



## Transforming lean and green over operations management for sustainable manufacturing

<sup>1</sup> Y Srinivas Reddy, <sup>2</sup> Dr. Manjunath VS, <sup>3</sup> M Shankar Lingam

<sup>1</sup> Research Scholar, NITTE, Bengaluru, Karnataka, India

<sup>2</sup> Professor of Management, NITTE, Bengaluru, Karnataka, India

<sup>3</sup> University of Mysore, Mysore, Karnataka, India

### Abstract

To stay competitive, groups facing today's ranges of unparalleled international competition have to design and provide better services and products and enhance their production operations. Lean manufacturing has been used to improve operational performance. Operations control is worried with converting materials and exertions into items and services as correctly as viable to maximise the earnings of an employer. It is so one can create optimized versions that make the great use of assets without affecting the services introduced or product created. Green manufacturing is a method of manufacturing that minimizes waste and pollutants. Lean production is the machine which goals in removal of the waste from the machine with a scientific and non-stop technique. This observe pursuits to discuss the lean and inexperienced production concept and its implementation in operation management. Operations control teams try and stability fees with sales to gain the highest internet operating earnings possible. In this course, strategies of lean philosophy can play the super function.

**Keywords:** lean manufacturing, green manufacturing, operations management, waste

### Introduction

Operations control refers to the administration of enterprise practices to create the best degree of efficiency possible inside a corporation. It is worried with changing materials and exertions into goods and services as efficaciously as feasible to maximise the income of an agency. Operations control groups try to balance costs with sales to reap the very best net operating earnings possible.

Like each organization-whether it produces items or affords offerings-sees Job 1 as furnishing clients with first-rate merchandise. Thus, to compete with other groups, an organization ought to convert resources (materials, labor,

cash, facts) into goods or offerings as efficiently as feasible. The higher-stage supervisor who directs this transformation procedure is referred to as an operations manager. The task of operations control (OM), then, includes all the sports concerned in reworking a product concept right into a completed product, in addition to those concerned in making plans and controlling the systems that produce goods and services. In other words, operations managers control the process that transforms inputs into outputs. The below Figure "The Transformation Process" illustrates this traditional characteristic of operations management.

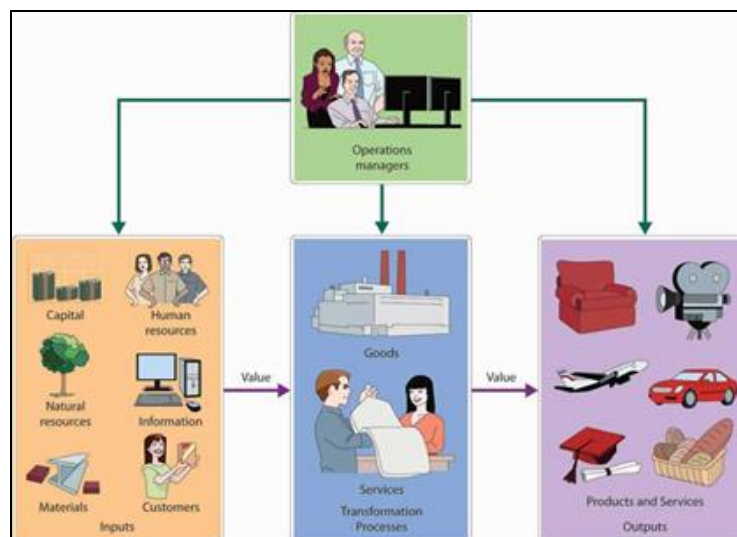


Fig 1: The transformation process

**Operations management in manufacturing**




Like all producers set out to carry out the equal primary feature: to convert sources into completed items. To perform this function in these days’s commercial enterprise environment, producers must usually strive to improve operational performance. They need to satisfactory-song their production techniques to cognizance on best, to hold down the charges of materials and exertions, and to eliminate all prices that upload no fee to the finished product. Making the choices worried in the attempt to obtain those dreams is the task of the operations manager. That person’s obligations can be grouped as follows:

- **Production Planning:** During production planning, managers determine how goods will be produced, where

manufacturing will take place, and the way production facilities can be laid out.

- **Production Manipulate:** Once the production manner is beneath manner, managers have to continually agenda and display the sports that make up that technique. They ought to solicit and reply to feedback and make adjustments in which needed. At this degree, additionally they oversee the purchasing of uncooked substances and the dealing with of inventories.
- **Quality Control:** Finally, the operations manager is directly involved in efforts to ensure that goods are produced according to specifications and that quality standards are maintained.

