

The level of achievement of Lean Manufacturing Implementation status before and after the development of KPIs at an Aerospace Manufacturing Company

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Abstract:

This research study focuses on the issue of the level of achievement of Lean Manufacturing Implementation status before and after the development of Key Performance Indicators (KPIs) at an aerospace manufacturing company. The KPIs are targeted to provide this company with a good performance measurement tools in supporting the success of their Lean manufacturing journey. The assessment will be based RAG (Red Amber Green) status.

1.0 Introduction

The growing of global competition have made businesses around the world more difficult and complicated than before. Every company have tried to search for a solution to make them survive and for making their business remain successful and being competitive.

For manufacturing companies, it has become more complex and complicated. To survive in this competition, companies have been struggling to improve their streamline business process, inventories, cycle times and factors related to cost. Factors related to cost involves reducing the manufacturing costs, strengthen relationships with the suppliers, offering variety of product and most importantly to reduce the response time to their customer needs and expectations. It has been estimated that almost 50% of manufacturing costs are attributed to purchase items, the raw material account for 80% of a finished product's lead time and 30% of its quality problems [1-2]. All of these are actually

driven by the economic needs. Moreover, if that manufacturing company manage to be successful and competitive to overcome all of these problems, it will bring them more customer demands.

However, many manufacturing companies nowadays are in different situation due to few problems they are facing which include excessive inventories, non-competitiveness, loosing the market share and unable to cater to the customers' needs on time.

Therefore, many manufacturing companies try to search for a system that can make their process more effective to overcome these problems. Over two decades there have been numerous manufacturing "revolutions", accompanied by clarion calls for universal adoption of some new paradigm such as Manufacturing Resources Planning (MRPII), Just in Time (JIT), Optimized Production Technology/Theory of Constraints (OPT/TOC), Flexible Manufacturing Systems (FMS), Total Quality Management (TQM), Lean Manufacturing, Agility, Time-Based

Competition (TBC), Quick Response Manufacturing (QR/QRM) and Business Process Re-Engineering (BPR) [3]. The later alternative that has been implemented by the aerospace manufacturing company under study is the implementation of Lean Manufacturing, which means waste elimination.

The purpose of this study is to see the level of achievement of Lean Manufacturing Implementation status before and after the development of Key Performance Indicators (KPIs) at an aerospace manufacturing company or in other words the links between the KPIs that has been developed to the lean implementations efforts.

2.0 Lean Manufacturing

Lean manufacturing has been introduced by Womack [4] which describes the TPS (Toyota Production System) developed by Eiji Toyoda and Taiichi Ohno at Toyota Motor Company in Japan. Taiichi Ohno, one of co-developers of the Toyota Production System; according to Kilpatrick [5], have suggested that “waste accounts for nearly 95% of all costs” and that is why Lean Manufacturing is practised to reduce the non-value added activities produced by an organization or factory [6]. In other words, it can be said that the philosophy of Lean Manufacturing can be illustrated by using Toyota Production System as an example [7].

The term ‘lean’ is used due to the majority of all activities are doing less compared to mass production techniques such as deducting half of the labour hours, factory space and tooling investment [7]. New products can also be developed by using less engineering hours. This principle is not only successfully applied in automotive industry but also in other sectors, including aerospace industry (across Europe and North America) [8].

The aerospace manufacturing company under study have established a Lean Promotion Office (LPO) to promote Lean

Manufacturing culture as company wide activities and to monitor all lean activities in production floor and report the progress to top management to drive cost reduction. In addition, LPO which is under Strategic Development Department (SDD) is responsible to organize internal lean manufacturing training and workshop in terms of principles, basic approach, tools and techniques, 7 wastes based on quality, cost, delivery, accountability and continuous improvement QCDAC targets.

3.0 Key Performance Indicators (KPIs)

KPI's is one of the tools for evaluating the performance measurements. One of the reasons for the success of company in implementing lean manufacturing is the performance measurement culture that already exists and established in it [8].

Smith [10] defined KPIs as measures of success or compliance. It is one of the tools in performance measurement systems that currently had been chosen by many industry analysts, organisations and enterprises. Measuring the performance of any operation needs KPI intervention especially in an industry which performance metrics exist.

