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# Change Agent System in Lean Manufacturing Implementation for Business Sustainability

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**Abstract**— This paper aims to propose a model of change agent system in lean manufacturing implementation to achieve organizational sustainability in terms of knowledge co-creation process with employees by changing their behavioural and mind-set thereby increase organizational performance. This study conducted multi-case design which contains more than a single case company viz., company A and company B are presented here. Results demonstrated with mentioned concept. Lean manufacturing accomplished by change agent system in manufacturing industry. The mentioned system is a promising way to ensure the translating of lean concept and its implementation to all workers in the company, by this means company achieving lean manufacturing culture to offer desired services to customers. This research contributes to create strategic corporate ways to succeed in lean manufacturing implementation by making knowledgeable and skilled human resource with the integrating of change agent system that will ensure value creation and organizational sustainability. There have been few scientific studies and research done on the mechanism involved in the change agent in lean manufacturing implementation. Our proposed model of change agent system to translate lean manufacturing concept is original and unique in practical field.

**Keywords**— *Change agent system, Lean manufacturing, Organizational performance, Knowledge value creation*

## 1. Introduction

Lean manufacturing is not a new concept. In the past decades, the concept has progressed from technical oriented to human oriented. The human elements in lean manufacturing share the destiny relations and team-work which include labour flexibility, multi-skill and greater responsibility in the maintenance, quality improvement and personnel issues [1]. From the year 2000, the lean concept has been involved to a greater degree of contingency and the scope has been enlarged to include the organizational learning perspective. Some analysts such as [2] and [3] believed that the

lean concept has a greater chance to progress and mature in the future. The evolution can be likened to organizational learning which take place through a phased process. [4] believed that, the lean manufacturing is a multi-facet system. The integrated nature of lean system includes both people and process components. It is also related with the firm (i.e. internal), and supplier and customer components (i.e. external). [5] in his analysis on Toyota, identifies that lean operates on two main principles: “continuous improvement” and “respect for people”. Many senior managers outside Toyota has ignored and misunderstood the “respect for people” compared to “continuous improvement” [6]. According to [7] and [8], lean manufacturing is rooted from Kaizen or continuous improvement mindset which requires the skills and a shared way of thinking to systematically eliminating waste and improving activities’ value. Therefore, the lean concept has progressed to a stage that includes the knowledge-creation management, which aim to create a learning organization where people are the soul of lean process [9-10]

Misunderstanding of the real concept and purpose of lean manufacturing is one of the main barriers of lean manufacturing implementation. [11] and [12] suggest that the reason of this misunderstanding is due to cultural differences that occur during transition or translation of the lean concept during the implementation. The misunderstanding of the concept leads to various major issues such as piecemeal adoption of lean tools and techniques [12], misapplication of lean tools [11,13], and lack of lean culture development that support the lean manufacturing in the organization [3].

The change to lean manufacturing system is a radical process and not an easy task [14]. In order to create the foundation for lean manufacturing to take hold, a significant organizational change must occur within the organization. According to [15], the process of lean transition requires significant changes in the functions of the company.

In lean manufacturing system the lean process begins by having a change agent system. The process of change within an organization is derived

fundamentally from the ability of a set of individuals within that organization to modify the behaviours (thoughts and actions) of others. 'Change agent system' is a system to assist the translation of change process so that it could be understood by all people in the organization [16-17]. The system can be initiated either from internal cross-functional team or external consultant team. According to [17] and [18], 'team building' is the key factor for successful plans of action. For effective change, a strong team with a strong leader should be developed. Study on the role played by change agents in the transfer of lean manufacturing techniques discovers that without the support of management the lean transformation in a company will fail even though the change agent have the determination for effective intervention [17]. [16] agreed that the support of consultant also contributes in initiating lean transformation. The main objective of this system is to spread the motivation and ensure the translation is understood by all people in the organisation for the change to lean manufacturing system. However, entirely depending on external consultant is not advisable for the long-term success of the organization. [18] found that as the consultant left the company, the effort to lean is faded away. This is because the lean activities were entirely driven by the consultants. Consequently, no fundamental change in the mind - shift and commitment to lean is transferred to the employees if it is driven by the consultants.

