Synthesizing the domain of lean practices in manufacturing operations – A review

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SYNTHESIZING THE DOMAIN OF LEAN PRACTICES IN MANUFACTURING OPERATIONS: A REVIEW

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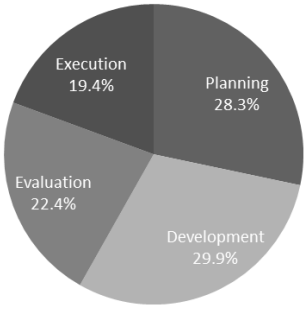
Graphical abstract



Abstract

The implementation of Lean practices via various techniques and approaches have provided the room of improvement for manufacturers to increase the manufacturing operations performance. Nevertheless, the lack of understanding in synthesizing each of the strategies can cause the implementation benefits of this practice are unable to be retained. This is possibly due to the weaknesses in identifying the exact domain and the right indicators in strengthening the Lean implementation processes. From the review, planning, development, evaluation and execution are the four primary domains that highly influenced the manufacturer performance in synthesizing the Lean practice. In fact, each of the domains has its own performance indicator in streamlining the strategy outlined in strengthening this practice in manufacturing operations. The ability to fortify all these domains is seen to be able to increase the performance of Lean implementation and ensure the adaptation process becomes smoother and easier for a longer period of time. This will be useful to the manufacturer and academician, primarily in formulating the best approach in establishing the sustainable manufacturing practice via Lean approach.

Keywords: Lean practice, manufacturing operations, synthesizing process, review

Abstrak

Pelaksanaan Lean melalui pelbagai teknik dan pendekatan telah menyediakan ruang penambahbaikan kepada pengilang untuk meningkatkan prestasi operasi pengeluaran. Walau bagaimanapun, kekurangan pemahaman dalam mensintesis setiap satu daripada strategi yang dilaksanakan menyebabkan faedah perlaksanaannya tidak dapat dikekalkan. Ini mungkin disebabkan oleh kelemahan dalam mengenal pasti domain yang tepat dan penunjuk yang betul bagi mengukuhkan proses pelaksanaannta. Dari kajian, perancangan, pembangunan, penilaian dan pelaksanaan adalah empat domain utama yang sangat mempengaruhi prestasi dalam mensintesis amalan Lean. Malah, setiap satu domain tersebut mempunyai petunjuk prestasi sendiri dalam memperkemas strategi bagi mengukuhkan amalan ini dalam operasi pengeluaran. Keupayaan mengukuhkan semua domain ini dilihat dapat meningkatkan prestasi pelaksanaan dan adaptasi Lean menjadi lebih lancar dan lebih mudah untuk jangka masa yang lama. Ini amat berguna kepada pengilang dan ahli akademik, terutamanya dalam merumuskan pendekatan terbaik dalam mewujudkan amalan pembuatan mampan melalui pendekatan Lean.

Kata kunci: Amalan Lean, operasi pembuatan, proses mensintesis, ulasan

1.0 INTRODUCTION

The ability to continuously strengthen Lean Practices (LP) with consistent effort can stimulate the performance of manufacturing operations, primarily in handling the effect of the current economic downturn. The advent of the LP as the dominant strategy in the continuous improvement activity does not only increase the level of competitiveness, but also successfully transform the manufacturing operations to be more dynamic [1, 2]. This does not only allow manufacturers to control the inventory level and optimize the utilization of work space, but also actively monitor the total manufacturing costs efficiently [3, 4]. This subsequently allows manufacturers to participate actively in revolutionising the manufacturing operations, primarily in increasing the productivity, improving the performance of manufacturing operations as well as financial performance [5]. Any production issue is able to be handled with more efficient, especially in managing the variety of demands in a competitive market environment [6, 7]. This is crucial, primarily for the manufacturer which produce the product that requires high customization level, in which a high response rate are mandatory [8].

Although the implementation of the LP positively can produce a considerable financial effects, but the challenges to retain the sustainability performance of LP implementation is difficult and often haphazard, primarily for a long period of time. This will be more challenging for the manufacturer that adopts a hybrid production approach (more than one approach simultaneously). In this situation, the customization of the LP is much needed in maintaining the flow rate of the operation that was executed. Therefore, the main focus of this article is to explore and discuss how the implementation of LP can be strengthened along its implementation processes. Based on the four domains, namely planning, development, evaluation and execution, the discussion is being carried out intensively on how each of these domains can boost the impact of LP implementation for the optimal result.

