

Customized Lean Methods

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Abstract	The Kingman's Equation provides an approximation of the mean waiting time of the components for a single process based on its utilization and variance. The higher the utilization, the higher the impact of variation, this results in longer waiting times and high WIP. Rajan Suri calls this "the magnifying effect".
Keywords	queue, waiting time, Kingman's equation, utilization, variation
Challenge	Identifying the mean waiting time for a job in the queue before a machine.
Current condition	Processing times, machine utilisation, and arrival of jobs vary from time to time. As a result, it is challenging to identify an approximate time that a job or order can be expected to wait before a machine.
Target condition	An approximate mean waiting time is known for a queue before a machine, such that relevant countermeasures can be taken to reduce the waiting time.
Moving toward the target condition	Kingman's equation provides insights into the mean waiting time before a process. Machines usually have a queue before them, and John Kingman described how a queue forms mathematically in 1961. He did this for a single server. So, for a queue waiting for one process or machine. Kingman's equation is an approximation of the mean waiting time. Three elements influence the time spent in the queue: 1. Processing time of a job 2. Utilisation of the process/machine 3. Variation in the process or arrival of jobs The principle behind Kingman's equation to approximate the mean waiting time can be expressed as: Mean waiting time = (Processing time of the Job) X (Effect of Utilisation of the Processes/Machinery) X (Effects of Variation)