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Lean Behavior in Implementing Lean Process Management

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Abstract: Lean is one of the popular concept has been practiced in most company. However, there are a lot of companies who implement lean are not realized whether lean level of company is improve or relegate .Thus, it is important to inspect the lean result after implementation of lean. So, this study presents to make the result comparison for lean behavior after implement lean for one year thru People development system which improves problem solving capabilities of people in eliminating wastages. Furthermore, the importance of problem solving capabilities of people in implementing lean process management also will be discussed. The survey was conduct in an aero composite manufacturer kitting department. Self-administered questionnaire has been selected to be the survey instrument. These questionnaires were distributed to 45 employees work in the kitting department. Results of feedback are collected and analyzed by using the Statistical Package for Social Science (SPSS) software version 13. The outputs of the analysis were in the form of index values, percentages and hypothesis testing.The result showed the improvement on lean behavior with the help of people development system implementation which enhance the people capabilities in eliminating wastages. These are supported by comparing the survey results on lean behavior for beginning and end of the year with the monitoring of real life data on the case study.

Key words: Lean Behavior, Lean Process Management, People Development System, Aerospace Company

INTRODUCTION

Lean is a philosophy of manufacturing that incorporates a collection of tools and technique into the business processes to optimize time, human resources, assets, and productivity, while improving the quality level of products and services to their customers Ronald, [18]. Although a lot of companies started implementing lean concept, according to Bhasin and Burcher [5], only 10 percent or less of the companies succeed in implementing lean manufacturing practices. Even though number of lean tools, techniques and technologies available to improve operational performance is growing rapidly, however a few companies that put effort to use them failed to produce significant results.

One of the major reasons for unsuccessful implementing lean manufacturing is the typical behaviors exhibited by people in the workplace, which are known to be deficient trust and gain commitment. Orr [17]. stated that the term "Lean" manufacturing seems to have forgotten the debate on human motivation, and has focused on techniques, where the emphasis has been on deploying new methods, rather than understanding how work is organized and lead. The practice of lean behavior is shown to be an essential element for producing healthy work environments that can lead to economic lean produces Emiliani, [10]. Emiliani and Stec[9]. stated lean behavior practices must apply all the lean principles where most companies failed to apply all the lean principles together to get significance result. In order for the business to enjoy the full benefits of lean, it is essential for the right behavior to exist amongst the organization's employees Sanjay and Peter, [19]. Implementation lean is a long journey process and not easy implemented. To fully benefit the company for Lean implementation, both the concept and techniques should be considered. Lean behaviors typically are essential factor should be assessed for a successful and complete implementation.

In this paper, the Lean Behaviour at an aerospace environment are evaluated to assess the success of Lean implementation thru a year. The specific objectives of this study are to compare the result lean after implement lean process management after one year and identify how the problem solving capability to make the improvement of the lean behavior of kitting department.

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The result will determine the main factor influence for the leanness of studied cased. It will make the company more understand; which is most important part in lean to increase the problem solving of employees? Which part is not done well for increase the problem solving capabilities? How important of problem solving capabilities? After that, the organization is able to improve and sustain the lean manufacturing. Besides that, the problem solving capabilities of employees will help the company to overcome the obstacle; it can let company become an energetic organization. For the long term, it will be a strongly weapon for company can competitive at international.

Lean Behavior: Lean behavior is defined as behaviors that add or create value. It is the minimization of waste associated with arbitrary or contradictory thought and actions that leads to defensive behavior, ineffective relationship, poor co-operation, and negative attitudes Emiliani, [10]. According to case study on Motorola, behavior is important to change culture to sustain implementing of lean concept. Many efforts failed due to the behavior of management. Employees will follow the management's behavior if they are ordered to do new things. Anonymous, [4].

Worley and Doolen [21]. investigated two specific variables impact on lean implementation which is management support and communication. For management support, top management should not only demonstrate commitment and leadership, it must also work to create interest in the implementation and communicate the change to everyone within the organization.

Comm [7]. states that five best practiced components must present in order to apply lean. The five best practiced components are environment change, leadership, culture, employee empowerment, and communication. The management is required to have these lean behaviors which will influence the employees to practice the five components.

Orr [17]. stated that leadership is the fundamental aspect in engaging this different approach in thinking. Leaders are not necessarily top and senior management. Leaders are employees with influence on the work, at whatever level of seniority and responsibility. A leadership must have nine lean behaviors. The nine lean behaviors are teaches and engages workgroups, Respect For people, Process Focus, Support and recognition, Lead by example, Deploy policy and objectives, Commitment to standards, Understand lean vision and principles and Support the change process. Meanwhile, there are other findings on factors that act as barrier for implementing lean concept. Emiliani [10]. stated four primary causes that management lack influence over employees; the four components are the barrier for the commitment of whole employees to implement lean concept. The four components are Trust, Communication, Processes and Environment.