This article is arranged as follows: the first section explains the need for the LP implementation in the manufacturing operations. Next, the research method that was used is explained in section two, followed by the discussion against each domain in strengthening the LP approach in retaining its implementation impact in section three. Meanwhile the last section will conclude the findings from the discussion and the suggestion in validating this research to the next level.

2.0 RESEARCH METHOD

This research was based on the method of qualitative analysis. The main focus is to identify the domain that can be used to synthesize the LP implementation process, primarily in strengthening the objectives of its implementation. Based on six stages of the systematic analysis approach, starting from the process of selection, know, comprehend, apply, analyse, synthesise and evaluate, the process in identifying the contributed domain are carefully studied [9]. At the initial stage, a number of articles published from 2003 to 2013 have been referred. The cross checking process for each article was then conducted, mainly to identify the indicators that influence the performance of the LP implementation process. Next, each indicator identified was then categorized based on four domains in the LP implementation process, namely planning, development, evaluation and execution. The discussion was then carried out comprehensively over each domain in understanding how each of these domains can be enhanced by improving the efficiency of the LP implementation process.

From the cross checking analysis against 24 articles, the major focus in LP implementation mostly influenced by the development domain (29.9%), followed by planning (28.3%), evaluation (22.4%) and execution (19.4%). It was summarized in Table 1.

Table 1 Summary of the indicator that influence the implementation domain of the LP

Implementation Domain	Influence Indicator	Percentage of indicator highlighted in implementation stage	Total percentage domain highlighted
Planning	Management Policy	12.5 (3)	28.3 (19)
	Level of Knowledge	20.8 (5)	
	Utilisation of new technology in operation or process	33.3 (8)	
	Role of organisations	12.5 (3)	
Development	Differentiate waste and value	25.0 (6)	29.9 (20)
	Continuous improvement program	45.8 (11)	
	Stability and commitment of suppliers	12.5 (3)	
Evaluation	Communication efficiency	8.3 (2)	22.4 (15)
	Good production plant assessment and monitoring	12.5 (3)	
	Working environment	16.7 (4)	
	Versatile and qualified workers with high level of knowledge	8.3 (2)	
	Workers commitments and satisfaction	16.7 (4)	
Execution	Quality management system and manufacturing capability	29.2 (7)	19.4 (13)
	Effectiveness of standard operation procedure	12.5 (3)	
	Selection of manufacturing production systems	12.5 (3)	

The ability in increasing the maturity of the process of each domains potentially increase operational control with more efficiency [10]. This is essential in synthesizing process and streamlining each of the domains either at the beginning phases of the LP implementation or after it has been adopted [11]. The percentage of the domain category that was highlighted from the literature review of each domain identified in the LP implementation process is summarized in Figure 1.

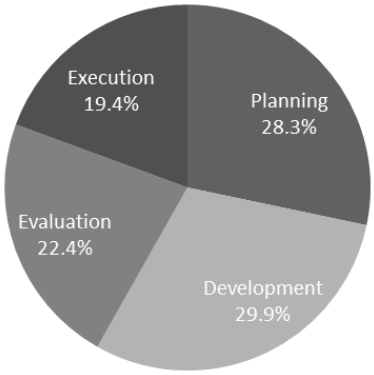


Figure 1 The four domains of LP from review

3.0 SYNTHESIZING LEAN PRACTICE DOMAIN

The technological development, an increase of initiatives in implementing the innovation, and the increasing competition in the market has caused the development and production of products become more complex and critical. This prompted manufacturers to increase the initiatives against current manufacturing performance in adapting to the changes that occur. The options to implement the LP strategy (such as JIT, Kanban etc.) consistently, does not only can decrease the operation defects (such as excess of inventory, scrap, rework and etc.), but also can improve the operational performance, expedite the processing time and reducing the total production costs [12].