KPIs allow a company to see what areas it is executing well and what areas require improvement. What ever KPIs selected, they must reflect the organisations goals, they must be key to success, and they must be quantifiable (measurable)

Lastly, with good KPIs as one of the performance measurement system tool, companies or organisations can be self-assured with their manufacturing tools and techniques implementation for achieving their goals or objectives. Hence, good KPIs must be clear, able to be gauged or measured with specific aim. Refer to Appendix (Figure 1.0) to see to new Company KPIs framework that had been developed.

4.0 Findings and Discussions

4.1 The level of achievement of lean implementation status before and after the development of KPIs

Level of achievement of lean implementation before and after the development of KPIs can be seen at Table 1-0 and Figure 2-0. To evaluate the level of achievement, RAG status measurement had been applied with reference to the audit criteria's in each of the tools and technique.

As a summary, based on results through Table 1-0 and Figure 2-0 it showed that ten out of fifteen tools and techniques had improve their level of score after the implementation of KPIs.

However, there are some tools and techniques that still could not score the targeted level of lean implementations. For example, the abnormality detection and operation availability tools and technique only managed to score the same level of achievement (amber status) even though after the implementation of KPIs. The main reason was because they had just started the systematic approach through Total Productive Maintenance (Fuguai) programme. Two others tools and technique that were also in amber status are Line Stop & Call (Andon) and cross job function.

The only tool and techniques that failed to improved (red status) was problem solving technique. Through the investigations, it was found that they are too many methods used by the user (employees) and this created confusion among them. The countermeasures that had been taken are to find the objective of every methods/tools that had been applied by six sigma coordinator.

However, overall it can be said that the level of lean implementation has improved after the implementation of the new KPIs.

5.0 Overview of the Research findings

Listed below is a summary of the important findings that address the questions of the study:-

- The level of achievement of lean implementation before and after the development of KPIs has been analysed .To evaluate the level of achievement, RAG (Red Amber Green) status measurement had been applied with reference to the audit criteria in each of the tools and technique.
- As a summary, results shows that ten out of fifteen tools and techniques had improve their level of score after the implementation of KPIs. Overall, it can be deduced that the level of lean implementation has improved with the new KPIs.

6.0 Conclusion

As a conclusion, from this study, the links between lean and KPIs have been found. Results showed that ten out of fifteen lean tools and techniques had improved their level of score after the implementation of KPIs. By and large, it can be deduced that the level of lean implementation has improved with the new KPIs.

References

- [1] Willis, T.H. and Huston C.R., (1990) "Vendor Requirements and Evaluation in a JIT Environment, International Journal of Operations & Production Management, 10:4, Page 41-50.
- [2] Doolen T., Traxler M. M. and McBride K. (2006), *Using Scorecards for supplier Performance Improvement: Case application in a Lean Manufacturing*

Organisation, Engineering Management Journal, Vol.18, No2,Page 26-34.

[3] MacCarthy B.L. and Wilson J.R., (2001), *Human Performance in Planning and Scheduling*, Taylor and Francis.

[4] Womack J. P., Ross and Jones D. T., (1990), "*The machine that changed the World*", Simon & Schuster.

[5] Kilpatrick J., (2003), "*Lean Principles*," Available online on <<http://www.MEP.ORG>> [8 December 2006].

[6] Comm C. L., and Mathaisel D. F. X., (2005), *An Exploratory Analysis in Applying Lean Manufacturing to a Labour-Intensive Industry in China*, Asia Pacific Journal of Marketing and Logistics, Volume 17 No 4.

[7] Burcher P., Simon D. and Geoffrey R. , (1996), *The road to lean repetitive batch*

manufacturing Modelling planning system performance, International Journal of Operations& Production Management, Vol. 16 No. 2 ,Page 210-220.

[8] Haque B. and Moore M.J. , (2004), *Measures of performance of Lean product introduction in the aerospace industry*, Institution of Mechanical Engineers, Vol 218, Part B, Page 1387- 1398.

[9] Theodore H. P., (2003), *Measuring Performance in Public and None profit Organisations*, San Francisco: Jossey-Bass.

