

Evolution of Production Systems: The Impact of Lean Management Integration

Munna Kumar, P.N. Ahirwar

Department of Mechanical Engineering

munnakumarbit@gmail.com, dr.pnahirwar@mpu.ac.in

Madhyanchal Professional University, Bhopal, Madhya Pradesh, India

Selection and peer review of this article are under the responsibility of the scientific committee of the International Conference on Current Trends in Engineering, Science, and Management (ICCSTEM-2024) at SAM Global University, Bhopal.

Abstract - In the ever-evolving landscape of production systems, the integration of lean management has emerged as a pivotal trend shaping the industry. Lean principles focus on maximising value while minimising waste and creating more efficient and streamlined production processes. This integration of lean methodologies into traditional production systems has revolutionised the way businesses operate, leading to increased productivity and profitability. One of the key benefits of incorporating lean management into production systems is reducing waste in all its forms. By identifying and eliminating non-value-added activities, companies are able to optimise their production processes and enhance overall efficiency. This results in cost savings and improves lead times and quality control, ultimately leading to greater customer satisfaction. Another significant trend in production systems is the emphasis on continuous improvement. Lean management encourages a culture of continuous learning and innovation, with employees at all levels actively identifying improvement areas and implementing solutions. This results in a more agile and adaptive production system that can quickly respond to changing market demands and customer preferences.

Keywords: Lean Management, Production System, Ceramic Industry, Waste Reduction

1. INTRODUCTION

The industry is transforming market conditions and customers' demands in the current scenario. Many organisations find themselves in a competitive environment where reducing production costs and maintaining profit margins is crucial[1]. Lean manufacturing principles and tools have emerged as a viable solution for organisations aiming to enhance their competitiveness by minimising waste and creating value, despite some criticism surrounding factors like the human element and the ability to manage. There are also

considerations regarding applying lean principles in discrete versus continuous manufacturing environments. As often cited in the literature, the key advantages of implementing lean manufacturing practices include reducing inventory and lead times, enhancing product quality, and, most importantly, eliminating waste that customers are unwilling to pay for. The ceramic industry is currently grappling with uncertainties in demand. To meet customer needs, ceramic companies must adjust their production levels and responsiveness to market changes while also focusing on improving quality

through continuous enhancement efforts. By embracing lean production methodologies, organisations can streamline operations, enhance efficiency, and adapt to the evolving market dynamics [2, 3]. This shift towards lean production reduces cost and facilitates value creation, positioning companies for sustained success in a competitive marketplace. Maintenance management ensures zero-failure outcomes in today's lean production environment, where high-tech machinery and advanced manufacturing concepts are utilised. Transitioning from traditional repair methods, Total Productive Maintenance (TPM) has emerged as a pivotal strategy to maximise machinery effectiveness and minimise downtime. This approach involves all employees' active participation and motivation to optimise production processes. TPM is fundamental to the success of any production optimisation strategy.

Reliable machines are essential for seamless operations, as disruptions can hinder manufacturing efficiency. To maintain machinery effectiveness, companies must address the six major losses that impact production: Downtime, Speed Losses, and Defects. The maintenance department ensures equipment reliability in pursuing asset optimisation and enhanced productivity. Preventive maintenance practices are key to avoiding potential issues and optimising machine performance. Low OEE values contribute to rejected products, rework, and extended setup times, impacting production outcomes.

Conversely, a high OEE value indicates improved productivity and efficiency within the production process. Companies can enhance production efficiency and achieve optimal performance by implementing lean maintenance management

practices and prioritising machinery reliability. The rest of the paper is organised as follows: Section II describes the implementation of lean manufacturing, section III describes factors that influence lean production in the ceramic industry, and Section IV concludes.

