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A CASE STUDY ON ESTABLISHING LEAN CONCEPTS THROUGH VALUE STREAM MAPPING

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ABSTRACT

Operational Excellence is becoming an important organisational factor that focuses on meeting the customer expectation. Lean manufacturing systems use several techniques to achieve efficient and effective processes, focussing on customer value and elimination of Muda in all activities. Lean practises are a tool to achieve operational excellence. Value Stream Mapping (VSM) is a tool which is used to chart the activities involved in a process and helps in identifying the time taken for each activities to complete. This paper gives an insight into how lean practises has helped in achieving operational excellence at standard production area. Through this case study the organisation was able to increase its daily production from 6 no's to 10 no's per day. There has been a reduction of 55% in the shop floor utilization as well as 53% reduction in the cycle time.

Keywords: Operational Excellence, Lean practises, Value Stream Mapping, Lean Manufacturing Systems

I. INTRODUCTION

The historical backdrop of lean practices or lean assembling framework backpedals to the early years of Toyota and the improvement of Toyota Production System (TPS). Lean administration means to actualize procedures to accomplish great, wellbeing and specialist resolve, while diminishing expense and shortening of lead times. The principle explanation behind this framework to be viable is its centre focus on the disposal of wastes from all procedures. Throughout the years, lean assembling has been getting an expanding measure of consideration for efficiency enhancements and cost decreases. It has turned into a way to dissect and enhance creation and the factoryfloor condition. Lean offers progressive instead of transformative proficiency changes. All the diverse exercises that are a piece of the generation procedure must be deliberately organized to expand the advantage of lean.

In order to understand the activities involved in the processes and the time taken one must create a map which give details about all the process involved. VSM is process that involves flowcharting the steps, activities, materials flow and other process elements involved with a process. It helps an organisation in identifying the non-alue added activities. A flow diagram depicting the process is drawn to show the current state of operation. The process is analysed in order to identify any opportunity to reduce and simplify the process. After analysing solution to the respective problems are implemented and futures state map is drawn. The future state map depicts

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how process looks compared to earlier. Until and unless the ideal state is attained the process is continuously analysed.

The case study was carried in a manufacturing unit located in Bangalore. This unit manufactures consumables & equipment for biotech research and production and other tools and laboratory supplies for life science industry. This study discusses the implementation of operational excellence through lean practises. The main objective of the research study are:

- Implement single piece flow
- Reduce overall lead time
- Reduce overall space usage of assembly area
- Reduce the non – value added (NVA) activities

II. LITERATURE SURVEY

Many noted personalities like Taiichi Ohno (1988), Robert S Kaplan & David P Norton (2000), Yang-Hua Lian and Hendrik Van Landeghem (2002), V Ramesh, K V Sreenivasa Prasad and T R Srinivas (2008), Lixia Chen and Bo Meng (2010), Dr Palmira Lopez-Fresna (2012) and Charles Richards (2014) have studied the concept of operational excellence and how to achieve it through lean practises.

Taiichi Ohno (1988) couldn't see waste initially (particularly over a topographical region). The author created Material and Information Flow Mapping (VSM) as a standard strategy for mapping the streams outwardly and it turned into the standard reason for planning enhancements at Toyota - as a typical dialect. It wound up plainly one of their business arranging devices. VSM is presently used all through the world, in numerous organizations to deliberately plan and it is the beginning stage to any lean change and usage.

Yang-Hua Lian and Hendrik Van Landeghem (2002) in their paper gave an insight how simulation and VSM helps managers see the impacts before and after implementation of processes. The research team built a simulation model for two scenarios – push and pull Kanban systems.By changing the process sequence, redesigning of layout and pulling production from downstream, there is a reduction in lead time, helps in lowering the Work-in-progress (WIP) inventory, steep increase in the value-added ratios and helps in solving the bottleneck problem

V Ramesh, K V Sreenivasa Prasad and T R Srinivas (2008) in their paper mentioned how VSM helps in Lean Implementation in Manufacturing Industry. They gave a basic idea of how to derive the current mapping as well as the future state mapping. They also gave insight in to how individual Kaizens can be identified and how to eliminate them so as to achieve the future state mapping. VSM provides a clear cut insight into the Value-added as well as the Non-value Added activities ratio. For preparation of the VSM communication with all level of the organisation is necessary. This will help in reducing the cycle time and improve the manufacturing process.

