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Lean and Green Manufacturing: Concept and its Implementation in Operations Management

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Abstract

To stay competitive, companies facing today's levels of unprecedented global competition must design and offer better products and services and improve their manufacturing operations. Lean manufacturing has been used to improve operational performance. Operations management is concerned with converting materials and labor into goods and services as efficiently as possible to maximize the profit of an organization. It is in order to create optimized versions that make the best use of resources without affecting the services delivered or product created. Green manufacturing is a method of manufacturing that minimizes waste and pollution. Lean manufacturing is the system which aims in elimination of the waste from the system with a systematic and continuous approach. This study aims to discuss the lean and green manufacturing concept and its implementation in operation management. Operations management teams attempt to balance costs with revenue to achieve the highest net operating profit possible. In this direction, techniques of lean philosophy can play the great role.

Keywords: Lean Manufacturing; Green Manufacturing; Operations Management; Waste.

1. Introduction

Operations management talks about applying business organization and management concepts in creation of goods and services. Operations management teams design the

method of conversion of inputs (materials, labor, proprietary information, etc.) into outputs (goods, services, value-added products, etc.) that is most beneficial to the organization. Operations management teams attempt to balance costs with revenue to achieve the highest net operating profit possible. For achieving this, lean and green manufacturing concept can be implemented in the industry.

1.1 Lean Manufacturing

The concept of **Lean Manufacturing** was first seen in Japan particularly in Toyota Production System. Lean manufacturing was originally developed by the Toyota Motor Co. in Japan based on concepts pioneered by Henry Ford. The concepts, tools and techniques had gone through a lot of testing before they were accepted .Lean manufacturing means manufacturing without waste. Waste takes many forms and can be found at any time and in any place. It may be found hidden in policies, procedures, process and product designs, and in operations. Waste consumes resources but does not add any value to the product.

1.1.1 Wastes

Waste in any organization or process is referred to the misuse of resources, production not fit for sale or resources that tie up cash and inventory while providing little or no benefit to the organization or its consumers. These resources could be better used elsewhere in the organization invested in value creating operations or opportunities. The aim of lean manufacturing should be about eliminating waste from their systems and operations and extracting as much outputs as they can from minimal inputs.

There are seven kinds of muda i.e., waste, that is addressed in the TPS are Waiting,Transport or Conveyance, Defects or Correction, Over-production, Unnecessary Motion or Movement, Unnecessary Inventory, Inappropriate processing. The ultimate goal is to have a minimum waste in the operations of the plant.

1.1.2 Lean manufacturing and traditional manufacturing

The lean manufacturing techniques are conceptually different from the traditional process. For example, the traditional manufacturing work is based on inventory. But Lean Manufacturing questions the role of inventory and defines it as a waste and reflects the imperfections that the system has. Lean Manufacturing is in direct opposition with traditional manufacturing approaches characterized by use of economic order quantities, high capacity utilization, and high inventory. In changing from a traditional environment to one of lean production, cultural issues will emerge quickly, as well as resistance to change. A managing change program is needed to accompany the effort. It has been established beyond doubt that the organizations that have mastered lean manufacturing methods have substantial cost and quality advantages over those which are still practicing traditional mass production (Singh and Sharma, 2009).

1.2 Green Manufacturing

Green Manufacturing is a method of manufacturing that minimizes waste and pollution achieved through research and process design. It is also a method that supports and sustains a renewable way of producing products and/or services that do not harm us or the environment. Green Manufacturing goals are also to conserve natural resources for future generations. The benefit of Green Manufacturing is to create a great reputation to the public, saves useless cost, and promotes research and design.

2. Literature Review

This chapter contains a comprehensive review of the literature with reference to lean manufacturing, green manufacturing and operation management .

The challenges include integrating environmental, health, and safety concerns with green-product design, lean and green operations, and closed-loop supply chains. Angell et al. (1999) outlines the development of environmental operations management, and discusses the integration of environmental and operations management in terms of both practice and recent research.

Saurin et al. (2009) presents guidelines for assessing lean production (LP) impacts on working conditions on employees either at a plant or departmental level, which were tested on a harvester assembly line in Brazil. The impacts detected in that line may provide insights for other companies concerned with balancing lean and good working conditions. Since the method adopted for assessing the impacts is fairly simple, it is a workable alternative for companies interested in surveying how LP is affecting their workforce.

