

Strategies for Sustainable Assembly Line Design with Lean and Ergonomics Perspective

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Abstract

In the current competitive world, lean manufacturing techniques have drawn the attention of all manufacturing community and other sectors. Lean techniques must be central to the strategy and mindset of the company or organization for sustainability. Even though the goals of ergonomics and lean production systems are congruent, the contribution of ergonomics to sustainable lean production system design has been limited. The influence of ergonomics on lean production is inadequately understood and seldom considered. In this research, an integrated methodology is proposed to investigate and redesign an assembly line by considering ergonomics and lean principles simultaneously. The impact of ergonomic interventions and lean concepts are investigated through a case study. The data collected from a machine tool assembly line are used to demonstrate the proposed methodology. The assembly activities are converted into human motions as advocated by Methods-Time Measurement (MTM) to evaluate the work methods and estimate standard time. Based on the results of the ergonomics evaluation and MTM studies, the choice of the final configuration of the workstations' is found out appropriately. This process helped to reduce the workplace risk level and subsequent non value added activities (NVA) in the assembly process. The reduction in workstation cycle time as the result of improved work postures and consequent non value added activities are quantitatively reassessed with MTM standards. The ergonomically improved assembly tasks and value added work methods are arrived based on the proposed methodology and used to redesign the assembly line. The performance of the improved assembly line is investigated for different takt times. The redesigned workstations resulted in improved work postures and reduced the assembly time of the machine tool bed by 25.14 min or 14.5%. In other words, the inference could be drawn that the resource productivity or freed up capacity were improved by 14.5% and subsequent assembly activities could be added to the respective workstations.

Keywords

Methods-Time Measurement, RULA analysis, lean waste, Assembly line balance, smoothness level.