Even a case study was conducted by O'hEocha [16]. on Cooke Brother Ltd manufacturing company about the influence of employee's attitudes on the use of 5S which is one of the lean tools for improvement environment management. After the company applies the lean tool in their company, employees were asked to identify the potential issues that may act as barriers to effective implementation. A survey was done by interviewing on the top management, middle management and shop floor. The top management barrier to implement the tool related to issues of communication and power. There were concerns that middle managers and supervisors may feel threatened by the perceived loss of control as shop floor staffs gain more power to use initiatives and make certain changes without consultation with line managers. Even they felt that there were difficulties when it came to making decisions regarding throwing away certain pieces of equipment and machinery that are very old, do not work and take up valuable space.

Middle management representatives commented that the 5Ss started off well but dwindled in certain areas. It was because they lost interest and it fell down on custom and practice/self-discipline. They also felt that they should have more power to make decisions relating to their positions. Shop floor felt that some employees had attitude problems, and put minimum effort into their jobs and were not bothered to use or implement the 5Ss, while others were actively involved. Besides, they also comment that their initiative was sometimes held back by their line managers. It was felt that certain line managers were fearful of their subordinates shining and potentially threatening their position. As a result, they did minimum and took no interest in the initiatives of 5S that were likely to be protected by their line managers. From the survey, it was clear to show that the management behavior is the important barrier to implement the lean tool. In Table 1, lean behaviors practices of impact lean manufacturing are highlighted.

Background of Study: The Company where the case study was conducted was incorporated on 16th August 1994. Currently, numbers of employees are 1155 person. The nature of business for this company is to manufacture composites components for aero and non-aero structures. The name of this company is changed to ABC in terms of confidential issues.

ABC was given a mandate by the government to spearhead Malaysia's foray into the high technology industry of aerospace and composites manufacturing.

Table 1.Component and lean behaviors practice of impact lean manufacturing

Authors	Component	Lean Behaviors Practice
Worley J.M. and Doolen T.L	i. Management support	- Commitment without fear, respect to people, recognition to people
	ii. Communication	- Clear communication
Clare L. Comm	i. Environment for change	- Understanding and proactive
	ii. Leadership	- Assist and coach employees, responsible
	iii. Culture	- Honest and respect to people
	iv Employee empowerment	- Given recognition for employees
	v. Communication	- Share information, understand the goal
Emiliani	i. Trust	- justice without favors some people, meet the promise
	ii. Communication	- Clear message, quick feedback,
	iii. Processes	- Clear about their responsibilities, follow procedures
	iv. Environment	- Given recognition to people, understanding people problem
Cameron	i. Leadership	- Teaches and engages workgroups, respect for people, process focus, support and recognition, lead by example, deploy policy and objectives, commitment to standards, understand lean vision and principles, support the change process

The objective of the establishment of ABC is to become the manufacturing arm for ABC's work cluster. ABC created the work cluster with the aim to provide design, manufacturing and aircraft production services to relevant industries. This company fits into the business plan by participating in manufacturing activities for sub-contract work. To date, ABC has succeeded in securing major wing manufacturing programmed with leading aerospace companies, BAE systems, specifically for the manufacture of Airbus A300, A320 and A380 range of aircrafts. The company has also secured non-aerospace composites component manufacturing of the Alvis Bridging Launch Rail in Advance Composites. Within a short span of time since its formation, ABC has emerged as a leading aerospace company in the region and a known industry player in the world.

Though ABC having start to implement Lean Manufacturing System since 2004, but there are some mistakes and frailness due to the lack of implementation which is observed as in production system, where the knowledge and understanding of lean manufacturing system as common and primary root cause problem. The whole of problems occurred throughout from the top level to the bottom. Due to this, the top management commitment, teamwork, and people capabilities in eliminating wastages are also lacking.

Furthermore, the problems occurred due to the lean implementation was not linking to the individual, department, and company's key performance indicator which was unmotivated the total employees of the company to practice the real of lean concepts. Therefore, based on this reality the lean behavior among the employees never rooted.

Effectively in the end of 2006, the company overcomes the past problems with new perspective of lean implementation by developing the integration and heuristic approach of lean concepts as a new strategy that involve all the company aspects in their operation that correlated to the KPI. The scope of study for this project is conducted only at kitting department.

Developing a New System to Enhance Problem Solving Capability: In today's competitive world, no company can afford to waste resources. The most underutilized resource of most manufacturing company is their people assets. The number one asset of any organization is also its people. In fact, people are one of the few appreciating asset an organization has. The real advantages of employee's involvement are to focus a group of employees with different perspective on a single objective that support the organization's strategic focus. The companies that develop and leverage the capabilities of all their employees will achieve better performance than those that do not. The companies that fail to unlock the potential of their workforce will be forced to carry more overhead, have more layers of management, will be slower to react to market change and opportunities.

Therefore, since we implement lean as a system in which the people functions need to be developed into a system which called "People Management Systems" to provide the capability for rapid improvement and adoption to change. Each of the three systems in framework has an own objective. The objective of the lean process management system is to identify and eliminate wastages by removing non value added activities. People management systems need to provide the capability for rapid improvement and adoption to change. Here, again, we must accept the fact that change is inevitable and that the speed with which the necessary modification are made is the deciding factor in our survival. The objective of the business management system is to apply carefully the organization's limited resources, including capital and hard assets as well as time and human assets.