Indian Brand Equity Foundation (2009) has brought out how the Indian manufacturers are achieving Operational Excellence. The paper emphasise on how Indian companies are emphasising more on quality. They have adopted the Total Quality Management (TQM) approach for better results. Manufacturing sectors are trying to reduce the emissions level through use of alternative fuels. The use of IT solutions enhanced the company’s productivity. Digital Manufacturing has helped the manufactures to improve productivity and efficiency.

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Dr Palmira Lopez-Fresno (2012) had recognized Critical Success Factors (CSFs) for compelling execution of QMPs, recommended that Lean Management is a straightforward, effective and cordial procedure to accomplish operational greatness. The paper additionally depicts an instance of execution of Lean Management in the human services association. After execution of the contextual analysis the lesson learnt were that Lean Management has conveyed significant execution picks up as well as conveyed some vital lesson, for example, authority, hierarchical structure and assets, outer help, clear destinations and so forth.

Charles Richards (2014) had presented a framework to quantify Operational excellence and its Linkage to the enterprise value. Through this he was able to show that this can act as a starting point based on which efforts can be built on thus addressing the fundamental challenge of investing capital into privately held enterprises. He used core value rating as reliable quantifiable measure of operational excellence.

III. METHODOLOGY

A methodology is an essential component for any project to take place. It describes the step by step activities one need to do in order to achieve the desired result. The methodology was defined after discussing with the management as well as on the data that was being collected. Fig. 3.1 shows the flow chart of the methodology used in the case study.

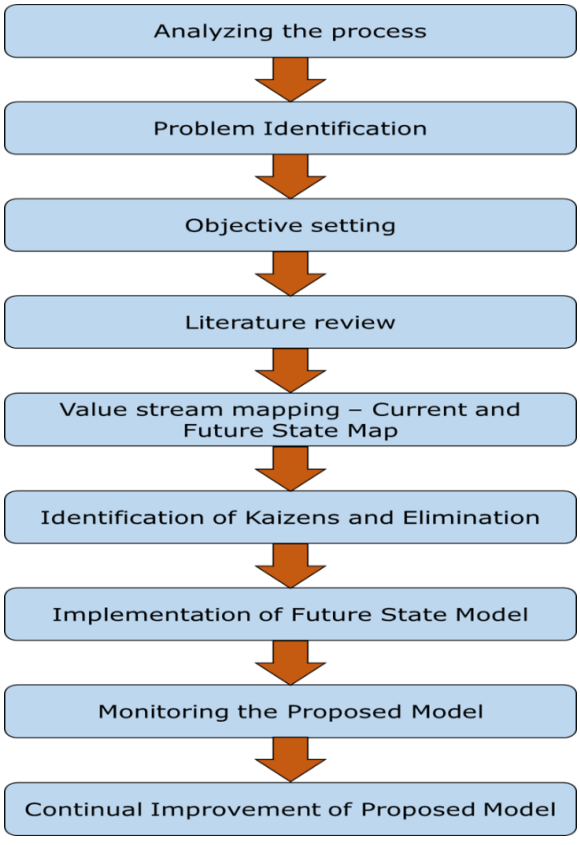

Fig. 3.1 Case Study Methodology Flow Chart

The steps involved in project methodology are:

1. **Analysing the Process:** The first step is to analyse the existing process and understand the various steps involved in the production process.

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2. **Problem Identification:** After analysing the process the following problems were identified:

- Production takes place in batch-wise
- Materials were not released based on confirmed material availability
- Chances of rejection at the final assembly
- Sub-assembly used to get accumulated on the shop floor
- Increased Lead time
- Large shop floor area consumption

3. **Objective Setting:** In order to tackle the problem a set objectives are defined. This objectives forms the basis for the working of the project.

4. **Literature Review:** Various research papers are read and based on which the project methodology is identified and set

5. **VSM – Current and Future State Map:** VSM maps the current procedure and aides in the recognizable proof of the waste and NVA. Current State Map demonstrates the current procedure, Future State Map indicates how the future resembles**.**

6. **Identification of Kaizens and Elimination:** The bottle neck process is identified and respective Kaizens are identified. Once all the Kaizens are identified, with the help of the stake holders the root cause analysis is done. The outcome of the root cause analysis will be the action plans.