However, there has been few scientific studies and research done on the mechanism involved in the change agent system in lean manufacturing implementation. The role of change agent is crucial in lean transition. According to [19], lean change agent must be sensitive to change issues. The reasons are most of the employees are not familiar with lean work environment, and it requires a behavioural and mindset change due to the different expectation for performance and value. Therefore, this research attempts to investigate the role of change agent in lean manufacturing system and how the team development could help the company in the successful lean manufacturing implementation.

Therefore, this work aims to investigate the role of change agent system in lean manufacturing implementation. It also aims to develop a model of change agent system in lean manufacturing implementation that reveals value creations and ensure to increase organizational performance leads to business sustainability. The rest of the paper is structured as follows. Section 2 describes the methodology of this research. Section 3 describes the data analysis and findings. Section 4 verifies and analyses real-life cases with regard to

implement lean manufacturing by integrating change agent system, and the final section concludes the paper with a discussion and summary.

## 2. Research Method

This study employed multi-case design which contains more than a single case company. The reason for choosing to do multiple case studies is the evidence from multiple case is often considered more compelling and robust as compared to single case study [20]. Another reason is the replication logic that only can be done in multiple cases. In addition, [21] stated that multiple-case studies are usually employed for comparison purposes. By investigating the distinguish characteristics of two or more cases, the contrast and similar findings could provide rich information on the research focus.

The data collection for this study employed two different sources of evidence: documentation and interviews. According to [22], a good case study should use multiple sources of evidence. If the entire evidence are used properly, they could assist to deal the problems of establishing the construct validity and reliability of the case study. In this study, the evidence of organizational change issues in lean manufacturing was collected using two different sources such as interview and direct observation. The advantages of multiple sources of data collection techniques are: to address a broader range of observational issues, the development of converging lines of inquiry and a process of triangulation [22]. Therefore the finding or conclusion of the case study will be more convincing and accurate.

In this study, the focus is on Malaysian manufacturing companies that implement lean manufacturing. The criteria of the company are: (1) implementing or attempted to implement lean manufacturing system, and (2) has at least one specialize department or unit in supporting lean manufacturing system. The respondent involved should be someone who is very familiar and experience in lean manufacturing implementation in the company. The data also obtained from site observation, and company's newsletter, in order to get the broader view and information regarding the role of change agent in lean implementation.

## 3. Data Analysis and Findings

Two Malaysian manufacturing companies were chosen for conducting in-depth interview. These companies were selected based on the criteria determined before and their willingness to

participate and experience in lean manufacturing implementation. Therefore the results of this multiple case study do not represent the actual overall situation of Malaysia's automotive industry. The author prepared the data collection by first contacting each company to be studied to gain their cooperation, explained the purpose of the study, and recorded the key contact information. A semi-structured interview guide was developed upon a common case study protocol inferred from the review of literature, and quantitative survey done prior to the case study. The interview protocol was developed to inquire the objectives of this study as shown as Appendix A.

To improve the research reliability, the same interview protocol was used to different interviewees for triangulation purposes. The need for triangulation arises from the ethical need to confirm the validity of the data obtained [22]. All interviews were in the form of a 'one to one' discussion that lasted approximately two hours for each respondent. Each interview was recorded and transcribed. The respondents involved were the key personnel in the company that directly involved in the implementation of lean manufacturing. They were questioned with regard to their actual experiences. For consistency in the data and its interpretation, the interview structure was provided. Table 1 summarized the respondent's background information that involved in the study.

**Table 1.** Interviewee Background Data

	Position	Year of employment in the company
<b>Company A</b>	R1 - Engineer Manager	16
	R2 – Chief performance staff	35
	R3 – Industrial Engineer	4
<b>Company B</b>	R4 - Lean Manager	5
	R5 - Lean Executive	4
	R6 - Lean Executive	3
	R7 – Lean Executive	2

A plant tour was requested at all visited companies. During the tour, the lean activities involved were shown and explained in detail. Whenever possible, the observation was made on the lean manufacturing implementation in the company, and the role of change agents. The information gathered was written down in a log book with the summary of the interviews. All companies involved insisted on no photograph regulation during the tour. The

purpose of these observations was primarily to verify the information collected from interviews.