Three integration elements with total employee involvement from top to bottom play an important role for sustaining problem solving among employees in practicing lean concept. It is important to create people development system (PDS) which consists of all these three elements with total involvement of people to increase problem solving capability. People management system, Business management system and

Lean process management system are integrated by principles that, in a sense, hold them together. These principles are meant to provide a framework (Figure.1) to focus the direction in enhancing problem solving capability among employees by forming as people development system (PDS) in lean process management. They are:

- Key performance indicator - KPI for every level such as company, department, section and individual levels which is link towards organization goal.
- Respect for people – Respect for people which mainly focuses on the lean behaviors that each employee in organization should build in their mind.
- Skill and Knowledge – Skill and Knowledge for employees will support them in practicing lean concept effectively and efficiently by utilizing the lean tool and techniques.

Another important element incorporated with this people development system framework is teamwork of top, middle and bottom management. The total commitment of all these three levels will enhance of problem solving capability in lean process management among employees.

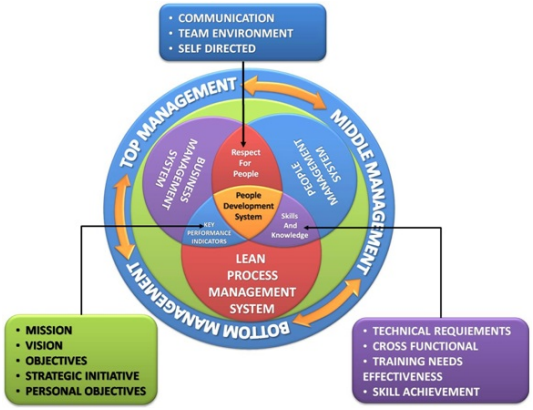

Fig. 1: PDS Framework for Enhance Problem Solving Capabilities among Employees source: A.P. Puvanasvaran *et al.,* [2].

Key Characteristic, Critical Success Factors (CSF) and Related Performance Matrix: The following key characteristics, CSFs and related performance metrics are identified A.P. Puvanasvaran *et al.,* [1] .as crucial in people development system of lean process management and are highlighted in Table 2.

- KPI in lean process management determination through Mission, Core Value, Vision, Objective, Strategy, Strategy Initiative and Personal Objective for people development system is crucial. This will align overall workforce of the company to follow for one common goal. Each level has its own portion of contribution towards the target. The results are compared with the target or goal used to measure the success of KPI. The accumulation of success from each portion will reflect the overall achievement of the company goal.
- Respect for people in lean process management is another crucial factor in developing the lean culture throughout organization. In order to measure the lean behaviors, top management commitment, leanness level of the company and perception of team member's capability, Likert-type scale is used to get the responses from respondent. For example, one can ask managers to rate the degree of support by top management on five-point scale from no support (1) to total support (5). Beside this, the problem solving capability also can be measured by counting the number of ideas generated, Level of people involved and the total cost of the project.
- Skill and Knowledge in lean process management is the fundamental requirement for employees to equip themselves. Without this they can't perform well in solving problem to identify and eliminate wastages. Lean tools and assessment techniques by using assessment criteria to determine the level of implementation using spider web chart with rating of 1 (beginning to introduce) to 5 (practice with excellent). Another measurement on employee skill metric will emphasize on employees skill and their cross functionality.

METHODOLOGY

To conduct the case study survey, the questionnaire was used which was developed by the ford motor company. The questionnaires contain the criteria of lean behavior practices based on the literature review Orr, [17]. The lean behavior practices are divided into three categories which are; respect for people (RFP), continuous learning and improvement (CL&I) and process and result driven (P&RD). This is exactly to fulfill the Toyota "4 P model" Orr [17]. For the RFP and CL&I, there are nine variables asked, and for P&RD, there are twelve variables to answer. The answers of questionnaire were using the four-point scale and circle the appropriate number. The response scale ranges from 1 to 4 representing the range of strongly agree, agree, disagree, and strongly disagree.

Table 2: An analytical framework for measuring problem solving capability in lean process management (Source : A.P.Puvanasvaran et al.,[2].

Key characteristics of integration elements	Critical success factors (CSF) of People Development System (PDS)	Performance Matrix
KPI		
	Customer Satisfaction	Achievements of KPI for each
Mission	On Time Delivery	level versus goal/target.
Core Value	Zero Defect	Productivity
Vision	Cost reduction	Customer complain
Objective	Effective Operation Cost	Scrap/Number of reject
Strategy		Attendance/ Absenteeism
Strategy Initiative		Tardiness (Schedule time)
Personal Objective		Using QCDAC principles
Respect for people		
Team Environment	Top Management Commitment	Number of ideas generated
Self Directed	Team effectiveness/formation	Level of people involvement
Communication	Ideas cost or value	Usage of lean tools
	Continuous improvements	Total cost saving projects
	Lean Behaviors	Measured by Likert-type scale on the following items:
	Rewarding system	Top Management Commitment
		Lean behaviors
		Achievement of Leanness level
Skill and Knowledge		
Technical Requirements	Produce skilled, knowledgeable and innovative employees	Lean tools and techniques assessment
Cross Functionality		Employee skill metric
Training Needs & Effectiveness		Audit by 3rd party or customers on lean practice
Skill Achievement		

The index value is used to determine the strength and weakness of lean behavior practices. The index value is calculated by formula provided by Nesan and Holt, [15].

$$\text{Index} = [(n1) +2(n2) +3(n3) +4(n4)] / [4(n1+ n2+ n3+ n4)],$$

where n1,..., n4 represent the number of respondents that indicated the respective practices on the scale 1 to 4. The formula yields indices ranging from 0 to 1, where below 0.2 represent minimum strength and above 0.8 represents maximum strength Nesan and Holt, [15].

