

A Monte Carlo simulation for a variable-value stream mapping (V-VSM) and risk assessment - Failure mode and effect analysis (RA-FMEA); A case study

Abstract

Value Stream Mapping (VSM) is one of the most used lean manufacturing methods for determining cycle time (CT) and lead time (LT) in the process flow from customer order to shipment. Value-added (VAA) and non-value added (NVAA) events in the flow must be defined and noted in the VSM. However, there are only a few studies that take risk management into account when calculating lead times. Variable VSM (V-VSM) will be used in this report, with (minimum, most-likely(mean), maximum) values for each CT/LT and Risk Assessment-Failure Mode and Effect Analysis (RA-FMEA) for all risks reported. For a more accurate result, the model will be simulated using Monte Carlo simulation with @Risk software. Prior to the simulation, each process must be described by the best-fit probability distribution. The (minimum, most-likely(mean), maximum) time values of total CT/LT and Risk that the management should consider when preparing the raw material order, VAA/NVAA activities in the production line, Work in Progress (WIP), process layout and shipment schedule are the results of this analysis. For management, the current and future VSMs could be finalized, displaying all relevant variables. This model will be tested in a small and medium food manufacturing facility that produces mixed powder drinks. However, the emphasis of this paper will be on the Monte Carlo simulation using @Risk software based on V-VSM and RA-FMEA model created.