## 4.0 Findings

### 4.1 Case Study 1: Company A

#### 4.1.1 Company Background and Structure

Company A was a USA based multi-national company. With nearly 40 years of corporate presence in Penang, Malaysia, Company A has established itself as a leading provider of mission critical communication and mobility solutions provider for government and enterprise customers. The company has three sites operating a world-class Integrated Manufacturing, Design and Development, and Distribution Centre in Penang as well as a Corporate and Sales office in Selangor. Currently, the operations in Company A include extensive manufacturing, design, development, and distribution of the company's global product.

Set up in 1974, both manufacturing operations and the product development functions have achieved ISO14001/ ISO9001/TL9000 accreditation. The facility in Penang is the company's only one in Asia Pacific that caters to two-way radio manufacturing, and acts as a one-stop radio communication solutions centre. It is equipped for the design, development, manufacture, distribution and support of its two-way radio products and solutions. The Company A's Design Centre in Penang was the first two-way radio design centre in Malaysia and the only one in Asia with over 30 years of R&D expertise. It is also equipped with state-of-the-art laboratories for conducting rigorous product compliance tests for radio communication products.

Company A actively contributes to the Economic Transformation Plan (ETP) in the Electrical & Electronics (E&E) sector, R&D and innovation that can help accelerate Malaysia into a high-income nation. It is one of the active founding members of Collaborative Research in Engineering, Science and Technology Centre (CREST), an important component of the ETP, designed to accelerate the development of Malaysia into an innovation-led, knowledge based economy.

#### 4.1.2 Lean Activities

In Company A, the Lean Office is driven by one engineer manager with six industrial engineers. The task of engineer manager is to encourage innovation in problem solving. Whereas, the job function of the lean team was to keep improving the production line in aspects of design, cost and continuous improvement. The main function of Lean Office was to drive the lean culture transformation in the company. According to R2,

there are three ways to make lean as a culture which are education or knowledge, monitoring and mentoring. To ensure the objective achieved, the Company A's Lean Office has divided the factory into value streams. The value streams were based on group technology as they have similar processes. The main aims were to reduce waste, continuous improvement and production line optimization. According to R3, "The Lean Office in Company A believes of five dimensions of lean. These dimensions are value stream, which mean create value stream mapping, management and culture, material transformation, error proofing or poka yoke, and Kaizen."

In Lean Office, the lean team focused on product portfolio and divided the tasks according to value stream mapping (VSM). For each process, consists of a manager and VSM team. Usually the VSM team consists of the owners of the process such as engineers and operators. To keep improving the production line, the lean team will talk with the operators to find problems or waste identification. Sometime video of the processes was taken and scrutinized. Next, the brainstorming sessions were done to fine the solution and improvements. After that, the process and workers were divided by value stream into VSM team. Each team has different type of project and they need to solve the problem together. Extremely difficult problems were done by the lean team. This process is called Kaizen. The role of lean team was to facilitate the Kaizen process. All workers were expected to practice Kaizen and give suggestion to Lean Office. Every month, the lean team will have a large meeting for lean review. In this meeting, the lean team will share findings, and planning with all VSM team members.

Another main activity of Lean Office is to provide training about lean manufacturing to all workers in Company A. Before the lean team was able to be a lean trainer, the members need to attend lean training. The basic lean training package was in-house training, which was given by the Engineer Manager as the lean champion in Company A. The training generally conducted for two weeks. This training also includes the visit to other lean factories or known as Training within Industries (TWI). The purpose of this training was for learning and benchmarking. Other than the training by Engineer Manager, the lean team was encouraged to actively searching other external trainings or workshops that could enrich their knowledge not only in lean tools and practices, but also other industrial engineering tools.

Regarding the training for other workers, the lean trainings were only done to newly employed operators. The training contents were basic lean concept, one piece flow, 5S and Kanban. This type

of training was given by lean members. There were also online trainings for all workers except for operators. At the end of training, there will be quizzes. The passing marks were 80%. If the marks obtained below than the passing marks, the workers would not get the salary increment.