The focus, knowledge and strategy to regulate and monitor the performance of each of the LP strategies that were developed must always be improved. This is to ensure that the strategy employed remains relevant to the current manufacturing operations environment. For that reason, each of the domains (planning, development, evaluation and execution) in implementing LP must be constantly synthesized and reinforced. Every indicator that influences each domain also must be always streamlined. This is not only beneficial in short term, but also essential in producing unlimited returns in a long term, especially in increasing the sustainability level in manufacturing practices. The flow and the pathway of each domain and indicator for each domain in stabilizing the LP implementation are illustrated in Figure 2.

From review made on the selected 24 articles, there are four indicator identified to be influencing the performance of planning domain. The ability to adopt and customize the latest technology has large influence when 33.3 percent of the articles that were reviewed had emphasized this indicator in implementing the LP strategy that was planned. This was followed by the awareness in increasing the level of knowledge (20.8 percent) and the ability in developing comprehensive management policy, as well as in determining the role of organization in implementing the LP strategy at 12.5 percent, respectively. All four indicators serve as the acting force in synthesizing the LP in streamlining the process of its implementation by providing effective changes in managing the cost and time robustly with a broad implementation scope [13, 14].

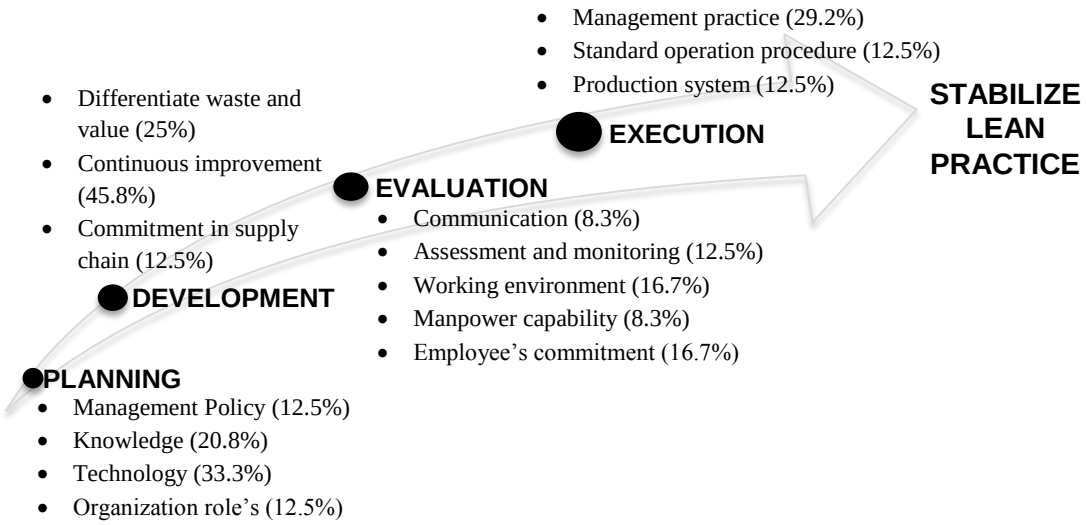


Figure 2 The domain and influence indicators in stabilizing the Lean practice

In the development domain, the awareness in minimizing the time required, increasing the quality of products that were produced, and allocating the reasonable production cost were seen as the contributor to the performance of development domain [5, 15]. Thus, the focus in developing the continuous improvement activity, the ability to distinguish between waste and value, and the motivation to improve the efficiency and the commitment in supply chain is important. From review made, 11 out of 24 articles or 45.8 percent has highlighted the awareness in implementing the continuous improvement activity as the primary action that was required in strengthening the development of the LP plan. This was followed by the ability to differentiate between waste and value and the concentration in increasing the commitment of supplier chain by supplier at 12.5 percent, respectively.

For the domain of evaluation, the integration between the levels of technology acceptance, the level of knowledge, the efficiency of manufacturing system adopted and the acceptance of employees in implementing the LP strategy were perceived to influence five indicators identified in strengthening this domain in the LP implementation process [10, 16, 17, 18]. The focus in assessing the commitment of employees and work environment respectively has been mentioned in almost 16.7 percent in the articles reviewed. These two indicators perceived to have a close relation with the integration between employees and manufacturing system [19]. This is followed by the requirement in performing the process of assessment and monitoring (12.5 percent), assessing the manpower capability and the level of communication at value 8.3 percent, respectively. The enforcement in strengthening these indicators also contributes to the consistency of this domain, primarily to attain the goal and to measure the implementation performance of the LP.