Oliveira et al. (2008) studied the leveling production problem at a small to medium foundry industry in Brazil. It presents a computer simulation model that has been used to balance the workflow of production operations to reduce the time of pouring times through an improvement in industrial layout and workload balancing including worker's multi skilling training. According to Congbo et al.(2010) Green manufacturing (GM) is a kind of modern manufacturing mode with the full consideration of resources consumption and environmental impact. Reducing environmental impacts and resource consumption in manufacturing processes is one of the important issues in green manufacturing (Yan et al., 2008). Therefore, activities taking place in the supply chain can have an influence on the selection of environmental technologies within a focal plant. Proactive environmental practices can lead to *win-win* opportunities in terms of environmental and manufacturing performance (Sarkis& Rashid, 1995). Other studies even proposed that organizations can develop some capabilities through their environmental effort, which translate into competitive advantage leading to greater profitability (Porter &Linde, 1995). To date, very little attention has been devoted to the potential influence of environmental management in the supply chain on plant-level performance.

Green manufacturing has become an important issue in industry, driven by regulations governing manufacturing emissions, growing worldwide environmental

certification requirements (ISO 14000) and an emerging consumer preference for ecolabel products (Singh et al., 2009).

According to Deif (2011) with today‟s global awareness of environmental risks as well as the pressing needs to compete through efficiency, manufacturing systems are evolving into a new paradigm. He presents the model which can capture various planning activities to migrate from a less green for the new green manufacturing paradigm into a greener and more eco-efficient manufacturing.

3. Tools and Technique to Apply Lean Principles in Operation Management

Some key lean tools and techniques have proven especially effective in reducing waste and improving sustainability in operation. In order to apply lean principles in operation management, some. tools and techniques are Kanban, Kaizen, operator care program, SMED, and 5S. Some of the lean tools are briefly explained as

3.1 Kan-ban System or pull-systems

A Kan-ban is a card containing all the information required to be done on a product at each stage along its path to completion and which parts are needed at subsequent processes.This concept focuses on reducing excess inventories of raw or work-in-process materials which cannot be consumed immediately by the production cycle.

3.2 Operator care programs

IT focused on developing standards of practice within the operating units decrease variation in the manufacturing process, which reduces the amount of product and raw materials waste.

3.3 SMED or single minute exchange of dies

It is a practice that helps the organization to reduce changeover durations in order to adjust the manufacturing process based on product demand. It has the potential to reduce the amount of waste generated from raw and unprocessed materials left over in the manufacturing processes.

3.4 5S

It means Sort (remove that which is not needed), Set In Order (organize remaining things), Shine (clean and inspect working place), Standardize (write standards for above), Sustain (regularly implement the standards)

4. What Islean to Green in Operation Management?

Reducing environmental impacts and resource consumption in manufacturing processes is one of the important issues in green manufacturing (Yan et al.2010). Operation management (OM) is attempting to use the tools and concepts of lean operations to add green metrics to the measures of excellence companies‟ use in

evaluating business processes (Kleindorfer et al.2005).According to Angel (1999), the field of operations management continues to expand in scope, currently towards the integration of environmental improvements into all areas of structural and infrastructural operating decisions.

Although wastes have different types of categories, both(Lean and Green waste) sets are designed to increase the efficiency and effectiveness of the value stream or system. To do this a traditional Lean thinker would seek to "map" these wastes in order to identify how they might be reduced or eliminated. It is found that there is no such thing as the right tool to do this. It takes a combination of diagnostic approaches, all with their strengths and weaknesses. In a similar way there is no single right green mapping tool, more a range of approaches for different stages of the processes. It emphasizes the legitimacy of environmental objectives as consistent with the overall requirements of product quality and economy. Lean manufacturing is the business model and collection of tactical methods that emphasize eliminating non-value added activities (waste)while delivering quality products at lowest cost with greater efficiency. With these concepts in mind, lean manufacturing is a link to green engineering.

The leading similarity between the benefits of lean and the benefits of green is waste, and so it makes perfect sense that in order to achieve higher levels of environmental performance, the organization must first adopt the principles and practices of lean manufacturing.

5. Conclusion

Lean and green manufacturing concept is one of the best recent trends in operation management. Operations management has long been focused on waste reduction, so modern management programs like **Lean Manufacturing** represent today's best practices in operation management. Even without explicitly targeting environmental results, lean efforts can yield sufficient environmental benefits. However, because environmental wastes and pollution are not the main focal points, these achievement may not be maximized in the normal scheme of lean . Thus it is concluded that the two strategies (lean and green) can be integrated and offered simultaneously in the operation management to reduce both waste and pollution. This will certainly increase productivity and profit of the organization. Higherproductivity is critical for the long-term competitiveness and profitability of organizations. It can be effectively raised if it is managed by lean manufacturing tools. For implementation of lean and green concept in the operation management, some tools and techniques have to be implemented in operation according to need. Some of the lean tools have been briefly explained in this paper also.

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