Company A also very concerned about the workers' motivation. Previously, the workers were given a food coupon when they were doing a good job. However, the top management had changed to have an annual party for those who had shown a good performance.

#### 4.1.3 Challenges

There are many challenges faced by Company A. The main challenge is how to sustain the lean success. According to R2, lean implementation in Company A has started in the last four years. For the past four years, so many improvements were done to the production line. However, things are getting harder. The company has achieved a lot of improvement, and it is hard to improve further. As mentioned by R2,

*"Once you have plucked away the low hanging fruits, to make improvements are getting harder."*

Another biggest challenge is to change the workers mind-set, especially those who have been working for more than 30 years in the company. The resistance to change the way of doing work among the workers were common. According to R1, the company has not achieved successful lean culture transformation. The main reason is due to ineffective training. Therefore, the lean department would like to review the training curriculum, especially on lean basic. The current training on lean basic is just for two hours.

## 4.2 Case Study 2: Company B

### 4.2.1 Company Background and Structure

Company B is a joint venture company based in Kedah, Malaysia, owned equally by The Boeing Company and Hexcel Corporation. It manufactures of flat and contoured primary (Aileron Skins, Spoilers & Spars) and secondary (Flat Panels, Leading Edges, Trailing Edges & MISC: Components) structure composite bond assemblies and sub-assemblies for aerospace industries.

The lean management concept has been implemented since the operation of the company. This is because it is a subsidiary of Boeing. As the parent company is already implementing lean concepts, therefore the subsidiary company also needs to implement it. However the level of implementation varies. The lean management

activities in Company B are coordinated by four personnel. It consists of one manager and three executives. The role of the manager in general is to plan the improvement program for the whole year for all areas in the organization and monitor the activities. He also needs to lead the Lean Production Office (LPO) to compile all the proposed projects of that year and convert them to a master project. Next, the selected projects will be scheduled for implementation for the year.

The roles of three executives depend on area of expertise. Executive R5 mainly responsible in 5S activities, Total Preventive Management and Self Managing Team. While Executive R6 main responsibility was arranging and providing Kaizen workshop and training related to lean management. The trainings are divided in few categories such as training for new employed employee, refreshment training for senior staff and also upon request training. Another executive, Executive R6 was responsible towards production preparation process such as Production Preparation Process (3P) and Visual Stream Mapping (VSM). Four of them are considered as the lean team for the organization and reported all the activities to General Manager of Company B. The lean manager was also considered as lean leader. He was trained by lean experts from the parent company. While the lean team trained by lean leader and being monitored by lean representative from the parent company.

#### 4.2.2 *Lean Activities*

Lean activities for continual improvement are planned for a period of 5 years ahead. The target is reviewed on a yearly basis. Every year the target will be increased from the previous year. The planning is comprised of all the lean management activities. The common and popular program is 5S. 5S activities are part of organizational culture. Any new employee employed the first training is 5S. 5S is the basic and fundamental for lean management. The organization has incorporated the 5S implementation as departmental key performance indicator (KPI) together with cost saving target. This target will be part of organization KPI.

In order to ensure the success of 5S implementation the auditing activities are conducted on a monthly basis. The auditor is from the owner of the workstation and also Executive R5 from lean team. Executive R6 will assess the 5S performance in each area and give the final result. He also will give advice to improve the area in order to meet the organization's target.

Beside the 5S activities other lean tools been implemented in Company B such as TPM and Self Managing Team are also implemented. However, not all departments participate in TPM activities as

the tool is not related to the department. Another lean tool implementation is the application of 3P concept. This concept involves the planning of new project. During the interview, the current 3P concept was applied in new factory building to suit with lean concept. It involved in further identifying any improvement that related to changing in machine layout or improves process flow. VSM is another tool that applied in Company B. However the application of VSM is not comprehensive. This is mainly due to lack of knowledge about VSM among lean team members. Further training on VSM is required by them. Kaizen is also part of continual improvement activities that implemented in Company B. These activities are focused on the short term improvement, especially at a work station. The generated ideas for improvement are given by the owner of the process. Lean team only assists and guides them on how to conduct the improvement activities. In order to ensure that the lean activities become a culture in the company, there are various initiatives have been taken by the lean team to promote the lean concept. Among other initiatives are employee suggestion scheme, lean quiz, Kaizen competition and also 5S competition.

