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Lean in a High Mix, Low Volume Manufacturing Environment – Case study

Anees Hussain, Jose Eduardo Munive-Hernandez, Felician Campean
Faculty of Engineering & Informatics
University of Bradford
Bradford, BD7 1DP, UK
A.Hussain286@bradford.ac.uk, J.E.Munive@bradford.ac.uk, F.Campean@bradford.ac.uk

Abstract

Market competition is fierce and has been intensified due to globalization, therefore companies have experienced increase pressure to improve cycle and delivery times and achieve a high level of customization. Lean principles have been designed and implemented to respond to market changes. However, these principles are commonly aimed to aid low-mix high-volume (LMHV) manufacturers. This paper aims to produce an approach to implement a lean framework in a high-mix low-volume (HMLV) manufacturing environment. An HMLV manufacturing environment, currently produces a variety of products which differs in terms of shape and size and different sequence of operation.
Furthermore, analysis of the manufacturing assembly shows there is a substantial variation in cycle and changeover time from product to product. In this approach, an action based study has been completed. This study uses data collection methods to be applied in order to calculate timings to be used in a Discrete Event Simulation (DES). The simulation uses lean tools to study material movement and facility layout to minimize bottlenecks and eliminate waste from the process. An introduction of lean supermarket is considered within the simulation whereby an operator withdraws products in an specific amount needed by a downstream process before introducing it across the assembly floor and an action plan is created. As a result, a lean manufacturing simulation study has been implemented to evaluate the effects of a supermarket concept within the current manufacturing environment. Initial results show a variation within the cycle and setup times for each of the different products due to the nature of the process. The paper, is limited to applying the approach to a singular production line and a singular manufacturing plant. The practical implications to implement this approach into a manufacturing environment is that there should be a need from the company. This approach should be driven by senior members within the organization as the resistance to change would increase the risk of failure. Another implication of the proposed approach is to ensure the accuracy of the data collected and to introduce a series of briefs within each stage of the approach. This is important as all stakeholders would need to be kept up-to-date with the project. However, the approach is applicable to any organization and can be applied to any sector. This paper, proposes a systematic approach to implement a lean framework in a high-mix low-volume (HMLV) manufacturing environment. The approach is validated in British manufacturing organization competing in global markets.

Biographies

Anees Hussain is currently a postgraduate research student within faculty of Engineering and informatics at the University of Bradford. He received his MSc in Mechanical Engineering in 2019, whilst working as a process improvement engineer for an automotive manufacturer. His research interests include application of modelling techniques, such as Discrete and Dynamic Event Simulation to support the implementation of lean and six sigma methodologies within manufacturing, supply chain management and big data systems.

Dr J. Eduardo Munive-Hernandez is a Lecturer in Advanced Manufacturing Engineering at the Faculty of Engineering and Informatics, University of Bradford. He received his PhD in Total Technology from the University of Manchester Institute of Science and Technology in 2003. He has industrial experience in the manufacturing sector

and in the automotive industry. His research interests include application of modelling techniques, such as System Dynamics and Discreet Event Simulation, to support analysis and performance measurement, process improvement and lean initiatives for sustainable operations and supply chain management. He is also interested in the analysis, development and implementation of strategic knowledge management systems to support those improvement initiatives.

Felician Campean is a Professor in Automotive Reliability Engineering and Director of the Automotive Research Centre at the University of Bradford. He holds a PhD in Reliability from Brunel University (1998) and a Mechanical / Manufacturing Engineering Degree from Transylvania University (1990). Worked in the bearings industry before joining Academia as a lecturer in manufacturing automation. Has joined University of Bradford in 1998 as a Research Fellow, and progressed to Senior Research Fellow (2000), Senior Lecturer in Competitive Design (2005), and Professor in 2011. Current research interests revolve around modelling complex systems, including model based methods for systems engineering, reliability, robustness and resilience analysis for multi-disciplinary complex systems, big data analytics methods for systems design and lifecycle management, multi-disciplinary design optimization applied to complex systems, modelling complex manufacturing and product development processes.