

**Application of Markov theory for inventory and cost analysis:  
Case study for tyre re-treading in automobile company**

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Tyre re-treading is a major value adding process in Sri Lankan rubber and tyre industry as it is focused on repairing, refurbishing and remanufacturing of used tyres' carcass by attaching new tread on the outer layer. The tyre repairing methods reduce the tyre disposal and enhances the recycling process to earn profits while making the company efficient in environmental performance. The process' complexity is much higher than traditional manufacturing process as it changes frequently based on the quality of the used tyre. Therefore, it requires close monitoring in order to ensure that the output is error-free to meet the customer expectation in an economical way.

Identified key processes in the tyre re-treading department are initial inspection, buffing, tread preparation and building, curing and final inspection which are followed respectively. These are considered as different workstations in the tyre re-treading process. At the end of the process, if the product is in an acceptable quality level, then it is dispatched to the customer, and if not, then the product is sent for re-work or considered as a defect /rejected product. It is experienced that there are many products fall into the re-work category causing higher inventory in every workstation and creating unnecessary work order complications and delivery backorders. Also, the processes which are not properly scrutinized incur unexpected raw material, labour and machinery consumption which finally become a huge cost to the company. Since there is no proper mechanism to identify the number of items sent for reverse operations or re-reworks, there is no way to incorporate these things in pricing strategy. Therefore, the unexpected re-rework at each station is not counted for bill of material (BOM) generated through the enterprise resource planning (ERP) system and the additional cost is borne by the company.

Therefore, this research is to be conducted to find solutions for the above issues relevant to tyre re-treading. Each workstation is considered as different states in the Markov process as a tyre at any stage can be reversed back to any workstation for the process of re-work and try to compute the number of units move from one stage to the other stage and finally, it moves to the absorbing stage. Application of steady state vector in Markov Theory enables the calculation of the probability of products which will be accepted or rejected in the long run. The transition matrix also enables us to identify the number of items in the reverse operations. Identification of number of products for rework supports not only to manage additional required resources, but also to calculate the relevant cost. This facilitates to compute the actual cost relevant to re-treading into account and enables to incorporate that to the Bill of Material. All these applications eventually increase the efficiency of the tyre re-treading process while reducing the cost borne by the company on re-rework. The research is in the conceptual stage and yet to find the results.

**Keywords:** Inventory management, *Markov* process, Pricing strategy, Tyre re-treading