#### 4.2.3 *Challenges*

The main challenge in implementing lean practices Company B is human which related very much to employees. It is very difficult to change people mindset and their perception. They have thousands of reasons not to follow instruction, especially it is required them to put additional effort and time. An organization unable to satisfy the entire employee's expectation, hence certain decision made by the superior may not be accepted by some of the workers. This could result in demoralization which affects the team work. Beside that the communication between top management and employees were not shared properly. Where some information should be shared together with the employees were not done, especially about the direction of the organizations which involving employee participation and commitment. The employee involvement in decision making was also not encouraged.

Another challenge can be highlighted is the organizational culture. The working culture Company B cannot bring everybody in the organization to work towards achieving the organization's target. The working culture very much related to individual beliefs and perception. The role of leadership is also an important element in deriving everybody to achieve the organization's target. The competent leader is able to bring every employee to belief and guide them to achieve their key performance index (KPI) and at the same time

lead to organization's success. In this case of Company B, top management has a different focus and lead to different direction.

## 5.0 Discussion

### 5.1 Role of change agent system in lean manufacturing implementation

The process of change within an organization is derived fundamentally from the ability of a set of individuals within that organization to modify the behaviour (thoughts and actions) of others. The change agent system is a system to assist the translation of change process so that it could be understood by all people in the organization [16-17]. All the two respondent companies, Company A and Company B have established a team or department that is responsible in lean manufacturing implementation with permanent staffs. The main tasks of this team are: to execute improvement activities which usually based on a project basis; encourage teamwork in every lean activity; give advice and monitor departments' improvement activities, and provide training in lean manufacturing. As described by Respondent R1 from Company A:

*"To make this (lean transition) effective, this person (lean leader) must understand lean. Clearly understand. A lot of people just attend the training but misinterpret the concept. They only have the theory but not practical. As a lean leader, to execute all these (lean) activities, you must have hands-on knowledge."*

Therefore, the role of change agent is crucial in lean transition. According to [19], lean change agent must be sensitive to change issues. The reasons are most of the employees are not familiar with lean work environment, and it requires a behavioural and mindset change due to the different expectation for performance and value. As mentioned by Respondent R4 from Company B, the lean change agents need to be creative.

In lean manufacturing system the lean process begins by having a change agent system. Next, team building is a crucial element for successful plans of action [17-18]. From both case companies, it is clearly shown that the lean activities were not only the responsibility of lean team. Smaller teams were developed to do the problem identification, brainstorming and problem solving. This team must be a cross-functional team and focus on continuous improvement. In order to empower the team members, training on lean principles and lean tools are essential. Appropriate training on concepts and basic principles, and reasons of lean could give a greater level of understanding of lean and

encourage motivation and innovation in the work culture and employee attitudes [23-24].

Therefore, another main role of change agent is conducting lean training to the workers in the company. Both case companies agree that training is one of the main roles of lean department. A study done by [25] shows that change agents are important links in that learning process. Change agents should incorporate different ways to interact and exchange information between people from different departments, to engage all the people in the organization [25]. Without workers' good understanding of Lean Manufacturing, it is not likely that company achieves effective Lean Manufacturing operation [26].

### 5.2 A model of change agent system in lean manufacturing implementation

In this section, the author proposed a model that developed from a review of literature, and case studies conducted, as shown in Figure 1. The model will be used to guide on the change agent system for smooth lean manufacturing system implementation. The purposes of this model are to provide a virtual understanding of the role of the change agent system, and also to aid the lean implementation into the companies.