For the second analysis is to determine the relationship or mean score of each level of management for each practice. Analysis of variance (ANOVA) is used to analyses situations in which there are several independent variables and how these independent variables interact with each other Field, [11]. Before calculating the ANOVA, one assumption must be considered is the score of variable is normal distributed.

For the third analysis, correlation is used to measure how between each principle variables are related. Before calculating a correlation coefficient, there are a few assumptions for correlation analysis which are normality and linearity Coakes, [7]. Pearson's correlation coefficient is a measure of linear association with the score for each variables are normal distributed. If the relationship is not linear and normal distributed, Spearman's rho will be used to measure the correlation between the variables Coakes, [7].

Pilot Test: Pilot test in conducted to ensure the result of the questionnaire is valid and meet the objective of this project. This is done by sending questionnaire to two lean expertise of the company. Discussion on the questionnaire was held when the company was visited. Opinion was given which help researcher to modify the questionnaire. Besides that, from the pre-test, the total time spend to answer the questionnaire also can be identified.

Sending and Receiving Questionnaire: The questionnaires send to a composite manufacturing company in Malaysia. The questionnaire is directed to three levels of the company, which are, top management, engineers and operators, and shop floor workers. For the top management level respondent, the questionnaires were answered by all department of the company. Meanwhile, the questionnaire only rated by kitting area department for the last two level respondents. The feedback is received within two weeks from the company. The total feedbacks are 53. The questionnaires send to one of composite manufacturing company in Malaysia. The questionnaire is directed to three levels of the company, which are, top management, engineers and operators, and shop floor workers. For the top management level respondent, the questionnaires were answered by all department of the company. Meanwhile, the questionnaire only rated by kitting area department for the last two level respondents. The feedback is received within two weeks from the company.

Analysis Using SPSS: After get the result from company, authors will use the software SPSS version 13 to make the analysis. In the 2nd part of the question (about lean behaviour), the outputs of the analysis were in the form of index values, percentages and hypothesis testing. In the literature review state that Emiliani and Stec [9]. explain lean behavior is applying lean principles and tools to improve leadership behaviors and eliminate behavioral waste.

RESULTS AND DISCUSSION

In order to assess the lean behavior before and after the lean implementation, a questionnaire was distributed and then an internal consistency analysis was used to evaluate the reliability of questionnaire.

Respondent Rate: The questionnaire distributed directly to the employees to do the survey. The beginning of the year (January) questionnaire was distributed to 45 employees of the kitting department. However, 3 employees already resign. Thus, the questionnaire only assigned by 42 people and the feedback collected exactly 42 respondent results. End of the year questionnaire was distributed to 44 people and collected back exactly 44 responds.

Reliability Test: Internal Consistency Analysis: An internal consistency analysis was used to assess the reliability of questionnaire. It is an indicator of how well the different items measure the same issue. The measurement of internal consistency involve for calculation of Cronbanch's coefficient alpha. The values of alpha range from 0 to 1where the value close to 1 indicate higher reliability. Alpha value should be positive and usually greater than 0.7 are considered acceptable for testing the reliability of factors.

As shown in table 3, the alpha value for the January 2007 in the three categories is range from 0.721 to 0.821. For respect for People, the scale reliability can be increase by eliminate Q02 which show 0.815. For Continuous Learning and Improvement, the scale reliability is better include all of the nine questions where any questions were eliminated will reduce the scale reliability. Last but not least for Process and Result Drive, the scale reliability can be improved by eliminate Q30 which show 0.829.

For the December 2007 the alpha value in three categories is range from 0.718 to 0.758. For respect for People, the scale reliability can be increase by eliminate Q03 which show 0.739. For Continuous Learning and Improvement & Process and Result Driven the scale reliability is better were reduced Q12 and Q23,which show 0.768 and 0.801.

Table 3. Reliability Statistic January 2007 and December 2007

Scale	N of items	Alpha if deleted	Alpha if deleted
Respect for People, Alpha (Jan= 0.790, Dec= 0.718)	9	-	
Q01		0.761	0.713
Q02		0.815	0.692
Q03		0.763	0.739
Q04		0.743	0.708
Q05		0.769	0.683
Q06		0.733	0.658
Q07		0.793	0.639
Q08		0.770	0.695
Q09		0.760	0.699
Continuous Learning and Improvement, Alpha (Jan= 0.721, Dec=0.747)	9	-	
Q10		0.705	0.678
Q11		0.681	0.767
Q12		0.709	0.768
Q13		0.668	0.730
Q14		0.681	0.717
Q15		0.708	0.703

