Integrated Lean Management System for Sustainable Development: A Conceptual Model

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Abstract
Sustainability manufacturing practices like lean and green manufacturing seek to optimize production efficiency while minimizing environmental impact and maintaining social equity. It is also well knowing fact that company that adopt sustainable practices are able to achieve better quality, improved productivity and profitable growth. Among these lean is an important practice that leads us towards sustainability initiatives by eliminating waste at all levels in system and using the resources efficiently. In this paper an integrated lean sustainability development model has been proposed to integrate supplier, organization and customer.

Keywords: Lean Manufacturing, Sustainability, Productivity

1. Introduction
The lean concept originated in Japan after the Second World War when Japanese manufacturers realized they could not afford the massive investment required to build devastated facilities. Toyota began the process of developing manufacturing processes to minimize waste in all aspects of operations. They produced autos with less of everything – half the human effort, half the manufacturing space, half the investment, half the engineering hours – compared with mass production; the prevalent manufacturing process at that time. Also, it requires lesser inventory, results in fewer defects, less scraps and produces a greater and ever growing variety of products. This was possible primarily through the Japanese effective management of production and human resources, as mentioned in The Machine that Changed the World book (Womack et al., 1990).

Lean manufacturing gives the manufacturers a competitive edge by reducing costs and increasing quality, and by allowing the manufacturer to be more responsive to customer demands by eliminating seven types of wastes occurring in manufacturing process (Womack et al 1990, Hines and Rich 1997). Lately, the under utilization of creativity of employees is considered as eighth waste; environmental waste is considered as ninth waste which is unnecessary or excessive usage of resources as well as substances released to air, water, or land that could harm human health or environment (Vinodh et al, 2011, Gehin et al. 2008, Millet et al. 2007). Lean leads us towards sustainability which is “meeting the needs of the current generation without compromising the ability of the future generations to meet their needs” (The Bruntland Commission Report, United Nations, 1987). Lean sustainable development is the effective management of the flow of products and services to provide value added product/service to the customer and environment.

Synchronization of lean and other sustainable practices quantifying the gains include reduced cost and lead time, improved process flow, customer satisfaction, improved environment gains as well as employee morale, social gains, energy consumption, hazardous waste, water usage, etc. Lean tools and techniques with other quality management techniques are aimed to reduce wastages in the whole system for ensuring sustainability. Kainuma and Tawara (2006) included re-use and recycling aspects in the supply chain throughout the life cycle of the products and services by proposing the multiple attribute utility theory model. They applied the theory model in a company and achieved improvements in the managerial and environment attributes. The elimination of environment wastes using lean practices enables the acquisition of business values (Kaebernick et al. 2003). Simpson and Power (2005) have performed a major literature review which elaborates efforts to improve or influence a supplier’s environment management practices that raised the critical issues of transaction costs and efficacy of approach for the buyer. They also developed a model for approaching issues of supplier environmental performance through lean supply. Lewis (2000) presented a model of lean production and sustainable competitive advantage using input resources (Raw material, WIP, skilled staff, market information, technology data) in the firm. Lean production model also stress the generic importance of the customers and suppliers. Ho (2010) integrated lean, TQM tools (ISO 9000, ISO 14001, OHSAS 18001), and Six-Sigma to improve the outcome performance parameters of the system. Both the above
The objective of this paper is to propose an eight stage integrated lean sustainable management system model which includes implementation of lean tools and techniques to eliminate wastes from the supply chain. It is a closed loop and cyclical thinking process to achieve the environmental performance goals, economic profits, and social goals. Some of the important associated aspects are also discussed at each stage along with the drivers and barriers of lean and the benefits of lean implementation.

