PRODUCTIVITY IMPROVEMENT OF THE MANUFACTURING PROCESSES THROUGH MODELLING AND SIMULATION ANALYSIS

A CASE STUDY OF A VEHICLE ASSEMBLY PLANT.

JAMES NJOROGE NDUNGU

A Thesis Submitted in Partial Fulfillment for the Award of the Degree of Master of Science in Industrial In Engineering and Management in the School of Engineering

Dedan Kimathi University of Technology

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DECLARATION

This thesis is my original work and has not been presented in any university / institution for a degree or for consideration of any certification.

Signature _____ **Date** 17-Nov-16.

James Njoroge Ndungu

Supervisors' declaration:

We confirm that the work reported in this thesis was carried out by the candidate under our supervision as University supervisors.

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ABSTRACT

The competitive environment in the automotive industry demands low cost as a strategic advantage. In addition, the Kenyan automotive industry has experienced steady growth over the last five years thus creating demand that is higher than supply. Consequently, each vehicle assembler is looking for ways to reduce the cost of manufacturing and at the same time to increase output in order to match supply with demand. Therefore, the purpose of this research is to develop a model for improving productivity of the vehicle assembler in order to provide a cost advantage and increase output to meet the demand levels.

This thesis seeks to improve productivity by providing an empirical method to evaluate a production system and determine its capacity and constrains. In order to gain the in-depth information required for modelling, a case study methodology was utilized. Key steps to achieve the thesis objectives were to develop a simulation model of the case assembly plant, simulate the model, optimize the model through experimentation and finally use the simulation results to derive strategies for improving productivity of the process. Lean manufacturing tools were applied to develop the improvement strategies. Arena® software was used to develop the simulation because of its ease of learning, minimal cost of ownership, analysis capabilities and its inbuilt statistical facilities.

A simulation model with complete process analysis was developed and run under different operating scenarios to identify optimal conditions that yield highest output. The optimal scenario led to a 110% improvement in productivity in the simulation. The strategies for improving the process were derived for the case study plant to implement adopted from lean manufacturing techniques. The contribution of this research to theory was to provide the link between simulation and lean manufacturing techniques that is vital for implementing the optimal simulation attributes at the shop floor. The contribution of this research to the case study plant was enormous in terms of output and capacity. The case study plant implemented some of the recommendations of this research and realised a 60% increase in actual daily production average.