7. **Implementation of the Future State model:** Once all the Kaizens are eliminated the derived future state is implemented in the line and the works are trained to work as per the future state.

8. **Monitoring the Proposed Model:** Once the future state has been implemented it is continuously monitored so as to ensure that the proposed model has no problem.

9. **Continual Improvement of Proposed Model:** Lean Management means Continuous improvement, it's a very essential part to achieve the ideal state. The proposed model may not be the ideal state and required continuous improvement.

IV. CURRENT STATE VALUE STREAM MAPPING

Mapping is a powerful tool and source to identify waste in a value stream. The outcome of VSM is elimination of large scale waste in the process. This case study deals with an assembly procedure that was facing the problem of backlog of output for the past one month due to which the number of output to be delivered was increasing day by day. Hence it was decide to draw a current state map of the process in order to understand the relationship between Value Added (VA) and Non-Value Added (NVA) activities.

In order to draw the current state map following procedures was adopted:

- Identification and drawing the product flow from the raw-material entry point of the manufacturing division (MFD) to the finished goods exit point of the MFD.
- Calculation of the Work-in-Process (WIP)
- Calculation of the cycle time, setup time

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4.1 Data Collection: The cycle time, setup time for the whole assembly process was calculated using a stop watch, where the whole assembly process was done by a single operator.Based on the data collected the current state map was drawn. Fig. 4.1 depicts the current state map for the entire assembly process.

