National University of Science and Technology

Think in Other Terms

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

FINAL YEAR PROJECT

PRODUCTIVITY IMPROVEMENT OF AN EXTRUSION PLANT USING SIMULATION AS A MANUFACTURING SYSTEM ANALYSIS TOOL (*A case study of Almin metal industries' extrusion plant*)

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ABSTRACT

This project researched on the performance of an Aluminium Extrusion plant in terms of productivity and inventory reduction. The aspect of productivity improvement is a vital point in Zimbabwean manufacturing companies which have experienced nearly a decade of productivity declining. Almin Metal Industry has been witnessing falling productivity especially in their Extrusion plant which is their major manufacturing plant. In contrast to productivity, the level of inventory such as work-in progress and raw material stock have increased to levels that poised great challenges in terms of storage space and how to control this inventory. This author used computer simulation as the manufacturing system analysis tool to analyze the performance of this manufacturing system. The audit of a typical extrusion process was taken as a critical area to gather past records and information about the processing time parameters and the trend of productivity and inventory levels. The inventory model was computed from and a simulation model for such a typical extrusion plant was designed using ARENA which is a simulation software. The simulation model developed was verified and validated to see whether it reflects the actual scenario on the ground. The validated simulation model was used for experimental purposes. First case study experimentation was carried out basing on the notion of the Theory of constraints that postulates that constrained resources determine the performance of any manufacturing system. In this Extrusion plant, two machine resources (the Oliver saw machine and the Aging furnace) are treated as the constraints to productivity improvement as they limit the whole plant's capacity to their design capacity which is lower than the rest of the machines. Therefore the experimentation is done by doubling the capacity of each of Oliver saw and Aging furnace and this is done by adding a unit of each machine in parallel to the existing one. The second case study is done basing on the assumptions of implementing sound Production planning and inventory control by using the optimal order quantity as the most economic amount of order that must be ordered for a typical production run. In this model raw material inventory arrival rates are adjusted to levels that approximates close to the optimal order quantity. The final case study is then modelled by assuming a Total Productive Maintenance (TPM) system being practised in the operations of this extrusion plant. In this case maintenance down times, machine failure rates and machine setup times are assumed to be minimal than in the real situation which is characterised by high failure rates and a lack of a well coordinated maintenance system. In all cases mentioned above simulation results are going to focus on the performance measures such as average plant throughput, average

inventory level, and machine utilization. Finally in each case study; single factor productivity is also going to be calculated with time manned being the input element being compared with the plant throughput obtained. The project concludes by recommending that the management at Almin can implement Total Productive Maintenance (TPM) and make use of Just-In Time (JIT) manufacturing concepts of pull production by making use of small lots order sizes.