2. Development of Conceptual Integrated Lean Sustainable Model

The proposed integrated lean sustainable management model as shown in figure 1 provides an eight stage approach for sustainability. Through the supply chain there must be a management commitment and fully employee involvement to achieve better outputs. Start with the Plan-Do-Check-Act (P-D-C-A) cycle company must formulate a project team (cross-functional team) of strong individual contributors and a project leader to carry out the lean implementation task. Hard working and dedicated professionals are always a first choice for such projects along with perseverance; tenacity and patience are also valuable attributes for team. They will choose well from the dozens of ideas by brainstorming sessions through gap assessment. Team also focus on the centralized budgeting, IT network, Vendor management and purchasing, and streamlining of paper- driven process, long range planning, development of core competencies, development of training centers, strategies partnerships etc. Project management team will apply a set of proven lean tools and techniques to eliminate wastes throughout the supply chain along the eight stages to achieve desired future state from their current state.

After going through initial preparations the first stage in this model is to identify the drivers and barriers such as government regulation, customer demands, international standards, social issues, financial and technological constraints, resources availability, workers resistance, skill and expertise, organizational culture, misunderstanding of lean manufacturing. In second stage adopt the “Top down motivation and bottom up approach” management system that will provide some clear vision to the workers about lean along with execution of training activities and establishment of performance appraisal systems for workers. Next five stages are Supplier- Input- Process- Output – Customer (SIPOC) in which input, process and output are within the boundaries of organization. Organizations must manage the Man, Machine, Material, Motion, Method and Motivation (6M) effectively so that wastes can be eliminated by adopting suitable lean tools and techniques to maximize the sustainable gains. Management can take the services in the form of outsourcing (maintenance, housekeeping, security, food services, mail, copy services, etc), collaboration (meet the need of doing more with less) and technological (knowledge sharing, idea generation, cost saving information, ERP) to move towards sustainability. One must also see the recycling, reusing and remanufacturing operations for resources so that cost saving may be possible. Third stage is choosing the lean supplier and its development by involving him also in the lean implementation project. JIT is the important concepts here and suppliers must aware of this tool. Using the IT tools supplier integration will be done so that more than one supplier can be identifying for supply of raw materials at the competitive price. Fourth stage is input stage where tangibles i.e. raw material, WIP etc. and intangibles i.e. skill, technology resources usages will be dealt with carefully. Fifth stage is transforming resources in to final shape by managing properly the layouts, shop floor execution system, working environment, automation, packing & distribution, energy inputs, modeling of system etc. Sixth stage is the output where one can expect that cost, quality, delivery, benchmarking, health and productive, branding aspects will be there in the system. Seventh is the customer satisfaction stage where awareness programs will be launch to tell them about the sustainable products. Pull production system should be adopted keeping environment is co-customer for products. In last eighth stage thinks strategically again and adopts continuous and cycling thinking in the system to gain sustainable growth of organization. Table 1 shows the benefits of implementation of lean sustainability concepts in the manufacturing system.
Table 1. Benefits of Lean sustainable management system

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<th>Benefits</th>
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<tr>
<td>• Reduction in all types of wastes</td>
<td>• Optimum utilization of resources in terms of space, manpower, material</td>
<td>• Energy usages reduction</td>
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<td>• Improvement in productivity and quality</td>
<td>• Effective equipment utilization and energy consumption</td>
<td>• Increased reliability of equipments</td>
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<td>• Introduction of innovative practices for improving overall competitiveness</td>
<td>• Orderly working place</td>
<td>• Lesser inventory and WIP inventory</td>
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<td>• Induce good management practices</td>
<td>• Imbibe a culture of continuous improvement</td>
<td>• Brand/reputation enhancement</td>
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<td>• Reduction in customer complaints</td>
<td>• Livelihood creation</td>
<td>• Natural resources protection or restoration</td>
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<td>• Improved delivery schedule</td>
<td>• Social relation enhancement</td>
<td>• Reduction in quality rejection from the manufacturing process</td>
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<tr>
<td>• Optimum utilization of resources in terms of space, manpower, material</td>
<td>• Livelihood creation</td>
<td>• Social relation enhancement</td>
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3. Conclusion

The proposed eight stage model of lean management system basically consist the implementation of lean practice to achieve the sustainability. This system integrates the supplier, organization and customer along with important aspects associated at each stage. However, the model needs to be validated by real life case studies.

References