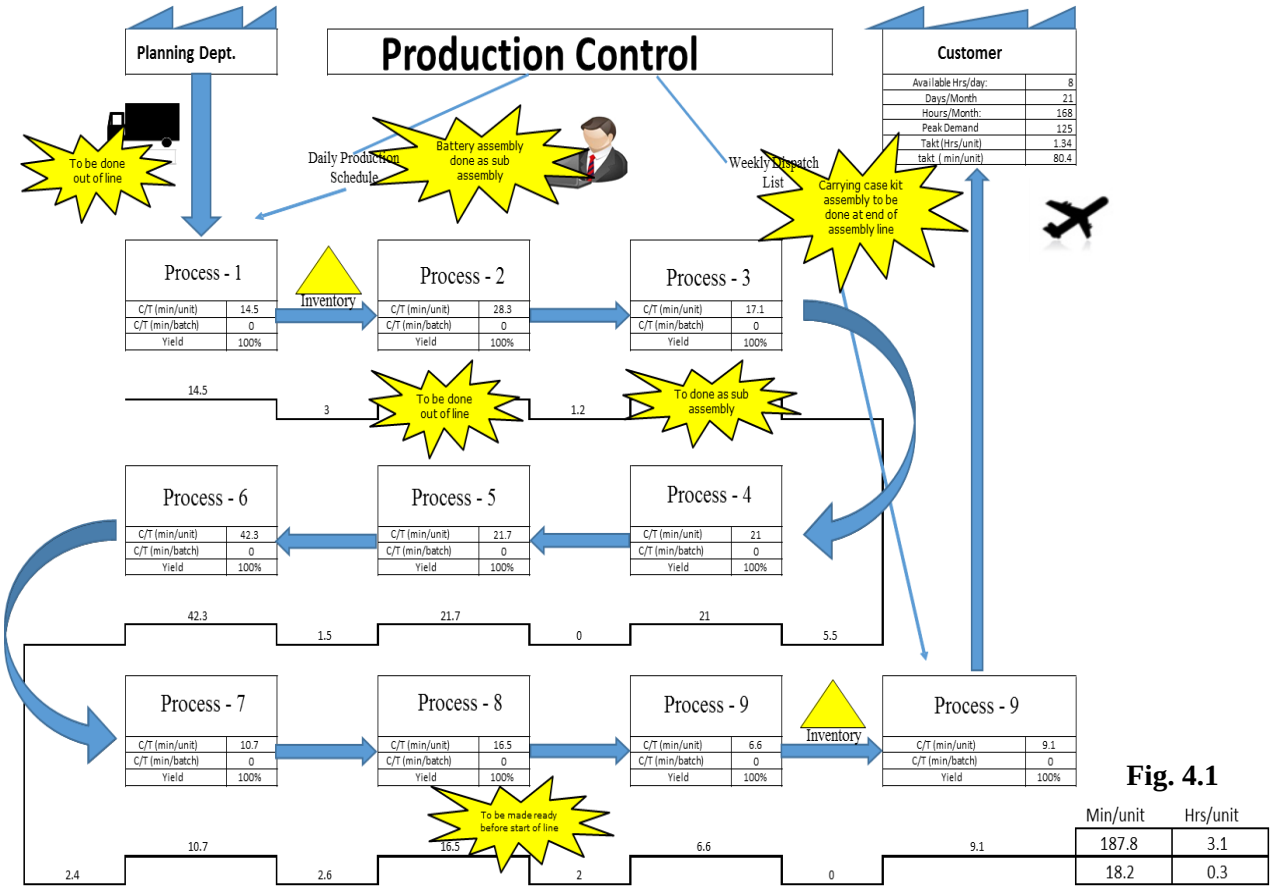

Fig. 4.1

Current State Value Stream Mapping

4.2 Analysis of Current State Map: Once the current state map was derived, each process was analysed in order to find out the VA and NVA activities. The total time taken to complete one

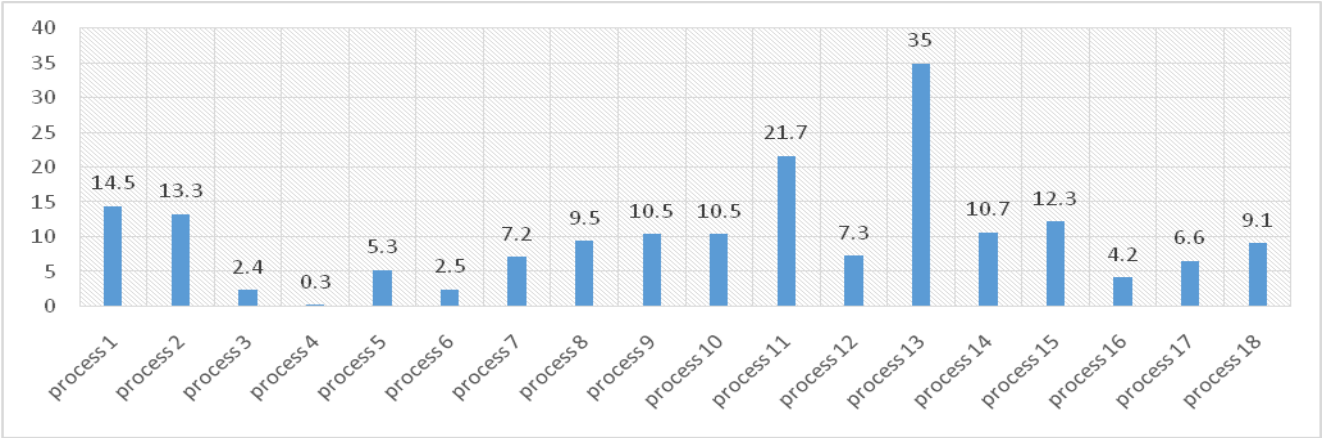

Fig. 4.2 Distribution of Cycle Time for the Process in Assembly Line

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product was around 187.8 mins which is more than the takt time of 80.4 mins. Also there existed certain process which could have been done independently without the main assembly component. In order to finish a batch of 20 units it used to take roughly around 4 days to complete. Thus increasing the amount of WIP on the floor. Fig. 4.2 depicts the distribution of cycle time for all the process involved in the assembly. Out of 187.8 min, 142.02 min constitutes VAActivities, while the remaining 45.78 min is the NVA activities.

4.3 Analysis for Future State Map: In order to derive the future state map following actions were decided upon:

- Development of a new layout where there was proper flow of materials.
- To bring the raw material at Point-of Usage (POU)
- Line balancing in order to produce the product within the takt time
- Reduction of idle time and change over time
- Elimination of Non – Value added activities in order to improve the cycle time.
- Reduction of WIP

4.4 Proposal for Future State Map: The aim to derive the future state map was to eliminate the waste and NVAactivities that was evident in the process. Table 1 shows the detail of Current state map, cause, effect and the improvement measures to be undertaken for improving the Future State Map.

