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Foundry Industry: Lean and Green Practices

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ABSTRACT

Foundry is an industry that produces castings. Over the last few decades, the role of foundry industry has been essential to the economies of many developing and developed nations of the world. The products manufactured by the foundry industry are used in important sectors like steel, electrical and electronics, railway, aerospace, automobile and various other industries.

Nowadays, lean and green concepts are being extensively practiced and implemented by many manufacturing industries in different countries across the world for improving operational and environmental performance. In the recent past, many foundries have been trying to adopt lean and green principles and practices in their organizations to stay alive in today's highly competitive marketplace. Lean manufacturing means reduction of waste. Green manufacturing means reduction of pollution and minimal use of resources. This paper presents the importance of lean and green practices for the foundry industry on the basis of review of some of the research papers.

Keywords: Lean manufacturing, green manufacturing, foundry industry

Introduction

Manufacturing companies, including the foundry industry, are facing tough competition in all aspects of the business. No matter how serious is the issue of global climate change, there are good business reasons to reduce energy usage, cut down waste, and look for sustainable components and materials as substitutes for their non-sustainable counterparts. Minimizing wastage of resources and moving towards the implementation of lean and green manufacturing has become an essential strategy

for success. The operations of the foundry have a large number of processes that take place in different shops. In addition to this, the foundry industry is often caused for polluting the environment. Some of the environmental issues associated with this industry are the emission of harmful and poisonous gases, dust and sand particles and generation of pollutants.

The operations of the foundry have a large number of processes that take place in different shops. The operations of the foundry processes can be termed as follows:

- Pattern and mould making processes;
- Melting process in furnace;
- Metal treatment and degassing if required before pouring;
- Pouring;
- Fettling and sand recycling;
- Cleaning, drilling and finishing (i.e., machining);
- Inventory, packaging, and shipping.

Thus foundry industry is having multi shop organisation and there is a scope of implementing lean and green practices.

Literature review

The aim of lean manufacturing is to reduce waste in terms of human effort, inventory, waiting, etc. from the systems and operations while increasing productivity by extracting as much outputs as they can obtain from lesser inputs (Liker, 2004). The purpose of green manufacturing is to manufacture products while conserving energy and reducing energy consumption and pollution using managerial and technological approaches (Tsai et al., 2014).

The major issues faced by the industry are larger volumes of by-products that are currently being sent to landfill, nuisance odours, and the need to maximize health and safety in the industry (Cleaner Production Manual, 1999). Sand is the largest by-product generated by volume in sand casting (Li et al., 2010). Table 1 shows contributions of various researchers related to foundry industry using lean and green practices.

Table 1: Literature Related to Lean and Green Practices in Foundry Industry

Sr. No.	Researchers	Inferences on Lean and Green Practices in Foundry Industry
1	Abdulmalek et al. (2007)	Described a case where lean principles were adapted for application in the process sector at a large integrated steel mill. Value stream mapping was the main practice used to identify the opportunities for various lean techniques.
2	Torielli et al.	Provides a broad perspective on combining lean methods with

	(2011)	environmental sustainability to assist foundries in remaining competitive. Their study also demonstrates that environmentally sustainability solution can also reduce foundries operating cost.
3	Chakraborty et al. (2005)	Suggested analytic hierarchy process (AHP) for an industry to reduce the existing die casting suppliers from five to three by adopting criteria based on lean and green manufacturing. The criteria considered were cost, quality, schedule adherence and general co-operation.
4	He et al. (2008)	Metal casters cite energy as one of their most significant costs; Enterprise Minnesota aims to optimize the five foundry's costs while reducing their environmental impact. At the same time, reducing their material waste will advance the foundries 'sustainability' practices.
5	Oliveira and Pinto (2008)	Studied the levelling 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-skill training.
6	US Environmental Protection Agency Report (1998)	Many modern pattern shops make use of computer-aided design (CAD) to design patterns. These systems can also be integrated with automated cutting tools that are controlled with computer-aided manufacturing (CAM) practices.
7	Degarmo et al. (1988)	Paths for the entrance of metal into the mould cavity constitute the runner system and include the sprue and various feeders which maintain a good metal 'feed' and in-gates attached with the runner system to the casting cavity. Gas and steam generated during casting exit through the permeable sand or via risers are added either in the pattern itself or as separate pieces.

Some foundries operate more than one type of furnace and may even transfer molten metal from one furnace to another to make use of the best features of each (US Environmental Protection Agency Report, 1998). 5S is often referred to as a universally acceptable lean tool in the steel industry (Abdulmalek and Rajgopal, 2007).

Conclusion

The Indian foundry industry is well established. This establishment can be sustained only when Indian foundries become world class manufacturing units. To be world class manufacturing units, Indian foundry industry is required to follow lean and green principles in the future. Expenditure on energy consumption is a major cost in all foundries. The major part of the energy is used in the melting

process. The choice of which furnace or furnaces to use or the decision to change from one type of furnace to another is not simple but depends on various factors. The company also has to strive hard to be innovative, profitable, technologically superior and productive as well as pollution free environment and consideration for sustainability. Overall, it is a great possibility for the implementation of lean and green manufacturing practice in foundry industry. Some tools such as VSM, AHP, CAD, CAM, 5 S etc can be applied for the implementation of lean and green manufacturing. It is crucial for the companies to be aware of different legislations that apply to their businesses and the actions that are required to ensure compliance.

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