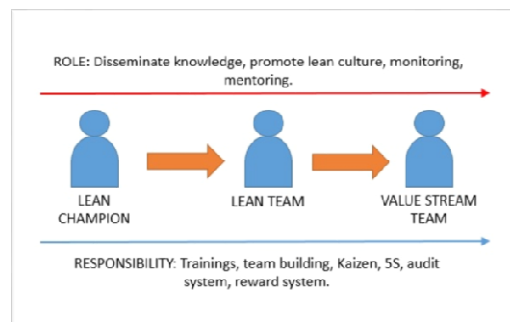


Figure 1: Lean change agent system model

The main element of this model is the lean change agents. These change agents are the people who are responsible in assisting the translation of change process so that lean manufacturing concepts could be understood by all people in the company. The lean change agents can be divided into three categories: lean champion, lean team and value stream lean. Lean champion is the leader of the change system, which in this study focus on change to lean manufacturing system. The second category is the lean team. The lean champion does not be able to play the role alone. He needs a team to assist him in translating the change process in the company. For effective change, a strong team with a strong leader should be developed. The lean team does not have to be a big group. Finally, the third

category is value stream lean. In order to reduce waste and optimized the production line, workers' involvement are crucial. By sharing the responsibility with more workers through the value stream in the company, the workers could be empowered. This somehow could give greater levels of understanding lean manufacturing, thus encourage motivation and innovation in the work culture and workers' attitudes.

The second element is the Role and Responsibility. The role of change agents disseminates lean knowledge, promote lean culture, monitoring and mentoring workers during the implementation of lean manufacturing system. In addition, the responsibility of the change agents are to conduct lean trainings, engage team building and team work in solving problems, promote Kaizen and 5S, and also develop the audit and a reward system. All change agents need to really understand the roles and responsibility of their position. This is to reduce unnecessary resistance and conflicts during the implementation of lean and thus improve the change of success.

## 6.0 Conclusion

In this study, the authors have highlighted the importance of the change agent system in the implementation of lean manufacturing system. As supported by previous literatures, change agent is a crucial factor to spread the motivation for change throughout the organisation. This study also has developed a model of the change agent system in lean manufacturing implementation. The proposed model would serve as the basis for further empirical research and validation. In addition, this model has important strengths because it explicitly frames the role of the change agent system in the context of lean manufacturing implementation. Therefore, the model may represent a novel framework for explaining the change agent system, and also the role and responsibility of a change agent in lean manufacturing context. On the other hand, often practitioners are very keen to implement lean manufacturing system especially SMEs but the process of implementation is full of challenges and resistance. The model of lean change agent system is intended to provide practitioners with a better understanding of the lean transition and a clear guidance to minimise the resistance and conflicts for the implementation of lean and thus improves its chance of success.

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## Appendix A

Interview section	Content
Respondent information	<ul style="list-style-type: none"> <li>• Description of the interviewee, their involvement in the lean transition and their function in the organisation</li> </ul>
Implementing lean manufacturing	<ul style="list-style-type: none"> <li>• Please describe the implementation of the lean manufacturing techniques in this division (plant)?</li> <li>• Please describe the LPO structure and role in the company?</li> <li>• What are the lean initiatives involved in LM implementation?</li> <li>• What are the trainings involved in LM implementation?</li> <li>• What is the key lean manufacturing metrics/performance measurement in the company?</li> </ul>
Role of lean leader	<ul style="list-style-type: none"> <li>• Where do you get the information/knowledge about lean manufacturing?</li> <li>• What is your perception of change to LM?</li> <li>• How you lead the change to LM?</li> <li>• Are you aware of the resistance you have to deal with?</li> <li>• Do you get the enough support from the management, lean team and workers?</li> <li>• Looking back, were there any conflicts occurs during the transition? How you handle it?</li> <li>• How you motivate and sustain lean manufacturing in your company?</li> </ul>
Role of lean team	<ul style="list-style-type: none"> <li>• Where do you get the information/knowledge about lean manufacturing?</li> <li>• What is your perception of change to LM?</li> <li>• How you motivate other employees in the change to LM?</li> <li>• Are you aware of the resistance you have to deal with?</li> <li>• Do you get the enough support from the management, lean leader and workers?</li> <li>• Looking back, were there any conflicts occurs during the transition? How you handle it?</li> <li>• How you motivate and sustain lean manufacturing in your company?</li> </ul>

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