Table 3: Continui

Q16		0.713	0.698
Q17		0.673	0.702
Q18		0.719	0.742
Process and Result Driven, Alpha (Jan = 0.821, Dec=0758)	12	-	
Q19		0.817	0.785
Q20		0.799	0.757
Q21		0.782	0.750
Q22		0.812	0.757
Q23		0.792	0.801
Q24		0.793	0.769
Q25		0.792	0.766
Q26		0.795	0.771
Q27		0.825	0.803
Q28		0.825	0.763
Q29		0.815	0.768
Q30		0.829	0.758

Although, the alpha value for the 3 categories for December 2007 is decrease when compare with January 2007, but the range is greater than 0.7, so the instrument are consider acceptable. Furthermore, elimination questions also not necessary as the alpha value is just increase slightly after eliminating. Since the alpha value are greater than 0.7, it can conclude that this instrument is reliable.

Analysis and Results: The structured postal questionnaire survey was designed to assess initial literature search finding concerning the 30 practices, in two different dimensions. Dimension 1 investigated the strength and weakness of lean behavior practices within the organization. Dimension 2 explored the relationship between the lean principles. For each dimension, four Likert scales ranging from 1 to 4 were provided and the scale was used is agreement scale. Agreement scale is used to determine agreement on of the 30 lean behaviors practices, the scale ranged from 1 (strongly disagree) to 4 (strongly agree).

Analysis of Strength and Weakness of the Lean Behaviors Practice: Data obtained from the survey were subjected to relative index calculations for agreement factor. The relative index was calculated by using the formula:

$$\text{Index} = [(n_1) +2(n_2) +3(n_3) +4(n_4)] / [4(n_1+ n_2+ n_3+ n_4)],$$

where n_1, n_2, n_3, n_4 represent the number of respondents that indicated the respective practices on the scale 1 to 4. The formula yields indices ranging from 0 to 1, where below 0.2 represent minimum strength and above 0.8 represents maximum strength Nesan and Holt, [15].

From the table 4, the indices calculated for all of the lean practices showed a similar pattern, with indices ranging between 0.464 and 0.78 for January 2007. For the December 2007, the range is between 0.597 and 0.818. In addition, the min index for 30 practices also increase from 0.691 to 0.7614, total increments is about 10%. This indicates that lean behavior practices in aerospace composite manufacturer are improved, and it is near to the lean behavior standard.

After compare the 2 group of index, we found that the index for the practices is increase a lot. Such are:

- Meetings start on time.+0.215
- People from outside areas help to solve problems.+0.207
- People share ideas and knowledge.+0.151

However, there is also some practices need to be improve where the indices show dropped. Such practices are:

- People contribute openly and honestly in the meetings I attend.-0.029
- People are coached and trained by their leaders/Supervisors.-0.017
- People deliver what was promised.-0.013

Basically, for the new result, many practices were practiced very well (it can be see clearly In Figure 2 and the sum of index of practices is increase a lot and meets the lean behavior standard (0.800) already. It is better result if compare with the January 2007 which is totally no got one practices meet the lean behaviors standard. Below are the practices where meet the standard:

- Before making decisions, people gather the information –from 0.708 to 0.818
- People share ideas and knowledge-from 0.667 to 0.818
- People are encouraged to improve their knowledge and skills at work -0.738 to 0.813
- People look for ways to improve their work –from 0.750 to 0.801
- People focus on the customer and the customer need (inside and outside the plant)-from 0.750-0.818.

But, got one practices need to be improve and need pay more attention where the indices showed very low. The practices are:

- Plant leadership is on the plant floor daily to provide assistance and improve the business is 0.597. However; the index also improved already, for the Jan 2007 just 0.464.

Beside the index, after compare the 2 group of ranking authors found that the ranking for the practices also change a lot. Such are:

- People share ideas and knowledge, it is raise 20 rank, from ranking 21 raise to 1. It is the biggest lift practices:
- Before making decisions, people gather information. It is raise 16 rank, from ranking 17 raise to 1.
- People from outside help to solve the problem. It is raise 14 rank, from ranking 28 raise to 14.

The result at table 5 shows that the increment respects for people was highest. The practices for RFP such as, people contribute openly and honestly in the meeting will give employees operational autonomy encouraged an innovative culture and let employee more contribute ideas to solving problem. Furthermore, the practices “people can participate in decision their job and focus on the problem” in RFP also got strong relationship with PSC. In a study among the employees of a manufacturing plant, found a positive relationship between participation and employees' innovative behavior, measured using self-ratings of employees' suggestions and implementation efforts will contribute the idea of solving problem.

The Figure 3 shows that index value of three main categories which all have significant increase. Especially, respect for people, which is increase from 0.67 to 0.773. This is followed by continuous learning and improvement raise from 0.679 to 0.763 and the process and results driven shows improvement from 0.653 to 0.698 in each. Overall the results shows the company improve in all 3 construct, Thus, we can say, the company really put a lot of effort in practices lean behavior. In conclusion, authors found that most practices of the lean behavior will improve the PSC of the employee. Thus, after implementing lean process after one year, problem solving capability of employee had been increase and make the lean result of company increase.

Analysis of the Relationship between the Lean Principles: Correlation between Respect for People, Continuous Learning and improvement and Process and Result Driven are shown in Table 6 and Table 7.