**Table 1**

<b>Manufacturing Operations Management</b> (Business and Manufacturing Process View)		
	<b>Level - IV</b> (Enterprise / Business Operations)	<b>Production, Demand and Supply</b> Product Production Capability Business Production Performance
	<b>Level – III</b> (Manufacturing Operations Management)	<b>Receiving and Shipping</b> Production and Process engineering operations, production assets, quality assurance, human resource and labour
	<b>Level – II, I</b> (Industrial Automation)	<b>Discrete, Hybrid, Batch</b>

**Lean Manufacturing**

This image summarizes that Lean Production is not about the Cost Reduction. Lean Production is to increase

- Quality
- Speed and Results

With the consequence of cost reduction.



**Fig 2**

Lean Manufacturing is an organization-extensive approach for accomplishing excellence:

- Creating value (from the client's attitude)
- Developing a lifestyle of continuous overall performance

improvement and running to dispose of ALL waste of sources and time

- Creating excessive fine, solid strategies and emphasizing respect for people all through the employer.

**Lean is a continuous process improvement methodology consisting of five primary principles**

1. Value (from the customer's perspective)
2. Value Stream (map the steps in the value stream)
3. Flow (create a smooth flow)
4. Pull (the right amount pulled at the right time, no more, no less)
5. Perfection (elimination of all waste in the value stream)

Lean Manufacturing The concept of Lean Manufacturing was first seen in Japan specially in Toyota Production System. Lean production was initially advanced by using the Toyota Motor Co. In Japan primarily based on standards pioneered by means of Henry Ford. The standards, tools and strategies had long gone via quite a few testing earlier than they have been widespread. Lean production approach production without waste. Waste takes many bureaucracy and may be located at any time and in any location. It may be found hidden in policies, tactics, system and product designs, and in operations. Waste consumes resources but does no longer add any cost to the product.

**Wastes**

Waste in any agency or technique is noted the misuse of sources, production now not fit for sale or resources that tie up coins and inventory while presenting very little gain to the corporation or its clients. These sources might be better used some other place in the organisation invested in value creating operations or opportunities. The intention of lean production have to be about eliminating waste from their structures and operations and extracting as an awful lot outputs as they can from minimal inputs.

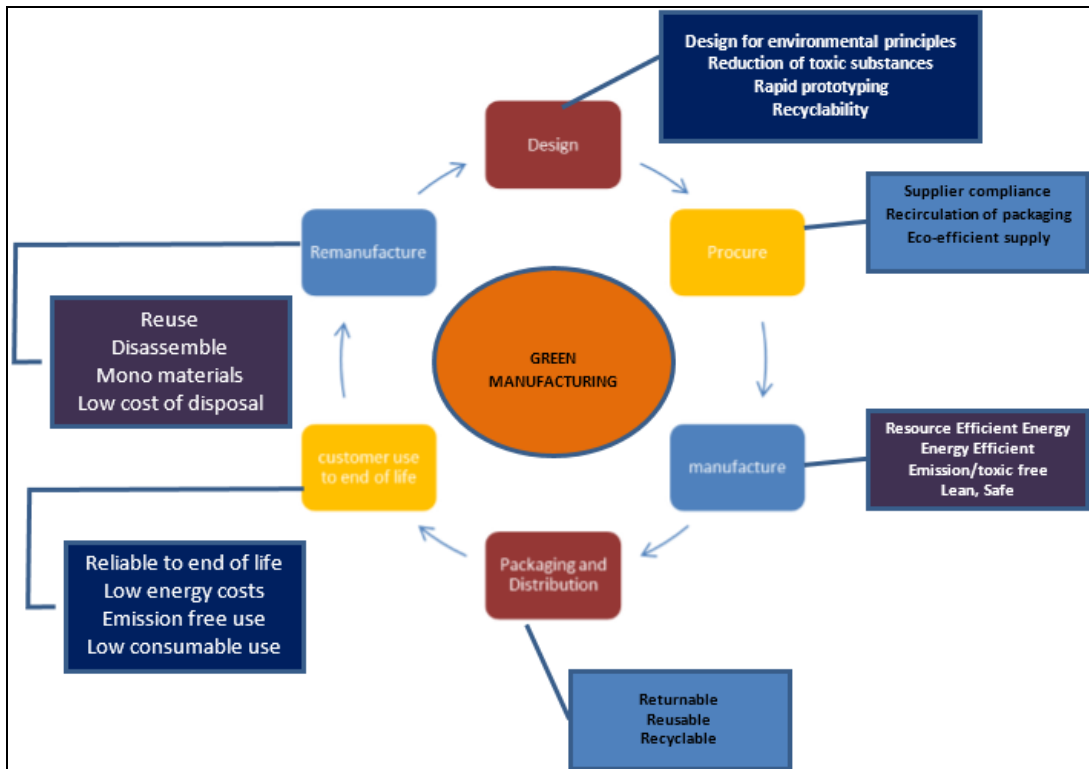
There are seven sorts of muda i.e., waste, this is addressed inside the TPS are Waiting, Transport or Conveyance, Defects or Correction, Over-production, Unnecessary Motion or Movement, Unnecessary Inventory, Inappropriate processing. The ultimate intention is to have a minimal waste within the operations of the plant.