While for the execution domain, the efficiency of management practices in integrating the LP strategy was found to have the highest influence in this domain when 29.3 percent of the articles reviewed emphasize this indicator in the LP implementation process. This was followed by the focus in streamlining the standard operational procedure and the production system employed where 12.5 % of articles reviewed had emphasized both indicator during the LP implementation process. At this domain, the integration of technology, knowledge, manufacturing system and employees can becomes the primary focus input in strengthening all indicators in the execution domain [20, 21].

3.1 Planning

The domain of planning is critical in the LP implementation process. Thus, specific focus is much needed against this domain to make sure the strategic plan can be accurately developed at every stage in the production floor [15]. Besides, this domain was also a vital mechanism in operation, mainly in streamlining the collaboration that is required in the new product development [22, 23]. Therefore, the constant focus in this domain as a key lever in LP implementation is much needed and have an important role in determining the implementation objectives of the LP at the early stage [24, 25]. This will provide the room for improvement in reducing the operating time, producing more quality products as well as increasing the level of manufacturing sustainability [4]. For this reason, special attention in the planning domain is indispensable either during the beginning stage of the implementation or after the LP strategy has been implemented [11].

The ability to synthesize the pathway of this domain is crucial, mainly in managing the resources that is required in manufacturing operations, so manufacturers can cope with the impact of any economic risks for long-term. This subsequently will increase the ability of the manufacturer to detect any interference to the operation at the earliest stage. It is because the repetition of the production scheduling cycle will always affect the control over the activity of the production floor [26]. This will also ensure any changes in manufacturing operations such as the process optimisation, the set-up time and the reduction of operating cost are always in line with the current market demand [27]. As an important platform in integrating several strategies and techniques of LP at production floors, the action taken in this domain must always be consistent with the goal setting and the performance that been measured. Therefore, it is important to make sure each indicator that contributes to the performance of this domain is always be streamlined [28]. This is to make sure every process and procedure that has been developed are monitored, updated, or upgraded consistently, in order to prolong the impact of LP implementation in manufacturing operations.

As a medium of communication between management and employees, the ability to formulate an accurate management policy with the nature of operations can avoid misinterpretation that potentially will cause inefficiency of operations [29]. The development of management policy must consider multi-facet of manufacturing operations encompassing the methods of inventory control, environmental and resource management, and the methods in the purchase of the material in supporting the implementation of LP. The ability to streamline this indicator with all aspects in strengthening the planning domain does not only influence the operational performance, but also significantly contribute to the net profit generated [30]. High discipline in strengthening this indicator is also useful in improving the level of sustainability in manufacturing cycle [7]. As a result, manufacturers will have an opportunity to alter the regular planning cycle without compromising the efficiency of manufacturing operations. In fact, the continuous improvement activity that was planned also can be well monitored in ensuring it is not in the opposite direction with the objective of LP

implementation [21]. This further allow manufacturers to establish the platform of shared values, mainly in encouraging the participation of employees to proactively involve in the LP implementation process [1].

The enhancement of the level of knowledge in relevant areas is necessary to make sure the planning domain can be precisely developed, primarily in re-engineering the planning system to be in line with the LP implementation strategy [26]. According to Dombrowski *et al.* [15], the crucial part in LP implementation does not only depends on how the knowledge is gained, but also how such knowledge is integrated in the entire operations. This indicates the level of knowledge was an important indicator that must be streamlined in enhancing the impacts of the LP implementation. Thus, it become the most important assets in forming various LP strategies and methods in the planning domain [2]. This will allow manufacturers to establish higher standards in competition, that eventually increases the scale of economic performance [31]. Besides, the level of consistency in quality control through the integration of various approaches and technique that were offered by LP also can be developed and monitored [32]. The ability to increase knowledge, either tangible or intangible does not only able to increase the competency level among employees, but also ensure the strategy employed in the LP implementation process can be fully understood [33, 34]. It is not only required in establishing the sustainability in the LP implementation process, but also to attain the competitive advantages in manufacturing environment [35]. This explains why the level of knowledge needs to be streamlined in the domain of planning.