[10] Smith, F. O., (2007), *Article in Column Information Control: KPIs Made Easy*, Control Engineering (January 2007), Page 42-46.

Appendix

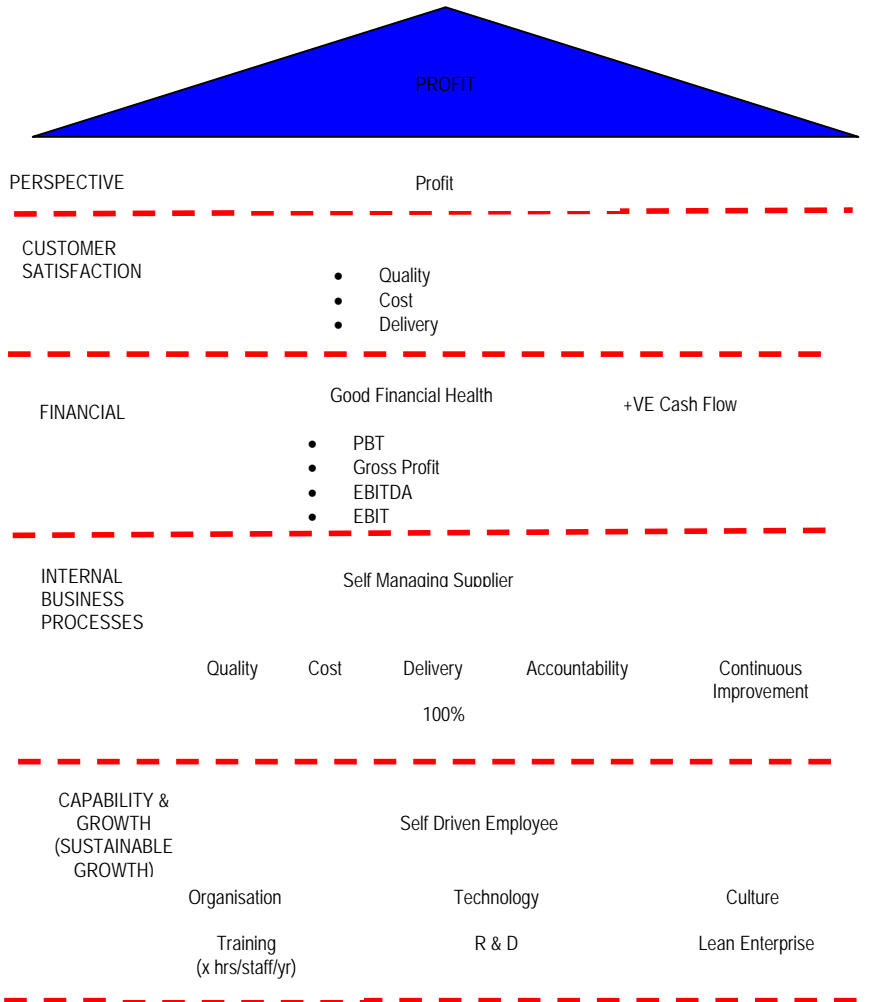


Table 1.0: The level of achievement of lean implementation status before and after the development of (KPIs)

No	Lean Tools and Technique	Level Score Before KPIs	Level Score After KPIs	RAG Status	Remarks
1	Problem Solving Technique	3	2.5	Red	Too many method used. User Confuse. Find the objective every method/tools by six sigma coordinator.
2	Abnormality Detection	3	3	Amber	Just started the systematic approach through TPM (Fuguai)
3	Line Stop & Call (Andon)	2	2.5	Amber	Most of manual activity practices stop the processes.
4	Jidoka	2	3.5	Green	No issue
5	Standard Operations	3	3.5	Green	No issue
6	Cross Job Function	NA	2	Amber	Just started evaluate due to PDS concerns.
7	Operation Availability	2.5	2.5	Amber	Just started the systematic approach through TPM (Fuguai).
8	5s (Best Practice)	3	3.5	Green	No issue
9	Visual Management	3.5	4	Green	No issue
10	QCDAC	3	3.5	Green	No issue
11	Inventory Management	2.5	3.5	Green	No issue
12	Customer Focus	2	3	Green	No issue
13	Kaizen	3	3	Green	No issue
14	Change Readiness	3	3.5	Green	No issue
15	Management Style	3	3	Green	No issue
	Average Points	2.67	3.10	Green	No issue