**Lean manufacturing and traditional manufacturing**

The lean manufacturing strategies are conceptually one-of-a-

kind from the conventional procedure. For instance, the conventional manufacturing work is primarily based on stock. But Lean Manufacturing questions the role of inventory and defines it as a waste and displays the imperfections that the device has. Lean Manufacturing is in direct opposition with traditional manufacturing techniques characterised by use of economic order portions, high ability utilization, and high stock. In changing from a traditional surroundings to considered one of lean manufacturing, cultural issues will emerge speedy, in addition to resistance to exchange. A coping with change application is needed to accompany the effort. It has been installed beyond doubt that the groups that have mastered lean production techniques have huge cost and satisfactory benefits over the ones which might be nonetheless working towards traditional mass production (Singh and Sharma, 2009).

**Green Manufacturing**



Source: Frost & Sullivan

Fig 3

In these days's global the e-waste the foremost issue, green era is the utility of 1 or greater of environmental science, green chemistry, environmental tracking and digital gadgets to monitor, version and preserve the herbal environment and sources, and to lessen the bad impacts of human involvement. The term is also used to explain sustainable strength technology which include photovoltaics, wind mills, bioreactors, Biofiltration, Bioremediation, Desalination etc. We don't usually have time, or take time, to research greater, study great print, decipher complicated elements, and are looking for options. The word "natural" has turn out to be an

over-used and inaccurately-used BUZZWORD in latest advertising and marketing; it's nearly lost all price. Green Manufacturing is a technique of producing that minimizes waste and pollution completed via studies and method design. It is also a way that helps and sustains a renewable manner of producing merchandise and/or offerings that do not damage us or the environment. Green Manufacturing dreams are also to conserve natural sources for future generations. The benefit of Green Manufacturing is to create a awesome reputation to the public, saves useless fee, and promotes studies and design.

## Literature Review

This chapter incorporates a comprehensive evaluate of the literature with reference to lean production, green manufacturing and operation management.

The demanding situations encompass integrating environmental, health, and protection worries with green-product design, lean and inexperienced operations, and closed-loop supply chains. Angell *et al.* (1999) <sup>[1]</sup> outlines the improvement of environmental operations management, and discusses the integration of environmental and operations management in terms of each exercise and current studies.

Saurin *et al.* (2009) <sup>[9]</sup> offers hints for assessing lean production (LP) influences on running situations on employees either at a plant or departmental level, which had been examined on a harvester assembly line in Brazil. The affects detected in that line may additionally offer insights for other businesses concerned with balancing lean and suitable running conditions. Since the technique adopted for assessing the impacts is fairly easy, it's miles a possible opportunity for companies interested in surveying how LP is affecting their team of workers.

Oliveira *et al.* (2008) <sup>[6]</sup> studied the leveling manufacturing problem at a small to medium foundry industry in Brazil. It affords a laptop simulation model that has been used to balance the workflow of manufacturing operations to lessen the time of pouring instances through an improvement in industrial format and workload balancing inclusive of worker's multi skilling training. According to Congbo *et al.* (2010) <sup>[2]</sup> Green production (GM) is a type of present day production mode with the entire attention of sources intake and environmental impact. Reducing environmental influences and useful resource intake in production techniques is one of the critical troubles in inexperienced production (Yan *et al.*, 2008) <sup>[12]</sup>. Therefore, activities taking location within the deliver chain can have a power on the selection of environmental technologies within a focal plant. Proactive environmental practices can result in win-win possibilities in terms of environmental and manufacturing overall performance (Sarkis & Rashid, 1995) <sup>[8]</sup>. Other research even proposed that groups can expand some abilities via their environmental attempt, which translate into aggressive advantage main to greater profitability (Porter & Linde, 1995) <sup>[7]</sup>. To date, little or no attention has been dedicated to the potential have an impact on of environmental control within the deliver chain on plant-degree overall performance.

Green production has end up a critical difficulty in enterprise, pushed via policies governing production emissions, developing worldwide environmental evaluating enterprise techniques (Kleindorfer *et al.* 2005) <sup>[5]</sup>. According to Angel (1999), the sector of operations management maintains to make bigger in scope, currently in the direction of the mixing of environmental improvements into all regions of structural and infrastructural running selections.

