement. Hines et al., (2004) propose that double-loop learning is integrated with lean production when the idea of value system is considered. This idea facilitates the organization to design and operate the system in accordance with its context rather than imitating the best way. Contingent factors such as plant size, industrial sector should be taken into account. It requires the organization to learn from supply chain members and even competitors and as it attempts to design its own way to be lean, it has to test every step of design and in return, the test can be viewed as an opportunity for every employee to learn from doing. The connection between the typology of organizational learning and lean implementation is summarized in figure 1.



Source: adapted from Hines et al. (2004)

3.2 Operationalizing organizational learning through lean production

As argued by many researchers, organizational learning falls into theoretical discussion and lacks practical guideline or examples; conversely, lean production possesses the advantage of providing good practices or practical ideas. This section discusses how lean culture and tools could operationalize organizational learning.

3.2.1 Lean culture and organizational learning

Researchers from an organization learning perspective point out that the organization should have an open organizational culture which enables managers and employees to get access to the information they need and communicate with each other efficiently. In addition, to achieving double loop learning, employees are encouraged to test their new ideas and explore

the underlying problems in current system. It implies that organizational learning requires open and supportive organizational culture which embraces both failure and success. However, it is difficult for these ideas to deal with practical issues. For example, as the organization receives a high amount of information every day, how to decipher what is important for managers and employees is challenging. How to enhance the efficiency and effectiveness of information transfer and communication within and between employees and managers can also be problematic. From a lean perspective, these practical issues may be solved by building a lean culture. According to the essence of lean production, lean culture possesses the following features. Firstly, in a lean organization, it is customer value oriented which means information relates to customer requirements and orders is the most important information for managers and employees. It implies that the feedback or comments from end users should be valued and analyzed by the organization and the current production system should be adjusted or even re-designed based on customer requirements. Secondly, as Womack and Jones' (1996) lean principles highlight by adding customer value, waste is viewed as the enemy to the organization. To ensure the efficiency and effectiveness of information transfer and communication, the organization should detect any waste within the communication processes. Ward (2009) categorizes three kinds of knowledge waste (i.e. scatter, hand-off and wishful thinking) that may inhibit information transfer or daily communication. Scatter means activities that disrupt knowledge flow such as poor information channels, long communication distance, poor layout design and the strict "class system" within the organization (Ward, 2009). Hand-off occurs when the organization separates knowledge, responsibility, feedback and action (Ward, 2009). In other words, the decisions are made by people with insufficient knowledge and each of them narrows the focus on his or her area. For example, employees in the marketing section concentrate on taking more orders while engineers dwell on making a more creative production system but

the president of the organization is the only one who is responsible for making more profits. The third kind of knowledge waste is wishful thinking which refers to making decisions without using practical information (Ward, 2009). Ward (2009) goes on to suggest that in a lean organization, it should find out the root cause of scatter and fundamentally solve the problem rather than simply fixing the current problem. Although fixing the root cause does not necessarily mean re-design the current system, Ward's idea partly reflects Argyris' idea of double loop learning and it provides the opportunity for the organization to question its current rules and policies. It is also proposed by Ward (2009) that to eliminate the waste of hand-off and enhance the effectiveness of communication, the organization should encourage employees or even managers to learn the whole operational mechanism and processes rather than the skills for daily work. It implies that piecemeal learning is insufficient for the organization to achieve lean, but instead, learning should be spread through the whole organization. Thirdly, as the fifth lean principle emphasizes perfection, the lean organization is built on continuous improvement based thinking. It means the organization should establish a certain mechanism which enables managers and employees to regularly check and improve its current status, for example, many lean thinkers propose that the idea of PDCA (plan-do-check-action) can be considered as the proper way.

3.2.2 Lean tools and organizational learning -facilitating organizational learning

As a set of tools which are used to guide and improve the daily work are developed by lean thinkers, it is worth detecting the potential opportunities to facilitate and operationalize the ideas of organizational learning through these tools. In the case of single loop learning, the main task is to detect the problems in current system and cope with them. However, researchers from organizational learning perspective do not provide the practical way to accomplish this task during the daily work. From a lean perspective, this task can be achieved

through lean tools such as 5S and visual management. According to Bicheno (2004) and Howell (2009), 5S which stands for sorting out the workplace, simplifying the layout of the workplace, sweeping the workplace regularly, standardizing the daily work and sustaining the improved work, could enable employees to review the current operation's processes and improve its performance without changing the configuration of the workplace. Similarly, visual management which aims to visualize the current activities of the organization (e.g. using the white board to visualise the working processes, operational structure, goals of the organization, or the responsibilities for managers and employees) provides the opportunities for employees to discover the potential problems and thereby, stimulates them to propose solutions. One advantage of the lean tools like 5S or visual management is that it can be much easier for some employees to learn and it can be widely used throughout the whole organization. Hence, Rich et al. (2006) describes 5S and visual management as the foundation of lean implementation. In the case of double-loop learning, the main task is to question and transform the policies and rules of the organizations. It is believed by many researchers that double-loop learning is difficult to achieve and it lacks a certain methodology for managers and employees to apply this idea. However, from a lean perspective, some lean tools could facilitate or at least stimulate the activities of doubl- loop learning. For instance, to detect the problems of underlying rules of the organization from the observed problem in the current system, it requires managers and employees to look into the root cause of the observed problem. One of lean tools named 5 Whys could assist the organization to find out the root cause through asking "why" several times (Murugaiah et al., 2010). According to the experience from Toyota, the root cause normally comes out after keeping asking "why" for five times (Bicheno, 2004). 5 Whys is often viewed as a simple but effective technique as it detects the underlying cause of the observed issue and encourages the organization to identify the most reasonable solution. Moreover, double-loop learning requires all employees to get

