

# **Systematic review of lean manufacturing practices in pharmaceutical industry**

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## **Abstract**

The purpose of this paper is to conduct the systematic review of lean manufacturing practices in Pharmaceutical Industry. It is the established fact that lean manufacturing practices are widely acceptable and popular in Pharmaceutical Industry unlike the other industries except automobiles. It is the facts also that despite this popularity, many companies are still unaware about the appropriate selection of relevant lean practices for their industry. This paper encompasses the comprehensive systematic review of lean manufacturing practices in Pharmaceutical Industry and identifies and discusses their applications.

The following research is based on twenty nine (29) papers which were published in well reputed journals, books, databases and conference proceedings. In initial search seventy five (75) papers were collected added in data pool. Later on, scrutiny was done according to the objectives of the research and twenty nine (29) papers were found most relevant to the research.

The lean practices are extracted after thorough study of the final pool of twenty nine (29) papers. This paper summarizes all mentioned lean practices into Forty (40). Furthermore, the deep study is conducted and most successful Ten (10) lean practices are identified for further discussion. The identified Ten (10) lean practices are discussed in detail and their applications are further elaborated by relevant case studies.

It is very important for industry practitioners to be aware of the applications of relevant lean manufacturing practices. In addition to this, industry practitioners must be aware also about the limitations and lean road map before starting the lean implementation process. Hence, this paper could provide valuable insights to Pharmaceutical Industry practitioners.

The findings from this case study are limited to focus areas of Pharmaceutical Industry and cannot be generalized for others in Pharmaceutical and/or other industry/services sectors.

This paper is based on a comprehensive systematic literature review which gives an opportunity to Lean Manufacturing researchers and Pharmaceutical Industry practitioners to understand most relevant Ten (10) Lean manufacturing practices in depth. In addition, highlighting the other thirty (30) relevant Lean Manufacturing practices and their applications in current literature and developing an agenda for future research, will save time and effort for readers looking to research in the area of Lean Manufacturing Practices in Pharmaceutical Industry.

## **Keywords**

Lean manufacturing, review, industry, pharmaceutical, lean practices

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## **Biographies**

**Muhammad Ali Khan** is working currently as Assistant Professor in asDepartment of Industrial Engineering and Management from Mehran University of Engineering and Technology, Jamshoro, Sindh, Pakistan. He has almost 16 years teaching experience the undergraduate level and few years at post graduate level. He has also supervised more than a dozen students at undergraduate level and a few at post graduate level. He is also PhD scholar in the same department. He has completed the Master of Engineering in Industrial Engineering and Management from the Department of Industrial Engineering and Management from Mehran University of Engineering and Technology, Jamshoro, Sindh, Pakistan. He has also completed his PGD in Industrial Engineering and Management from the Department of Industrial Engineering and Management from Mehran University of Engineering and Technology, Jamshoro, Sindh, Pakistan. He has also completed his MBA in Industrial Management from IoBM, Karachi, Pakistan. Earlier, he has also completed his bachelor of engineering in Industrial Engineering and Management from Mehran University of Engineering and Technology, Jamshoro, Sindh, Pakistan. He has authored various research papers at the national and international conferences. He has authored various research papers in national and international journals.

**Dr. Shakeel Ahmed Shaikh** currently works as Associate Professor in the Department of Industrial Engineering and Management, Mehran UET, Jamshoro, Sindh, Pakistan. He has completed his Bachelor of Engineering in Industrial Engineering from the same department. Dr. Shakeel completed his Master of Engineering in Manufacturing from the same department. He has received scholarship for PhD from University of Nottingham, United Kingdom. He has completed his PhD in 2015 with specialization in Manufacturing Engineering and Operations Management from University of Nottingham, United Kingdom. He has supervised many theses at undergraduate and post graduate level. He published his research work in many journals , book chapters, and conference proceedings. He has participated in many professional seminars, workshops, symposia and trainings. He is registered with Pakistan Engineering Council and many other professional bodies. He does research in Human Factors Engineering, Total Quality Management, Motion Capture Analysis, Cloud Manufacturing. He has also earned various certifications in his areas of research.

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