In order to arrive the Future state map following suggestions were proposed:

- As from the Fig. 4.1 we see that the process was not balanced each had different time and the waiting time between each process was different. The first step was to balance the line so that the difference between the processes was reduced which led to the reduction of WIP in the line. But during line balancing there were certain process which were done before hand or prepared ready before the start of the line as these had a curing time of 1440 mins. After balancing this how the distribution of cycle time lookslike as shown in Fig. 4.4

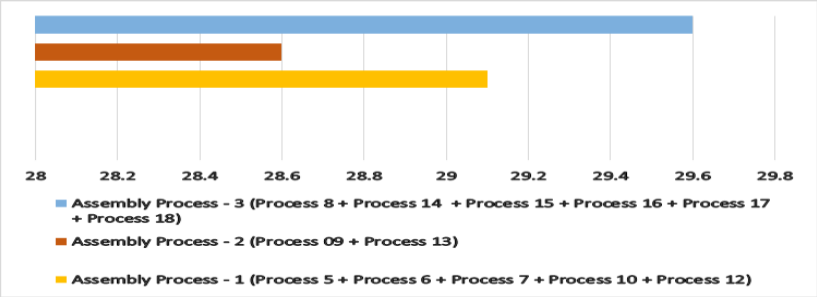

Fig. 4.4 Line Balancing

- The layout of the assembly line should be changed in order to obtain a proper flow of material.
- Raw material required for the assembly process has to be stored near to the POU on the worktable rather than on a shelf or heavy duty rack. This will reduce the worker movement.
- The raw material placed at the POU has to be marked as per the Standard Operating Procedure (SOP) along with the picture of the material rather than the part number or description.

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- The workers along with the supervisor has been trained why single piece flow is essential rather than batch production through games. This enabled them to understand the benefit of Lean Practises.

Fig. 4.4 represents the future state map for the assembly process. The whole assembly process hase been divide into three as the time taken for each process is alsmost same. This led to reduction in WIP. Also the cycle time has been reduced by 54.1%.