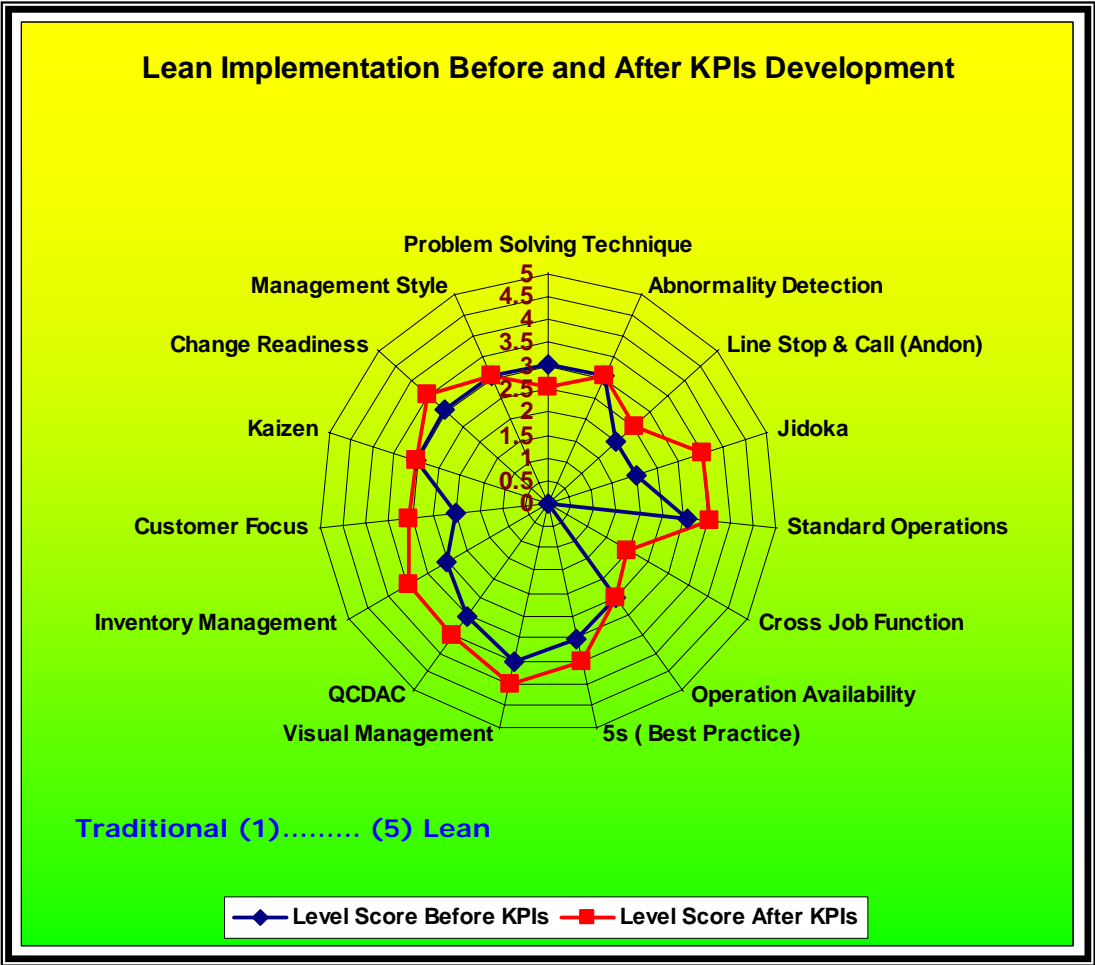


Figure 2-0: Lean implementation status before and after the development of Key Performance Indicators (KPIs) .(Level 1 – Traditional way; Level 2 – Starting Change; Level 3 – Standardized; Level 4 - Supply Chain Integrations; Level 5 – Lean Sustainability)