

Balancing Demand and Capacity &

Risks of 100% Capacity Utilization - Summary

Demand and Capacity

Demand Management

This involves forecasting and adjusting to customer demand, ensuring production aligns with market needs. Techniques like demand smoothing and demand shaping can help balance workload.

Internal demand management focuses on controlling the demand from inside the organization (e.g., rescheduling or offering alternative products).

External demand management includes influencing demand factors from outside the organization such as through marketing or pricing strategies to align with available capacity.

Capacity Management

Involves planning and adjusting resources (labor, equipment, etc.) to meet demand.

When describing the output capacity of your operations, we might use 2 phrases:

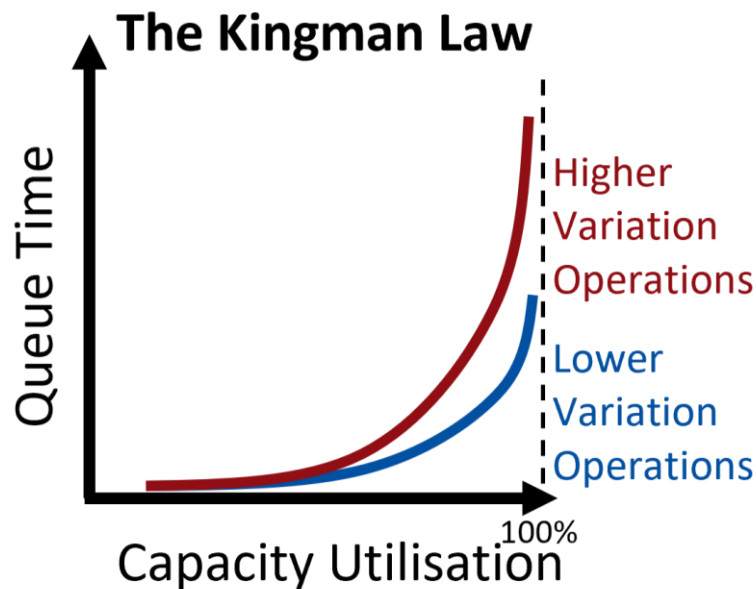
- **Theoretical Capacity:** The maximum output capacity in a perfect world.
- **Actual Capacity:** The realistic output considering standard expected downtime, maintenance, and issues.

Risks / Consequences of 100% Capacity Utilization

While operating at full capacity is efficient and typically offers the lowest unit cost; there are enormous downsides that are typically misunderstood.

The Kingman Law

The Kingman Law is a crucial aspect of “Queueing Theory”. The graph below shows us how wait times grow exponentially as capacity utilisation increases.



- **Increased Wait Times / Queues:** Moving towards 100% utilization causes exponential growth in wait time & lead times. This causes a corresponding explosion of WIP, incurring huge extra inventory holding costs and complexity of managing it, plus the inevitable customer dissatisfaction from the huge waits / queues.
- **Huge scheduling complexity:** **With no slack in the system** any scheduling change can cause significant disruption, a net loss to overall output further exacerbating already huge growing wait / lead / queue times.
- **Decreased Flexibility:** A business operating at full capacity struggles to adapt to changes in demand or product customization, limiting its ability to capitalize on new opportunities.

- **Long term consequences:** By our definition, 100% capacity utilization is the “sustainable” output rate. However, obviously, pushing human resources to the maximum can lead to stress, higher turnover, and decreased efficiency over time. Also, if non-urgent but important activities such as training and improvement initiatives are neglected consistently for short term output, the long term prospects will likely suffer.
- **Unexpected Costs:** Any additional demand beyond sustainable 100% capacity causes very significant extra strain. This can incur especially large overtime costs, rush orders for supplies, and expedited logistics which can significantly drive up operational expenses for a few extra units of output.

So yes, 100% capacity utilization sounds like operations utopia, but beware, trying to squeeze just that little extra out can have dramatic additional consequences.

The book “Factory Physics” by Hopp and Spearman is the seminal text on this subject of the Kingman Law. (very very mathematical but the conclusions are revelatory and cuttngly practical.)