Although wastes have exclusive kinds of categories, each (Lean and Green waste) units are designed to growth the efficiency and effectiveness of the value stream or machine. To do that a conventional Lean philosopher might seek to "map" those wastes with the intention to discover how they is probably decreased or removed. It is discovered that there's no such aspect as the proper device to try this. It takes a mixture

of diagnostic strategies, all with their strengths and weaknesses. In a comparable manner there's no unmarried proper green mapping device, greater a range of methods for exceptional tiers of the procedures. It emphasizes the legitimacy of environmental targets as consistent with the general requirements of product pleasant and economic system. Lean production is the enterprise version and series of tactical strategies that emphasize eliminating non-price added sports (waste) even as turning in exceptional products at lowest cost with greater efficiency. With those principles in mind, lean manufacturing is a hyperlink to inexperienced engineering.

The leading similarity between the advantages of lean and the blessings of inexperienced is waste, and so it makes best feel that in order to attain better degrees of environmental performance, the organisation should first undertake the principles and practices of lean production.

## Conclusion

Lean and inexperienced manufacturing concept is one of the high-quality latest tendencies in operation management. Operations management has long been targeted on waste reduction, so current control packages like Lean Manufacturing constitute trendy nice practices in operation control. Even without explicitly focused on environmental outcomes, lean efforts can yield sufficient environmental benefits. However, because environmental wastes and pollution are not the primary focal points, those fulfilment won't be maximized in the everyday scheme of lean. Thus it's far concluded that the 2 techniques (lean and green) may be included and provided concurrently within the operation management to reduce both waste and pollutants. This will honestly increase productiveness and income of the employer. Higher productiveness is crucial for the long-term competitiveness and profitability of corporations. It can be efficiently raised if it is managed with the aid of lean manufacturing equipment. For implementation of lean and inexperienced concept in the operation control, some equipment and techniques have to be applied in operation in line with want. Some of the lean equipment have been in brief explained on this paper also.

## References

1. Angell LC, Lewis HS. Environmental and Operations Management Face the Future Decision Line, 1999.
2. Congbo L, Fei L, Xianchun T, Yanbin D. A methodology for selecting a green technology portfolio based on synergy International Journal of Production Research; Dec, 2010; 48(24):7289-7302.
3. Deif A. A system model for green manufacturing Journal of Cleaner Production; 2011; 19(14):1553-1559.
4. Editorial. Advancing lean manufacturing, the role of IT Computers in Industry Elsevier, 2009; 60:235-236.
5. Kleindorfer, Singhal, Wassenhove V. Sustainable Operations Management. Production and Operations Management, Production and Operations Management Society, 2005; 14(4):482-492.
6. Oliveira CS, Pinto EB. Lean manufacturing paradigm in the foundry industry" Estudos Tecnológicos, 2008; 4(3):218-230.

7. Porter ME, Linde CV. Green and Competitive: Ending the Stalemate. *Harvard Business Review*. 1995; 73(5):120-133.
8. Sarkis J, Rasheed A. Greening the Manufacturing Function. *Business Horizons*. 1995; 38(5):17-27.
9. Saurin TA, Ferreira CF. The impacts of lean production on working conditions: A case study of a harvester assembly line in Brazil *International Journal of Industrial Ergonomics Elsevier*, 2009; 39:403-412.
10. Singh B, Sharma SK. Value stream mapping a versatile tool for lean implementation: an Indian case study of a manufacturing firm. *Measuring Business Excellence Q Emerald Group Publishing Limited*. 2009; 13(3):58-68. ISSN 1368-3047
11. Singh B, Garg SK, Sharma SK. Reflective Practice : Lean can be a survival strategy during recessionary times *International Journal of Productivity and Performance Management, Emerald Group Publishing Limited* 1741-0401. 2009; 58(8):803-808.
12. Yan H, Fei L, Jinlang S. A Framework of scheduling models in machining workshop for green manufacturing *Journal of Advanced Manufacturing Systems*, 2008; 7(2):319-322.
13. Yan H, Fei L, Jinliang S. A framework of scheduling models in machining Metal casting News, 6 *Foundry Management & Technology*, 2010.
14. Suresh Prasad, SK Sharma. Lean and Green Manufacturing: Concept and its Implementation in Operations Management, *International Journal of Advanced Mechanical Engineering*. 2014; 4(5):509-514. ISSN 2250-3234
15. <http://open.lib.umn.edu/exploringbusiness/chapter/operations-mgt-in-manufacturing/>
16. ID Paul, GP Bhole, JR Chaudhari. A review on Green Manufacturing: It's important, Methodology and its Application at 3rd International Conference on Materials Processing and Characterisation ICMPC 2014.
17. <http://www.frost.com/prod/servlet/cio/188029182>
18. <http://www.lnsresearch.com/research-library/manufacturing-operations-management>