The data obtained was analyzed by using Statistical Package for Social Science (SPSS) software version 13. Correlation method was used where correlation is a measure of relationship between variables Field, [11]. Table 6 and Table 7 show a matrix is displayed giving the correlation between the three variables. For the January 2007correlation coefficient 0.587between Respect for People and Continuous Learning and Improvement is 0.456, and the significance value of this coefficient is 0.001. But for December 2007, the values become 0.129, and significance value is 0.202 while the correlation coefficient between Respect for People and Process and Result Driven is 0.526 with the significance value is 0. But for new result is 0.101 and the significance value 0.258.last but no least, correlation coefficient between Continuous Learning and improvement and Process and Result Driven is 0.193 with the significance value is 0.111. For new result is 0.310 and 0.020.

Success of People Development System in Case Study Company: The importance of problem solving capabilities of every employee in implementing lean process management to make the improvement in lean behaviors is evident as depicted by the real life data of kitting department as the company case study.

Idea Generated and Level of Involvement: Many studies focus mainly on the creative or idea generation stage of problem solving. In this context, employees can help to improve business performance through solving problem, such as generating ideas and use these as building blocks for new and better products, services and work processes Joreon. P.j.de.long, [13]. From the graph shown below, every week at least one idea had

Table 4. Strength values for January 2007 and December 2007

Questions	Sum	Sum	Index	Index	Rank	Rank
1	121	126	0.720	0.716	14	27
2	127	128	0.756	0.727	3	24
3	111	128	0.661	0.727	23	24
4	116	134	0.690	0.761	19	18
5	119	144	0.708	0.818	17	1
6	106	135	0.631	0.767	26	15
7	116	137	0.690	0.778	19	11
8	88	130	0.524	0.739	29	22
9	110	131	0.655	0.744	24	20
10	112	144	0.667	0.818	21	1
11	78	105	0.464	0.597	30	30
12	126	129	0.750	0.733	4	23
13	122	140	0.726	0.795	12	6
14	124	143	0.738	0.813	7	4
15	123	140	0.732	0.795	10	6
16	124	135	0.738	0.767	7	15
17	95	136	0.565	0.772	28	14
18	123	137	0.732	0.778	10	11
19	122	140	0.726	0.795	12	6
20	118	137	0.702	0.778	18	11
21	121	140	0.720	0.795	14	6
22	124	140	0.738	0.795	7	6
23	130	131	0.774	0.744	2	20
24	126	141	0.750	0.801	4	5
25	120	133	0.714	0.756	16	19
26	108	125	0.643	0.710	25	29
27	112	127	0.667	0.722	21	25
28	104	126	0.619	0.716	27	26
29	131	135	0.780	0.767	1	15
30	126	144	0.750	0.818	4	1

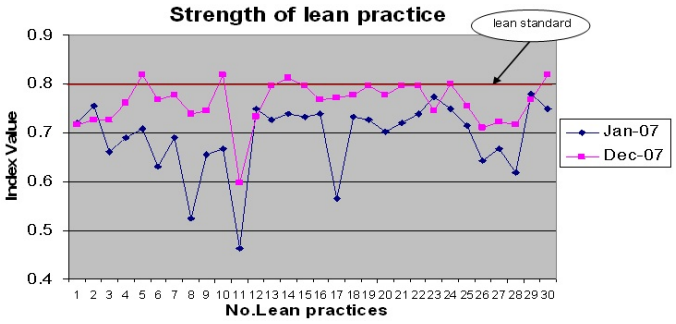

Fig. 2: Strength of lean practices.

Table 5. Analysis mean value index RFP, CLAI, PARD

Construct	Jan 2007	Dec 2007
Respect for people (RFP)	0.67	0.773
Continuous learning and improvement (CLAI)	0.679	0.763
Process and result Driven (PARD)	0.653	0.698

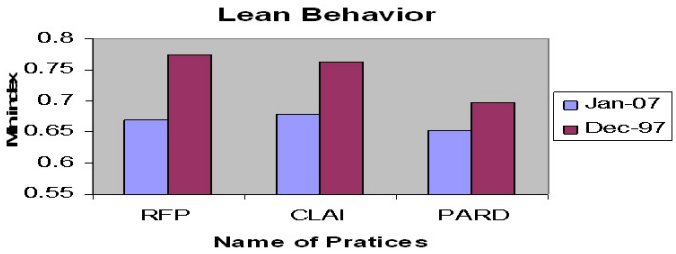

Fig. 3: Lean behaviors index value

Table 6. Correlation between factors in January 2007

		Respect for People	Continuous Learning and improvement	Process and Result Driven
Respect for People	Correlation coefficient	1.000	0.456**	0.562**
	Significant value	-	0.001	0.000
Continuous Learning and improvement	Correlation coefficient	0.456**	1.000	0.193
	Significant value	0.001	-	0.111
Process and Result Driven	Correlation coefficient	0.562**	0.193	1.000
	Significant value	0.000	0.111	-

Table 7. Correlation between factors in December 2007

		Respect for People	Continuous Learning and improvement	Process and Result Driven
Respect for People	Correlation coefficient	1.000	0.587**	0.101
	Significant value	-	0.001	0.258*
Continuous Learning and improvement	Correlation coefficient	0.587**	1.000	0.310
	Significant value	0.001	-	0.020
Process and Result Driven	Correlation coefficient	0.101	0.310	1.000
	Significant value	0.258*	0.020	-

* $p < .05$; ** $p < .01$

Table 8: Index value of lean behavior in January 2007 and December 2007

Variable	Index (Jan)	Index (Dec)
DOB	0.691	0.7164.