The consideration of using new technology in a planning domain during LP implementation phase does not only successfully increase the level of responsiveness, but also can improve the operational performance and reduce unnecessary movement at production floors [10, 18]. This enables manufacturers to respond over any changes of customer expectation, or demand with efficiency [20]. The ability to adopt and integrate the latest technology with the LP principle in the planning process dramatically able to improve the level of productivity [36]. This evidently shows that the utilisation of technology is vital in the LP implementation phase. Moreover, the ability in streamlining this indicator at the early stage of the planning process can enhance the efficiency and the transparency of control over the manufacturing operations comprehensively [11]. According to Hj Bakri *et al.* [37], the growth of business operation highly depended on the ability to utilise the technology in manufacturing operations. This will bring a vital implication in developing an appropriate LP strategy in delivering high quality products. It can also be a stepping stone in developing an innovative strategy in managing the manufacturing operations. To remain competitive in a dynamic business environment, manufacturers must be able to plan, develop and deliver a more desirable product ahead of the competitor before new technology emerges or market condition starts to change [2]. However, the flexibility in streamlining this indicator in the domain of planning is still depends on the capability of manufacturers to tailor the technology used to the organisation size, strategy and operating environment.

The roles of organization are also important in ensuring the impact of LP implementation can be maintained for a longer period of time. This can provide a great benefit over the current manufacturing landscape, mainly in strengthening the manufacturing operations function. As a proven approach in increasing the effectiveness of operation, LP also offers a room for improvement in establishing best practice to confront with the new manufacturing paradigm. For that reason, the awareness in expanding the roles of organization in LP implementation is crucial. This will help in realizing the process of planning, especially in formulating manufacturing operation strategy in managing the resource. It must cover the multi-facet of operation structures, especially for the organization with several different manufacturing functions [6, 30, 38]. Thus, the roles of organizations in the planning domain must be taken into account, mainly in identifying the value of efficiency in controlling the production floors [20, 26]. These do not only able to enhance the effect of LP implementation, but also can reduce the disruption of the operations as well as provide the opportunity to effectively integrate all resources required in manufacturing operations [27, 33]. Azadegan *et al.* [39] claimed that the weakness of organizational roles, mainly in a complex manufacturing operation can increase the potential of error in planning domain, primarily to forecast raw material requirement and manage the bond of the logistics function. Therefore, the ability in streamlining this indicator, primarily in translating all input of operation to a better output in terms of physical quantities, costs and quality of products produced can increase the level of leanness in the planning domain [34]. This subsequently makes the context of LP implementation becomes more meaningful [1, 40]. Lack of focus and support of organizations in the LP implementation in driving the planning domain can cause its implementation becomes less effective or the implementation result not able to retain for long operations period of time [7].

3.2 Development

The awareness over the development domain will ensure roles, planning, processes engaged and tools used in implementing LP have been always relevant with the current operations was in a steady state condition [18]. This will help to reduce or eliminate any interference or obstacles over the implementation strategies that have been developed. At this stage, the development domain also can be used to evaluate the performance of teamwork, skill

development and process control in formulating a more productive and flexible plan in implementing LP in a comprehensive manner [41]. The ability to emphasize this domain is crucial in ensuring the setting goals are achievable. This subsequently can provide the opportunity to identify any implication from the strategy employed, so any issue occurs can be well handled at an early stage [33, 35].

The aptitude to determine and distinguish the element of waste and value of each process must be adequately streamlined in ensuring the development domain can be well developed. This will ameliorate the efficiency in managing the variability of control in supply chain and processing time, which was mainly influenced by the changes in demand. Therefore, the action in differentiating the waste and value must be regularly performed. This could include the operational flexibility, people, process control and optimisation [11, 20]. For a better result over development domain, the process of differentiating waste and value can be realized based on seven basic of waste (defects, overproduction, transportation, waiting, inventory, motion and over processing) in developing a more holistic strategy in the LP implementation process [16]. This will potentially increase the ability to eliminate the waste, increase the level of responsiveness and offer the opportunity to implement the best practice in manufacturing operations [6, 8]. The stabilization of this indicator can reduce the production time, improve the flow of the production floor as well as increase the reliability of data in strengthening the domain of development [14].

