CIPS KNOWLEDGE

Lean manufacturing / production

The benefits of lean manufacturing include lead time reduction, reduced inventory and overall cost saving (Feld)

This knowledge paper is supportive of Procurement professionals operating at managerial level of the CIPS Global Standard

01 CPD HOURS

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Lean manufacturing / production

Introduction

The main aim of the lean production process improvement is to achieve significant benefits for companies, for example, lower costs, faster time-to-market and better customer experiences. Lean production programmes stand in line with other improvement tools such as Total Quality Management, Business Reengineering and Six Sigma (Power, 2010). Lean production was originally developed at the Toyota Motor Company and was called the Toyota Production System (TPS). The system was developed to organise and manage product development, operations, suppliers and customer relations with fewer human effort, space, capital, time and defects and to precise customer requirements (Liker, 2004).

Elimination of waste is the central issue in lean production activities (Liker, 2004). Some of the tools and principles that help to eliminate waste in lean production include constant process analysis and improvement (kaizen), pull production (using kanban) and mistake proofing (pokayoke). Other essential principles are pull processing, perfect first time quality, waste minimisation, continuous improvement, flexibility, building and maintaining a long-term relationship with suppliers through collaborative risk sharing, cost sharing and information sharing (Womack and Jones, 2003).

Eliminating non-value-adding elements in the production system is central to lean production. Waste, which can be related to inventory, overproduction, rework and defects, inspection, product and information flow, waiting, motion, and underutilisation of talent, is seen not as a cause of problems but rather as a symptom of problems hidden in the system. Therefore, the key is to determine the causes of such waste (Gander and Snyder, 2002).

Generally, opportunities for quick improvements in manufacturing costs and performance lie in five key areas: equipment (reducing machine downtime, improving maintenance, boosting overall equipment effectiveness and output), processes (standardising work, cutting out low- value steps, optimising work flow, improving line staffing), material yield (reducing loss from scrap and obsolescence), logistics (boosting warehouse productivity, minimising freight costs) and inventory (right-sizing, rethinking levels of buffer stock, streamlining material flows, improving demand forecasts) (Zinser and Ryeson, 2011).

Definition

Lean manufacturing (production) is a business philosophy, a strategic tool and a process improvement programme employed to drive organisations towards cost reduction, strategic positioning for advantage, improved quality and profitability. Dirgo (2006) describes lean production as a way of doing more and more with less and less by eliminating waste and improving quality (Dirgo, 2006).

Successful Application

Core principles in the implementation process of lean production are the elimination of waste, multifunctional teams and pull scheduling. Before moving onto a lean production companies should analyse the payoff and make sure it is clear and understandable, ensure that it has enough manpower and access to the capital needed to undertake the project and that there are no competing priorities and identify hidden costs that are not immediately visible. This is especially important in complex global production networks (Zinser and Ryeson, 2011).

Steps to Successful Application

Prioritise opportunities based on time to results, relative effort and financial impact. Focus scarce resources on top priorities to generate quick wins.
Develop a coordinated effort within and across plants to rapidly surface and adopt best practices.
Create an environment that rewards speed and an acceptable level of risk taking.

Zinser and Ryeson (2011)

Hints and Tips

Simple reorganisation of workflows and slight modification of the production line to make the work area more concentrated (e.g. assigning each operator two lines instead of one) can lead to considerable reduction is labour costs - reductions by up to 4% have been re- ported (Zinser and Ryeson, 2011).
Competing demands for attention, competing mindsets and behaviours, strategic irrelevance, traditional management processes and the pain of disruption are among factors that can get in the way of a process improvement (Power, 2010).
A deep analysis of underlying cost drivers (scale, efficiency, overheads, and logistics) can help to identify hidden costs, for example, uncover the reason why some plants and geographies perform better than others (Zinser and Ryeson, 2011).
Reorganisation of floorspace can help achieve considerable improvements. For example, parts and materials stored on the floor often get damaged by forklifts or workers before they can be used. Designating a section on the shopfloor, creating racks to move inventory off the floor and putting guardrails protects it from damage and can lead to savings (Zinser and Ryeson, 2011).
The biggest opportunities for a quick transformation to lean production lie in overall equipment effectiveness (OEE), line staffing, and scrap reduction. This can be due to the fact that these areas are easy to analyse, they can be changed without a major capital in- vestment and can have room for improvement (Zinser and Ryeson, 2011).

Potential Advantages

Many success stories are associated with the implementation of lean production by companies. At the centre of these case studies are the achievement of cost reduction and higher quality delivery (Feld, 2000).
Some benefits of lean manufacturing include reduction in changeover time, reduction in machine set up time, reduced inventory, reduced downtimes and lead time reduction (Feld,
2000; Lucansky et al., 2002).
As 'lean' focuses on waste elimination and optimal use of resources, it can enable organisations to adopt environmental management practices, reducing waste and pollutants (Miller et al. 2010; Yang et al., 2011).