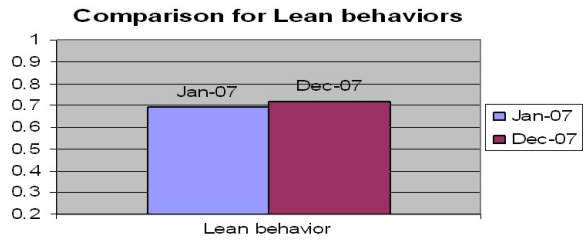

Fig. 4: Comparison for lean behaviors.

been generated in kitting department, and highest is 5 ideas generated per week. In past one year, total of 139 ideas have been generated .It is proved that kitting department proactively and continually sought ideas to solve problems, and indicates employee have capability to solve problem to become a central tenet of lean manufacturing best practice Kerrin, [14].

The employee involvement is categorized according to three main levels which are top, middle and bottom management. The Figure 6 below shows the level of involvement of employees by generating ideas for the year 2007. The highest contribution is coming from bottom level which is 38 and followed by middle level with 12 top level is 2. Besides this, there is also a combination level involvement in idea generated. Bottom-middle level is 52, middle-top is 35 and bottom-top is 1. Furthermore, total idea generated for group combination level is 87 and single group level is 52. Percentage for combination level is 63% for total ideas generated and 3 type levels is 37%. However if we compare 2 groups, the result shows that total idea generated by group combination level is 35 more than single group level. Thus, the result indicates the teamwork of bottom; middle and top management in both sharing and applying knowledge for generated idea to solving problem are important Delbridge *et al.*,[8].

Total of Wastages: The graph at Figure 7 gives us an idea about type of wastages identified at the kitting department, where it is classified into 9 categories. It is obviously noted that the highest waste for company is space waste which is 39, second is time waste at 21, and the lowest waste of transportation which is at 5. Without classification of any wastage into performance measurement, no monitoring can be made and no problem solving can be done to reduce the waste, which the impact is the failure of lean process management implementation A.P. Puvanasvaran *et al.*,[2]. It indicates employee of the company have capabilities to solve waste problem using the performance measurement.

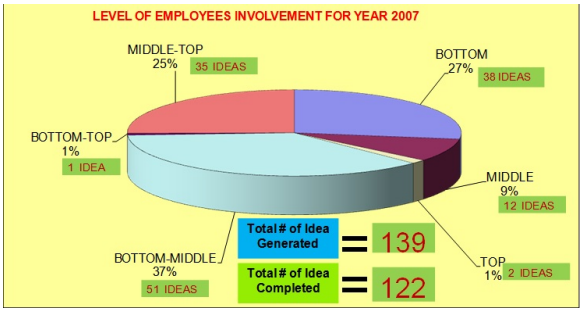

Fig. 5: Level of employee's involvement for year 2007

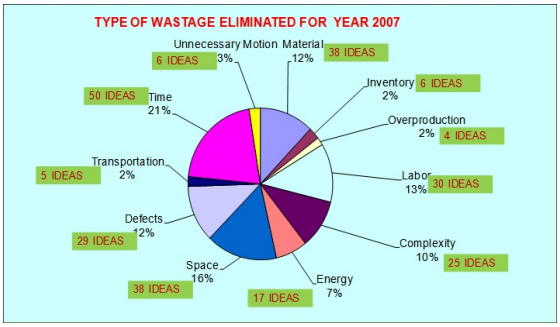

Fig. 6: Type of wastage eliminated for year 2007.

Cost Saving: Cost saving is an important standard to indicate the problem solving capability of organization. The aim of lean manufacturing is elimination of waste in every area of production and includes customer relations, product design, supplier networks, and factory management. To meet the objectives of saving cost Womack and Jones [20]. Kitting department ran a Kaizen Project in 2007, and the total amount saving for reduces wastages in past one year is RM1, 952,617.98. Thus, achievement of cost saving for company indicates employee had contributed much solution to solve problem waste. So, it can be construed that problem solving capability of employees actually improved significantly. The table 9 indicates total cost savings of the kitting department with the reference to their kaizen project generated form the problem solving activities.

Lean Tools Used in Problem Solving: In general, lean tool for kitting department can be categorize to 9 types such as five S, total productive maintain, kaizen, visual stream map, visual indicator, just in time, standard

work chart. The most common tool used by kitting department is TPM, which is 62 times, followed by 5s by 55 time and mean values of using lean tool is 21 times. In past one year, the kitting department total used 189 times of lean tool. In order to introduce lean thinking within manufacturing environment, the philosophy relies on the identification and elimination of the waste problem, which have effectively targeted and applied the various lean tools B.J. Hicks, [12]. Thus, the frequency of employee using the lean tool indicates employee understanding identification and elimination waste problem. In deduction, the employees have capability of problem solving.