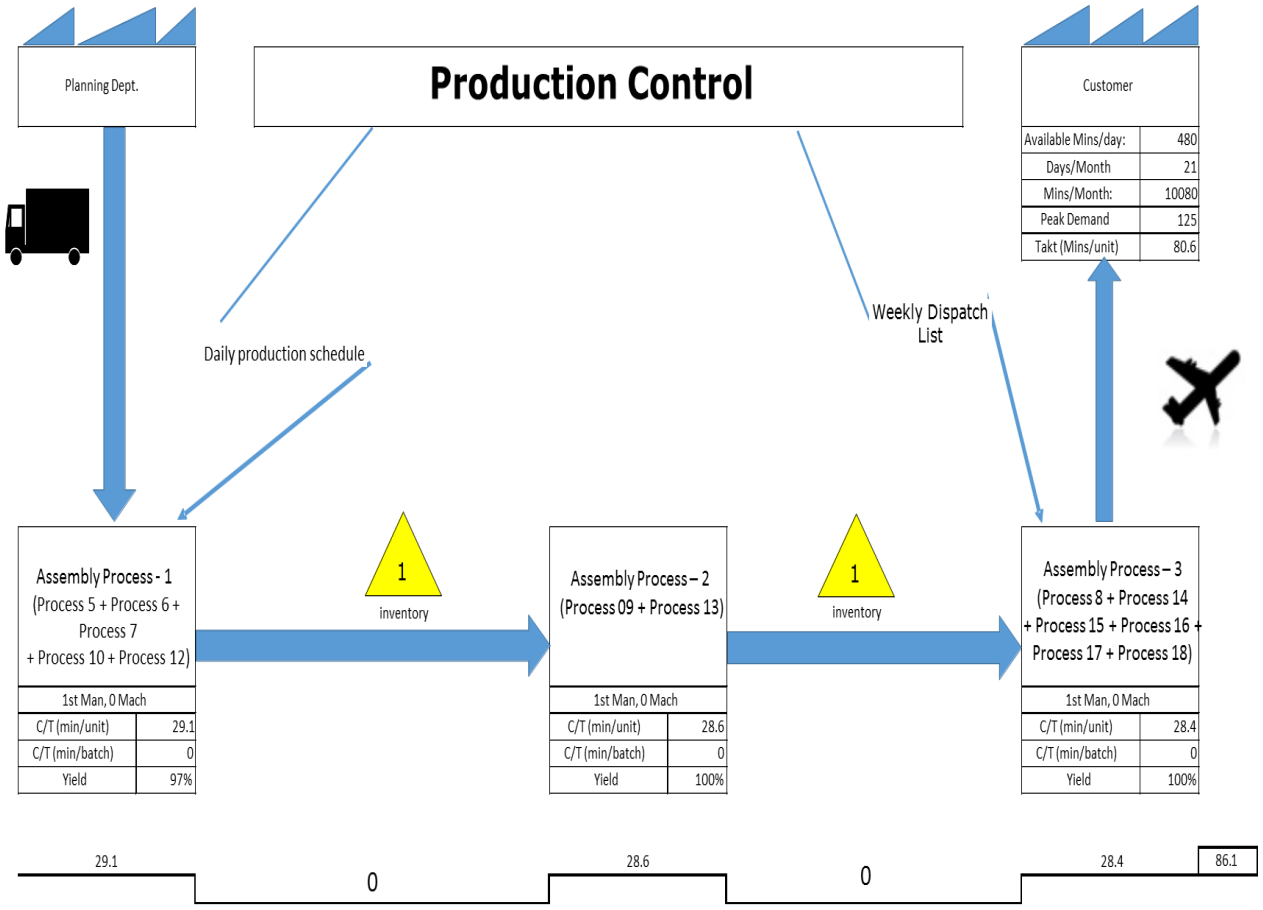

Fig. 4.4 Future state map

V. CONCLUSION

Over the years Indian manufactures have started to use lean practises in order to achieve operational excellence. Setting aside traditional practises they are more focussed on generating values. Through this case study one can observe that the current state of the assembly process was imbalance with lots of NVA's present. The time study revealed a lot of data regarding WIP, cycle time for each process, changeover time etc. By analysing the data with the team measures have been taken to reduce the cycle time, WIP and improve the overall efficiency. Through this the overall productivity of the line has been increase from 6 output per day to 10 output per day, which shows an overall increase of 40% productivity. Also the cycle time has been reduced by 54.1 %. The

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overall floor usage has been reduce by 44%. This shows if proper lean practises are adopted then is scope for larger improvements.

Table 1 Waste and the improvement measures for Future state

Waste	Current State	Cause	Effect	Future State
Motion	Movement of worker between process	Improper layout design	Increase in Lead time and Fatigue	The existing layout had an improper flow of material, based on the line balancing it was decided only 3 workstaion was required. Majority of the movemnt was due to non availability of raw material at the POU
Waiting	MPS Release without confirmation of material availability	Improper comuncation with Planning Dept.	Increased WIP between process	Material will be released only if there is 100% availabilty of materials
Inventory	Amount of WIP between process ranged from 15 - 20	No cycle time study was conducted	Increased WIP between process	Cycle time study was done for each process, based on the result the processes are combined so that the time between two process is less than 2 mins which inturn reduced the WIP
Space	The shop floor area was 473 sq. ft.	Due to improper layout and machinery location	More material movements, more time and controls required	One piece lean design concept was applied and the shop floor area was reduce to 224 sq. ft. A total reduction of 45% achieved.
Storage	Materials used to stored on the Heavy duty rack or shelf	No location available	Increased movement of worker between worktable and shelf	POU storage was introduced were the rw materials is stored at the worktable itself for easy access.
Talent Utilization	Need for additional traning	Quality of the product and other issues related to the expertise level of the worker	Leading to the isolation in the work culture and the work becomes monotonous	Extend good lean releated training

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ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

REFERENCES

[1.] Dr. Palmira Lopez-Fresna: 'Contribution of lean management in excellence', *Nang Yan Business Journal – 1.1*, (2), pp. 90-98, January 2012