2. IMPLEMENTATION OF LEAN MANUFACTURING

In the realm of ceramic plant workplaces, integrating Lean concepts presents opportunities and challenges that merit careful examination. Central to this exploration are two fundamental questions: What are the potential impacts of implementing Lean practices, and what challenges might arise while implementing Lean Management in ceramic product production? To comprehensively address these inquiries, conducting a thorough analysis of the ceramic industry and gaining a deep understanding of Lean philosophy is essential. Before a company can effectively adopt Lean Management, it must thoroughly scrutinise its functionality, suitability, and the associated implementation costs. Key areas requiring evaluation include the specific nuances of the ceramic production technology, available resources (human, informational, material, financial), adopted production system, enterprise size, infrastructure, customer expectations, business development opportunities, competitiveness enhancement, operating costs reduction, and environmental impact. The incorporation of Lean Management principles into ceramic production processes holds significant promise. By embracing these principles, companies can streamline operations, minimise waste, increase productivity, and ultimately enhance their competitive position in the market. Indeed, the importance of Lean principles in production cannot be overstated,

making them indispensable strategies for modern ceramic plants seeking to optimise efficiency and

profitability. Figure 1 depicts the lean production process in the ceramic industry [4, 5, 6, 7].

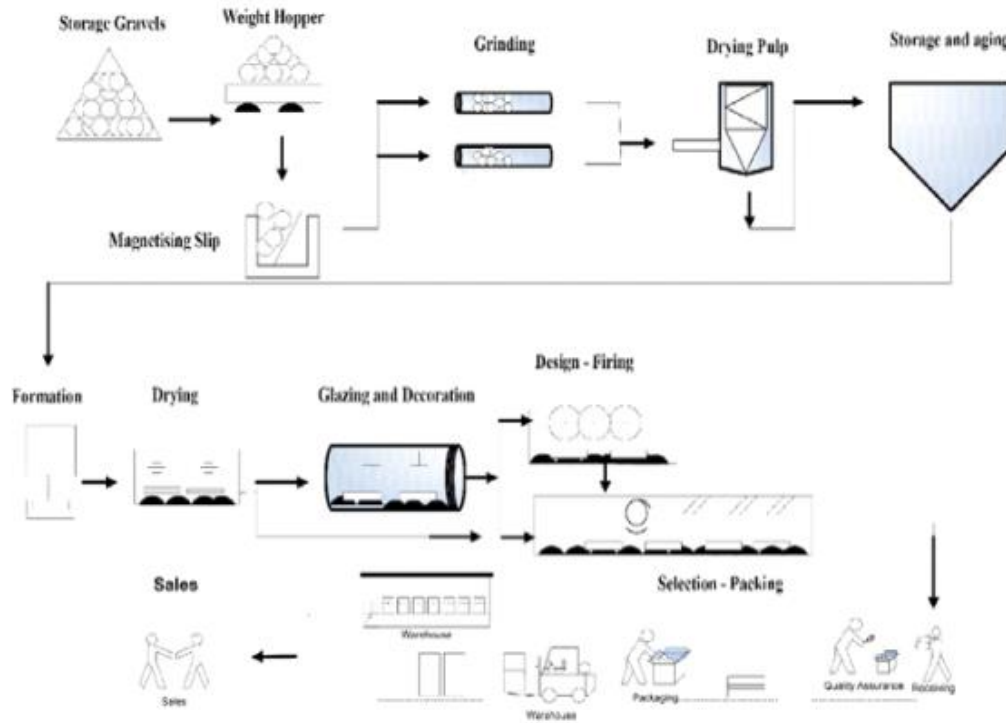


Figure 1. The production process of title

3. FACTORS THAT INFLUENCE THE PRODUCTION PROCESS

The ceramic industry revolves around ceramic plants specialising in producing various ceramics, including building, sanitary, functional, and technical ones. Each plant has a unique production profile, making it difficult to develop a one-size-fits-all pro-lean solution for the entire industry. However, the main production processes are common across all ceramic plants and are essential for producing ceramic products. The production profiles of ceramic products vary based on the product range and the size of the plant, ranging from individual to mass production. The size of the enterprise is a significant barrier to implementing lean principles

in ceramic plants. Research conducted in ceramic plants aligns with the literature and findings in various industries. Implementing lean tools in large enterprises requires a conscious, well-planned, and long-term approach. Large production facilities have the necessary resources, such as financial, material, human, and information resources, to adopt new solutions effectively.