Potential Disadvantages

Potential weaknesses in the lean approach can include the limited potential for creativity and innovation (Harrison, 1994).
Often, when embarking on a lean programme, companies make the mistake of trying to do too much at once, making the transformation long and costly (Zinser and Ryeson, 2011).
Rigid lean manufacturing environments can include negative characteristics, such as worker isolation, harassment and dangerous conditions on the production line (Harrison, 1994).

Performance Monitoring

Responsiveness: on-time-delivery, manufacturing lead time, inventory turns (Chase and Aquilano, 2004).
Quality: delivered quality, rework/repair cost, customer complaints (Chase and Aquilano,2004).

Financial measures: margin, manufacturing space used, conversion cost (Chase and Aquilano, 2004).
Safety measures: reportable incidents, days worked without lost time/accident, ergonomic management (Chase and Aquilano, 2004).

Case Studies

Wipro, a software services firm, incorporated the basic essence of Toyota's lean principles into its software project planning and delivery processes. The Wipro Lean Initiative has been implemented to ensure differential benefits like increased productivity, delivery excellence and operational excellence. Wipro achieved a 35% productivity improvement through lean application for a leading global financial institution and reduced the test setup time by
75% resulting in the overall reduction of cycle time (Staats and Upton, 2009).
In 2002, Delphi Corp., a major automotive component supplier, driven by the vice President
R. David Nelson began implementing lean production. In 2003 supplier quality showed a
34% improvement, delivery performance went up by almost 100%, premium freight costs reduced by 51% and worldwide customer complaints dropped by 13% (Dutrnit and Vera- Cruz, 2007).
Since 1990 when new management pursued lean transformation, Wiremold increased stock by 32% per year, the first shipment fill rate from 60% to 92% sales per full time employee from $92,000 to $241,000. Moreover, inventory turnover rose from 3.4 to 15.8 and new product development cycle time declined from two-three years to 3-12 months (Power, 2010).

Further Reading/Reference

Web Resources

The Manufacturing Institute: Lean manufacturing http://www.manufacturinginstitute.co.uk/
Applying lean production techniques to start-ups http://www.ft.com/cms/s/30f3bcac-e07e-11df-abc1-
Lean production (in)ability to withstand disruptions http://www.ft.com/cms/s/d9667732-
The triumph of lean production: BBC News article http://news.bbc.co.uk/1/hi/business/6346315.stm

Books

The Machine that Changed the World, James P. Womack, Daniel T. Jones & Daniel Roos, ISBN 978-1847370556
The Toyota Way, Jeffrey Liker, ISBN 978-0071392310
Lean Manufacturing, William M. Feld, ISBN 978-1574442977
Lean Production Simplified, Pascal Dennis, ISBN 978-1563273568
Lean Work: Empowerment & Exploitation in the Global Auto Industry, Steve Babson, ISBN 978-0814325353

References

Ahlström, P. (1999) Sequences in the Implementation of Lean Production. European Management Journal, Vol.16 (3), pp. 327-334.
Deaves, M. (2002) Big Cat Habitat (Factory Redevelopment). Manufacturing Engineer, Vol.81(2), pp. 92-94.
Dirgo, R. (2006) Look Forward Beyond Lean and Six Sigma: A Self-Perpetuating Enterprise
Improvement Method. J Ross Publishing.
Dutrnit, G. and Vera-Cruz, A.O. (2007) Triggers of the Technological Capability Accumulation in MNCs' Subsidiaries: The Maquilas in Mexico. International Journal of Technology and Globalisation, Vol. 3(2/3), pp. 315-336.
Feld, W.M. (2000) Lean Manufacturing Tools and Techniques and How to Use Them. The CRC Press Series on Resource Management.
Lee, B.H. and Jo, H.J. (2007) The Mutation of the Toyota Production System: Adapting the TPS at Hyundai Motor Company. International Journal of Production Research, Vol. 45(16), pp. 3665-3679.

Liker, J. (2004) The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer. McGraw-Hill: New York.
Lucansky, P., Potapchuk, L. and Burke, R. (2002) The Lean Perspective: Lean Transformation: A Framework for Making the Transition to Lean. PharcaChem Journal Anno1(B5), pp. 11-12.
Miller, G., Pawloski, J. and Standridge, C. (2010) A Case Study of Lean. Sustainable Manufacturing. Journal of Industrial Engineering and Management, Vol. 3(1), pp. 11-32.
Power, B. (2010) Keep Your Eye on Process Improvement. Harvard Business Review, 18 Au- gust.
Staats, B.R. and Upton, D.M (2009) Lean Principles, Learning and Software Production: Evidence from Indian Software Services. Working Paper, 08-001. Harvard Business School.
Womack, J.P. and Jones D.T. (2003) Lean Thinking: Banish Waste and Create Wealth in your corporation. Simon and Schuster: London.
Yang, M.G., Hong, P. and Modi S.B. (2011) Impact of Lean Manufacturing and Environmental Management on Business Performance: An Empirical Study of Manufacturing Firms. International Journal of Production Economics, Vol. 129(2), pp. 251-261.