[2.] Yang-Hua Lian and Hendrik Van Landeghem: 'An application of simulation and value stream mapping in lean manufacturing' , *14th European Simulation Symposium*, pp. 257-263, May 2002

[3.] V. Ramesh, K.V. Sreenivasa PrasadandT.R. Srinivas3: 'Implementation of a lean model for carrying out Value Stream mapping in a manufacturing industry', *Journal of Industrial and Systems Engineering*, Vol. 2, No. 3, pp 180-196, August 2008

[4.] Lixia Chen and Bo Meng: ' The application of value stream mapping based lean production system' , *International Journal of Business and Management*, Vol. 5, No. 6; pp. 331-336,June 2010

[5.] Indian Brand Equity Foundation: ' Operational Excellence in Indian Manufacturing' , January 2009

[6.] Anthony, J. and Banuelas, R. (2002), "Key ingredients for the effective implementation of Six Sigma program", Measuring Business Excellence, Vol. 6 No. 4, pp. 20-7.

[7.] Asif M., Joost de Brijin, E., Douglas, Al, Fisscher, O. (2009), "Why quality management programs fail. A strategic and operations management perspective", *International Journal of Quality & Reliability Management*, Vol.26, No.8, pp.778-794.

[8.] Beyer, J.M. Ashmos, D.P. and Osborn, R.N. (1997), "Contrast in enacting TQM: mechanistic vs organic ideology and implementation", *Journal of Quality Management*, Vol. 2, No. 2, pp. 3-39.

[9.] Bititci, U.S., Mendivil, K., Nudurupati, S., Garengo, P., Turner, T. (2006), "Dynamics of performance measurement and organizational culture", International Journal of Operations & Production Management, Vol. 26 No. 12, pp. 1325-1350.

[10.] Cagnazzo, L., Taticchi, Pl, Brun, A. (2010), "The role of performance measurement systems to support quality improvement initiatives at supply chain level", *International Journal of Productivity and Performance Management*, Vol. 59 No.2, pp. 163-185.

[11.] Choi, T.Y. and Eboch, K. (1998). "The TQM paradox: relations among TQM practices, plant performance and customer satisfaction", Journal of Operations Management, Vol. 17 No. 1, pp. 59-75.

[12.] Dahlgaard-Park, S.M., and Dahlgaard J.J. (2007), "Excellence – 25 years evolution", *Journal of Management History*, Vol. 13 No. 4, ppt. 371-293.

[13.] Dean, J.W. and Snell, S.A. (1996), "The strategic use uf integrated manufacturing: an empirical examination", Strategic Management Journal, Vol. 17 No. 6, pp. 459-80.

[14.] EFQM (1999), Self-assessment Guidelines for Companies, European Foundation for Quality of Management, Brussels.

[15.] Fernández-González, F., López-Fresno, P., (2002) "Leading with complexity in healthcare". *Proceedings of the International Conference on ISO 9000 and TQM.* Hong Kong Baptist University & RMIT.

[16.] Garvin, D.A. (1986), "Quality problems, policies and attitudes in the United States and Japan: an exploratory study", *Academy of Management Journal*, Vol. 29 No. 4, pp. 653-73.

[17.] Harari, O. (1993), "Ten reasons why TQM does not work", *Management Review*, Vol. 82 No. 1, pp. 33-8.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

[18.] Kwak, Y.H. and Anbari, F.T. (2006), "Benefits, obstacles, and future of Six Sigma approach", *Tec novation*, Vol. 6, pp. 708-15.

[19.] López-Fresno, P., Estrada-Rubio, F., Fernández-González, F. (1999) "Is Top Management Commitment Enough? A Case Experience in an Airline Company" *Proceedings of 12th Annual Management Conference*, American Association for Quality.

[20.] López-Fresno, P., Fernández-González, F. (2002) "Integrated Management in a Turbulent Environment" *Proceedings of 7th International Conference on ISO 9000 and TQM*, Hong Kong Baptist University & RMIT.

[21.] López-Fresno, P., Fernández-González, F. (2007) "Achieving Excellence Through 5-S. A Case Experience" *Proceedings of 12th International Conference on ISO 9000 and TQM*, APBEST and HK 5S Association.