In contrast, small ceramic plants face barriers such as limited personnel resources, unstable employment, challenges in strategic planning, implementation costs, and training. Small and medium-sized enterprises also struggle with managerial knowledge, resistance to

organisational innovations, and inadequate data collection methods. In conclusion, optimising production processes in the ceramic industry with lean principles is a complex task that requires overcoming barriers related to enterprise size, resources, planning, and organisational culture. By addressing these challenges, ceramic plants can enhance their efficiency and competitiveness in the market [8, 9, 10, 11, 12].

4. CONCLUSION AND FUTURE SCOPE

In today's competitive business landscape, implementing Lean Manufacturing principles has proven to be a game-changer for large enterprises. However, there is a growing interest in Lean Production among small and medium-sized enterprises. Despite this interest, these companies face barriers to fully embracing Lean practices. This is often due to a lack of management awareness and limited financial resources. Unlike their larger counterparts, small and medium-sized enterprises do not have the same financial capacity to invest in process improvement activities. However, by educating employees about the importance of eliminating waste, these companies can increase production efficiency and enhance their competitiveness in the market. Small and medium-sized enterprises can streamline their production processes and improve organisational culture by implementing Lean Production. This shift towards Lean principles can lead to more effective functioning in the labour market and, ultimately, better financial results for the ceramic industry.

REFERENCES

- [1]. Desai, Darshak A., and Aurangzeb Javed Ahmed Shaikh. "Reducing failure rate at high voltage (HV) testing of insulator using Six Sigma methodology." *International Journal of Productivity and Performance Management* (2018).
- [2]. Bustmoy, A., and Iriani Rochmoeljati. "Analisis Kualitas Produk Keramik Untuk Meningkatkan Kualitas Dengan Metode Six Sigma Dan Kaizen Di Pt. Xyz." *J. Manaj. Ind. dan Teknol* 1 (2020): 152-61.
- [3]. Kleszcz, Daniel. "Barriers and opportunities in implementing Lean Manufacturing tools in the ceramic industry." *Production Engineering Archives* 19 (2018).
- [4]. Yadav, Narottam, Kaliyan Mathiyazhagan, and Krishna Kumar. "Application of Six Sigma to minimise the defects in glass manufacturing industry: A case study." *Journal of Advances in Management Research* (2019).
- [5]. Maia, Mariana, Carina Pimentel, Francisco Silva, Radu Godina, and João Matias. "Order fulfilment process improvement in a ceramic industry." *Procedia Manufacturing* 38 (2019): 1436-1443.
- [6]. Rajpurohit, Arjun, and Vivek Deshpande. "Application of Lean Tools in Ceramic Industry: A."
- [7]. Uluskan, Meryem. "Analysis of Lean Six Sigma tools from a multidimensional perspective." *Total Quality Management & Business Excellence* 30, no. 9-10 (2019): 1167-1188.
- [8]. Raja Sreedharan, V., Anjana Balagopalan, V. Murale, and P. Arunprasad. "Synergising Lean Six Sigma with human resource practices: evidence from literature arena." *Total Quality Management and Business Excellence* 31, no. 5-6 (2020): 636-653.
- [9]. Patel, Mihir, and Darshak Arunbhai Desai. "Critical review and analysis of measuring

the success of Six Sigma implementation in the manufacturing sector." *International Journal of Quality & Reliability Management* (2018).

- [10]. Kleszcz, Daniel, Michał Zasadzień, and Robert Ulewicz. "Lean Manufacturing in the Ceramic Industry." *Multidisciplinary Aspects of Production Engineering* 2, no. 1 (2019): 457-466.
- [11]. Minh, Khaw Sui, Suhaiza Zailani, Mohammad Iranmanesh, and Shima Heidari. "Do lean manufacturing practices have a negative impact on job satisfaction?." *International Journal of Lean Six Sigma* (2018).
- [12]. Kim, Yong-Hyeon, and Young-Wook Kim. "Direct bonding of silicon carbide ceramics sintered with yttria." *Journal of the European Ceramic Society* 39, no. 15 (2019): 4487-4494.