The process of identifying waste and value potentially becomes valuable if this process is expanded in the continuous improvement program. The ability to actively engaged in the continuous improvement activity is very beneficial in supporting the strategy and techniques in streamlining the operational flow under the development domain [25, 42]. This further turns the continuous improvement activity as one of the key indicators in increasing the manufacturing capability in achieving better performance outcomes [10]. This is due to the implementation of LP does not only need to rely on singular concept, but must cover all aspects, including management and operational level [43]. The effort in promoting the culture of continuous improvement will encourage the front line staff to take control of their own work [7, 24]. This was important primarily in ensuring the development of the LP can be reinforced to attain high performance in managing the production operation.

As well as emphasizing the focus on internal indicators, the implementation of LP also must consider the influence from external indicators such as the commitment in developing the links in the supply chain. At the development stage, this indicator plays a vital role in ensuring the collaboration between manufacturer and supplier can establish an efficient partnership in term of efficiency and flexibility in increasing the competitive advantages [28]. However, the commitment against this indicator is still at low level and was influenced by the size of manufacturing organizations. This was supported by Bhasin's finding [44] which stated that the higher commitment in the supply chain is dominated by large organization (74 percent), followed by a media organization (53 percent) and small organization (47 percent). This variability depended on the ability in confronting with the extraneous issues of supply chain. Any improvement plan that link with this indicator must be always emphasized in overcoming any issues professionally. Lack of action in strengthening this indicator can lead to weak linkage of information flow and the relationship between supplier, manufacturing organization and customers. This will bring risks to the manufacturer in supply chain issues (such as shortage of material, poor material quality), and then cause the manufacturing operation to be disrupted [37]. It also can increase the chances of error in projecting the required material, resources as well the logistics issues, especially in fulfilling the diversity of customer demands [39]. Therefore, the commitment that encompassing the suppliers, manufacturers, distributors and customers must be well integrated and strengthened [36]. The proactive action in streamlining this indicator will allow better coordination in getting the optimum effect of LP implementation under the domain of development [26, 29].

3.3 Evaluation

The manufacturer must be capable to stabilize the evaluation domain since it is critical, primarily in measuring the performances and the implication of the strategy that is formulated at the planning and development stage. This domain must be consistently evaluated on all manufacturing operations, either in the moderate way or radical in measuring the impact of LP implementation against the production floor's performance and financial performance [18, 45]. This is because the evaluation process was the best approach in identifying whether the goal of implementation is achievable or not.

The main indicator that should be always emphasized on strengthening the evaluation domain was the level of communication. This domain seen to have a vital role in increasing the accuracy and reliability level of the information flow, mainly when manufacturers need to adapt various approaches and techniques of LP in the manufacturing operations [11]. In fact, Magnier-Watanabe [1] claimed that the ability in establishing the effectiveness of communication was a critical element in improving the success of the operation, and strengthen the relationship between all parties in manufacturing organizations. The capability to improve this indicator periodically will expand the communication channels, primarily in decision making processes in getting the best result from the LP implementation. According to Welo *et al.* [2], the ability in streamlining the level of communication has high influence in reducing the risk

of failure of strategy that has been developed, improved the quality, increased the productivity and enhanced the level of knowledge transfer. This will ensure the LP was not being implemented in the opposite direction in cultivating a high commitment in establishing a better work environment [27]. Lack of awareness in streamlining this indicator does not only reduce the performance of the evaluation domain, but also can create a conflict that can cause the quality and productivity of manufacturing operations at low level [22].