KPI Achievement: KPI is an important element that enables the achievement of vision, mission, core value, strategy, and the personnel objective for people development is crucial. Achievement of KPI shows the evidence of people involvement to drive high performance to gain stakeholder and customer satisfaction. Monitoring on each performance, measurement and counter-measurement taken to solve any problem occurring have contributed to the achievement of KPI.

The table 10 shows total monthly man hours percentage of Overtime at kitting department has set the limit to below 12% for the year 07. During PDS implementation, overtime are controllable all the time; not even a month exceeded the limit of overtime, which eventually gave a value of 11.5% for the whole year. It indicates the company has save considerably on labors cost in the past one year. The cost saving is due to employee success in lowering the stop time for the machine DCS 1, DCS 2, DCS 3.

The table also shows the achievement for the value scrap is 1.97% which achieved the goal of 2.6%. The reason why the value is achieved is because the employees use the PDS methods to solve many scrap problems such as material dry and ply damage for the whole year. Besides this, complains on product produce from internal and external customer shows null. It shows that quality of kitting department undergone significant upgrading due to problem solving capability of employees.

Kitting department of the Company has gained benefits from many elements that have not been monitored before, the implementation of PDS. Wastages have reduced dramatically. Thus, the achievement KPI proves that problem solving capability has increased.

Table 9: Continuous improvement projects for the year 2007 and 2008.

KITTING CONTINUOS IMPROVEMENT PROJECTS FOR YEAR 2007/2008			
2007		2008	
REGISTERED	TOTAL (RM)	REGISTERED	TOTAL (RM)
1. REDUCE TIME SET UP FOR S91 CONTROLLER	$19,042.80	1. REDUCE CONSUMABLE USAGE	$100,000
2. JIT PRODUCTION PREPARATION	$136,973.44	2. REDUCE SPACE	$20,000
* KANBAN REGULATOR		* NESTING AND STICKER RACKS	
* REDUCE PLASTICS USAGE		* JIT SUPERMARKET	
* REDUCE OVERTIME		3. CONVERT WALKWAY INTO CLEAN ROOM	$100,000
* ELIMINATED NIGHT ALLOWANCES			
* REDUCE ELECTRICITY USAGE			
TOTAL	$156,016.24	TOTAL	$220,000.00
UNREGISTER	TOTAL (RM)	UNREGISTER	TOTAL (RM)
1. TOOLS TROLLEY	$127.70	1. DRY & RESIN RICH ISSUE	Under Monitoring
2. SPLIT AND BATCH PAPERWORK	$1,795,988.16	2. NESTING IMPROVEMENT ON A320 AND A400M	Under Monitoring
TOTAL	$1,796,115.86	TOTAL	

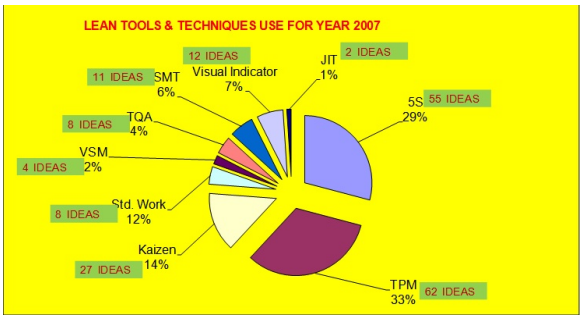

Fig. 7: Lean tool & techniques use for year 2007.

Table10: KPI Achievement..

Principles	Matrix	Unit	Goal/Limit	2007 Achievement
Quality	Scrap	MQ%	2.60%	1.97%
	NCR	%	7.80%	0
	Snag Sheet	Control Limit%	20%	0
	Audit	# of CAR	Zero	1
Cost	Overtime	Total Monthly man hours%	12%	10.50%
	Downtime	%	10%	
	DCS 1	%	10%	9.14%
	DCS 2	%	10%	8.80%
	DCS 3	%	10%	7.65%
	S91	%	10%	10.34%
Delivery	Output	%	97%	100%
Accountability	Attendance	%	92%	90.7%
	Training	Hours	188hrs	2314hrs
	Staff/trg hours	%	47 staff	100%
	Major Accidents	Qty accidents	Zero	0
	Accident Free Days	# of days	90days	365
Continuous Improvement	Kaizen	RM	150K	156K
	SMT	Level	Level 4	L4
	5S	Level	Level 4	L4

Conclusion: The purpose of this project has been to evaluate the improvement for the lean behavior possessed by the company in past one year. The result show practices lean practices had been make improvement of the company in lean direction and important of problem solving capabilities in eliminating waste and saving cost. The results have provided support to the two proposed hypotheses. Besides that, evidence was found to support the relation between improvements of kitting department with problem solving capability.

The main findings show that the company is improving in past one year. Initial result of the kitting department was in moderate level stage to become lean, but result end of year show that they had nearly meet the high level stage of lean they need to keep their efforts in order to success in lean manufacturing implementation. It is also help the company to recognize the important of increase problem solving capability for employee to eliminating waste.

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