access to the right information they need. It does not simply mean input all the information into an information system, but it needs a certain production mechanism (i.e. pull production mechanism) to ensure that employees could reach the right information. From a lean perspective, the customer-based information is the right information, to ensure it reaches every operation processes lean tools such as Kanban and VSM are commonly employed. In a Kanban system, information of customer orders (e.g. the number and style of products) is sent to the last operation process (i.e. normally packing or shipping process) and it is then broken down into detailed information according to each operation process (e.g. the number and style of each component). It implies that the customer-based information could be effectively absorbed and decomposed by the organization and employees in each process could receive the relative information which is translated into the common language they are familiar with rather than a great amount of messy information. Similarly, VSM which can be viewed as an analytical tool for discovering non-value added processes and re-designing the value-added system is another useful lean tool. VSM visualizes both information and material flows and the linkage between them through a comprehensive map of the current working system and it calculates both waste and value added time in the system (Wood, 2004; Braglia et al, 2006). Aligning with the use of 5 Whys, it is more likely for the analysts to detect the root cause of the waste and for the whole system to be redesigned in a more effective way, allowing the information of customer orders to flow smoothly and efficiently to each process. The lean tools shown in this section are examples of operationalizing the idea of organizational learning as these tools are widely and commonly employed by many organizations and it is approved by many empirical studies that both managers and employees could accept and operate them effectively in the daily work.

3.3 Achieving and enhancing the continuous improvement of lean implementation through organizational learning

Given the origins of lean production, it is unsurprising that many studies focus on shop floor improvement. However, as mentioned in previous sections, with the development of lean, many researchers invoke that lean production is more than a group of tools. It stands for a kind of operations system or even management philosophy. This idea is later reflected by the discussion of critical success factors for lean implementation as it is summarized that invisible elements such as strategy, leadership and employee engagement are the critical success elements. It implies that lean implementation is the transformation throughout the whole organization, as the organization attempts to fundamentally adjust or re-set its current strategy and organizational culture, facilitate top management commitment and encourage every employee to engage in the lean implementation. It seems that the idea of lean production has been developed at a higher level, but there is one dilemma: how to actually achieve and enhance continuous improvement? Some researchers may argue that lean production has already solved this issue by providing lean tools, such as Kaizen. It is approved by many studies that Kaizen can assist the organization to achieve or at least move closer to the idea of continuous improvement, but the actual problem is whether it is sufficient to achieve and enhance continuous improvement by only employing these lean tools. It is observed that many organizations launch lean implementation programmes with the assistance of professionals. Hence, it is believed by the organization that the professional groups enable it to benefit from lean implementation within a certain period (e.g. the program may last for 1 year or several years). In this case, the lean program may largely, or at least partly, rely on the work of these professionals, or even some key managers and employees, who are mainly responsible for the program (e.g. general manager, team leaders). However,

how can we ensure that the organization still has the adequate abilities to continuously improve its current status after the program finishing or the key managers and employees leaving the organization? One reasonable answer is enhancing the organizational memory. Researchers from organizational learning perspective argue that, like human beings, the organization has its own memory which is embedded in its daily operations. The organizational memory is affected by many factors such as employee turnover, information distribution and transferring mechanism (Huber, 1991). To enhance the effectiveness organizational memory, Huber (1991), suggests that establishing a computer-based information system is a proper solution to store and retrieve the "hard" information and for the "soft" information owned by individuals (e.g. experts in the organization), Huber (1991) proposes that it is necessary for the organization to build computer-based expert system and thereby, the organization could retain the useful ideas and skills of experts. Another solution is to institutionalize the learned information. According to Crossan et al. (1999), institutionalizing is a proper way for the organization to maintain the valuable information from individuals through embedding the learning in the operations system, structure, strategy and routines. As a result, even though some managers and employees leave the organization, it still operates under the established rules and routines. For example, in a lean organization, past rules such as "working fast" or "pursuing high productivity" can be changed to new rules such as "working without defects" or "producing exactly what the customer needs". Once the rules are set up and standardized in the form of standard operating procedures (SOPS), they will not be affected by the employee turnover. The idea of institutionalizing through changing the past rules is consistent with Argyris' idea of double-loop learning and the changed rules can be viewed as the guideline for the organization's daily operations.

4. Conclusion

The paper aims to detect the potential connections between organizational learning and lean production. It reviews the literature of these two concepts including the definitions, typology, process and issues of organizational learning and the definitions of lean production, the journey to be lean, critical success factors for lean implementation and the issues of lean production. Later in the discussion section, it discusses and analyzes how these two concepts can be connected from both theoretical and practical perspectives. The first connection relates to the typology of organizational learning and the journey to be lean. As shown in figure 1, it is argued that tool focused and efficiency based lean production is closer to the idea of single loop learning as it mainly focuses on shop floor improvement and piecemeal learning with limited use of lean tools. Conversely, effectiveness and sustainability based lean production is linked to the idea of double loop learning as it concentrates on adjusting or re-building the organizational strategy and culture as well as increase employee engagement. In addition, the second connection presents how to operationalize the idea of organizational learning through employing lean culture and lean tools. It is argued that lean culture enables the organization to identify the most important information which is customer based information and remove the wastes among daily communication processes and thus enhance the efficiency and effectiveness of information transfer and communication within and between employees and managers. It is also suggested that employing some simple and easy lean tools such as 5S, visual management could facilitate the application of organizational learning. Meanwhile, it addresses how to achieve continuous improvement in a lean organization by enhancing the organizational memory and institutionalizing learning. However, as a conceptual study, the paper discusses these two concepts in a generic context and lacks the specific empirical case to illustrate the discussion points in detail. Hence, for future research, more empirical studies

can be done to explore the connection between them in the particular context.

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