The ability to accomplish good practice in assessment and monitoring at production floors is crucial in strengthening the LP implementation process. The focus in this indicator will enables manufacturer to closely monitor all the strategy employed, and evaluates the impact of the LP implementation effectively [5]. The evaluation process must cover all related activity includes work content, work organizations, continuous improvement activity and the health and safety aspect at work place [17]. This indicator is emphasized especially when the current manufacturing system practice has changed or modified. Meanwhile, the monitoring activity in the LP implementation phases should be implemented over the awareness level of management, criteria in assessment and strategic planning, conceptual design and basic phase of planning [15]. The focus must include both tactical and strategic plan that has been implemented [20]. This will allow manufacturers to respond with any discrepancies that were caused by the suppliers, customers or government regulations [26, 39]. It has further allowed manufacturers to evaluate the current performance, and use it to formulate a more holistic approach in expanding the implementation impact of LP [44].

The manufacturer also needs to regularly evaluate the work environment in ensuring the implementation of the LP can provide the optimal advantages in manufacturing operations. The appraisals of work environment must be emphasized in LP implementation phase since it is closely aligned with the performance of work produced [17]. The evaluation result of this indicator is useful in channeling the required information in designing the work stations, primarily to meet the standards of ergonomics and the aspect of safety and health [23]. It not only allow manufacturers to improve the comforts in the work environment, but also can boost up the employee motivation in the cycle of work performed to attain the optimum work performance result [24].

In verifying the implementation performance of the strategy implemented, the manufacturer must always consider to evaluate the capability of the manpower in accomplishing the assigned tasks. It is crucial in ensuring the workload is uniformly distributed, especially in a complex manufacturing environment. The ability to regularly evaluate and strengthen this indicator will help manufacturer to stabilize the process as well as increasing the competency in adapting the LP in manufacturing operations [10]. This information is useful in measuring the complexity of the process, the availability of time and the team size required in implementing the strategy that was planned. It does include the consideration on the availability of the workforce and the level of interaction between work instruction with work standards or standard operating procedure. The capability in increasing the index of flexibility and possessing a workforce with a diversity of skills can increase the versatility of job rotation in the LP implementation phase [7, 31]. This will allow manufacturer to allocate sufficient resources in controlling the quality and improving the productivity. As a part of the indicator in the LP implementation, the ability to streamline manpower capability can provide the optimal impacts over the long term of the period of its implementation.

Moreover, the employees' commitment in the LP implementation also should be evaluated. This can become a valuable indicator in evaluating the employee's satisfaction in developing the best approach in strengthening the LP implementation process. It also can be used to develop the best method in creating the flexibility of work which is always relative with the LP technique used [13]. The ability to evaluate this indicator will provide the opportunity in identifying the gap between work standard with the current situation in minimizing the violation effect against the designated work procedure [5]. This will help manufacturers to handle any disruption of the procedure at the early stage with more holistic and transparent measure. The evaluation should include the level of motivation, satisfaction, anxiety, task control and so on [24]. According to Losonci *et al.* [18], belief, commitment, work methods and communication were the factor that should be considered in evaluating the confidence of employees with the adaptation strategy that has been implemented. This is due to the implementation of the LP that have a high dependency level on roles of employees in implementing the LP strategy that has been employed [21].

3.4 Execution

The process of strengthening the execution domain can become a great challenge, especially in ensuring the plan and the strategy that was defined at the planning and development phase can be well adopted and streamlined. The monitoring and evaluation process must be engaged with each other in this domain in ensuring the objectives of the LP implementation are achievable. This can be a very tight process, especially in integrating the technique and strategy at the beginning process of the LP implementation [1]. Lack of awareness over this domain can cause the implementation process of several techniques of LP to be difficult in controlling the necessary resources to support each strategy that is being developed [37]. At the phase of execution, the capability to change the behaviour and mindset of the employees were a great challenge that must

be prioritized in adapting new working environment. Thus, this domain must be given an extra care, primarily at the beginning stage of its implementation. This ability will dramatically help to improve the operational outcomes and financial performance, mainly in term of inventory management, the production of quality products and reducing the product throughput time [46].

The ability to define the role of management in supporting the implementation process of the LP is important in strengthening the domain of execution. This will affect the success in adopting various LP techniques such as Just in Time (JIT), Kanban and etc. [12, 38]. The focus in streamlining this indicator is also able to increase the level of contribution of the management in reducing the marginal cost of operations [47]. This is due to the implementation of the LP does not only rely on manufacturing function, but also how this practice can be integrated in various sizes and types of manufacturing operation [20]. The consideration of this indicator can be very crucial especially for organization that has different sections, but share the same goals in the LP implementation. Furthermore, the level of management practice in adopting LP can also influence the effectiveness in managing the resources, flow of information and the adoption of techniques in realizing the implementation of LP [13, 19]. Moreover, it is very beneficial in simplifying the process and enhancing the data integrity [10]. Conversely, the weakness in management practice can cause the basic foundation in implementing LP could be interrupted or unsuccessful [8]. Therefore, the focus on improving the level of management practice must be aligned with the strategy appointed in order to obtain high impact over the LP implementation [20].

The manufacturer also must always improve and update the effectiveness of standard of operation procedure (SOP) used at operational level. This is to ensure any changes on the work procedure or reassignment of the task in improving the level of implementation of LP can be well understood by all employees or section involved [24]. Furthermore, it will help to balance all the processes and the procedure employed, and eventually improves the manufacturing operations performance. This further allows the operational activity such as the flow of material, storage and quality control are executed in a comprehensive manner [7, 42]. As a result, the operational deficiencies are reduced or eliminated, and new strategy able to be developed in improving the manufacturing operations performance. As a part of the continuous improvement activity, the ability to improve and update the SOP also will ease the monitoring and evaluation process [25]. This will become more critical when the process involve in the LP implementation consists various types of function and activities, primarily involving with job rotation [5]. The ability to always monitor this indicator will also ease the process of evaluation of each operational parameter such as an operational cost, efficiency of the production floor, material utilization capacity, lead time, cycle time and inventory level. This eventually will ensure the manufacturing process and operational responsibility becomes more transparent and well defined in increasing the production output [18].

The accuracy in the selection and the development of the LP strategy and technique will not only avoid the process from becomes more complicated, but conversely will simplify the operation that was being performed. This will provide sufficient space for the process of improvement, particularly when involving with the control of materials used and the formulation of the strategic plans in the supply chain and maintenance activities on the production floor [13, 25]. The ability to select an appropriate manufacturing system will increase the capability of the manufacturers in addressing the manufacturing complexity as well resolving any problem occurs harmoniously. This will allow manufacturers to increase the level of responsiveness as well as producing high degrees in products customizations. In synthesizing this domain, high level of managerial action, high control of manufacturing operations and high awareness in implementing improvement activities is desired [8]. It does not only cover the internal systems, but the interaction with the external systems variability is also required. This is due to the implementation of LP must compose of highly integrated systems of interrelated elements in achieving the optimistic impact of LP implementation [6, 43]. This indicated that difficulty in streamlining this indicator appears when manufacturers always assume the production system must operate based on pure technical systems. Therefore, wise decision in the selection of the suitable manufacturing or production system is required in ensuring the resources can be facilitated easily, as well as increasing the level of acceptance over any changes in the systems [18] [15].

4.0 CONCLUSION AND FUTURE RESEARCH

This article discloses that the process of synthesizing the LP can be streamlined through high focuses against four domains, namely planning, development, evaluation and execution. The ability in streamlining all these domains potentially increases the stabilisation rate of the LP implementation process. In fact, it will become more effective if manufacturers can streamline all the indicators that contribute to each of the domains outlined. This is due to both domain and indicator was seen to serve as the acting force that is required in retaining the LP implementation performance. The desire to stabilize the supply chain, increase the commitment of the supplier and awareness in implementing the continuous improvement activity could increase the operational performance in manufacturing organizations. This will absolutely assist manufacturers to distinguish between value and waste in production floors in increasing the efficiency in managing the manufacturing operations. This explicitly brings

positive impact on the LP performance against the workflow at production floors, thus allowing this practice to attain the stability at every implementation stage continually and comprehensively.

For future research, this information can be used comprehensively in a field study to validate each of the domain and indicators that were identified in synthesizing the LP in Malaysia's manufacturing sector. This will provide clear information that was required in developing a better strategy in enhancing the adaptation of the LP, particularly in achieving the sustainability in manufacturing practices. A comparative analysis between the information that was disclosed in this article with the results obtained from a field study will provide more information in developing the best platform in improving the overall performance of manufacturing operations, particularly in establishing a more competitive manufacturing practice.

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