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Applying the TOC replenishment solution to manage a storage space constraint in the supply chain

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Jean Laubscher is a determined and skillful Industrial Engineer with 8 years of experience in operations and supply chain optimization. Most of his experience was gained while working at Sasol in various business units including Mining, Nitro and Oil. He is currently working for the Supply Chain Business Optimization Centre of Expertise (CoE) at Sasol. He has a demonstrated record of cost reductions, cost savings and process improvements through the use of approaches such as Theory Of Constraints, Lean / six sigma and SCOR.

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Project context

- Growth expected in certain areas of the business
- Limited ability to test impact of changes in business environment on the overall supply chain and evaluate various strategies of accommodating these changes

Project objective

- Assess, design and implement an effective supply chain solution (people, process, technology, infrastructure) that will ensure a competitive advantage for the business and will gear the business for growth. This means optimizing all the following:
  - Supply chain throughput (money generated by the entire system through sales)
  - Applicable inventory in line with optimal supply chain design
  - Appropriate supply chain expenses in line with optimal supply chain design
  - Appropriate customer service in line with business and marketing strategy

- Focus: Direct supply chain

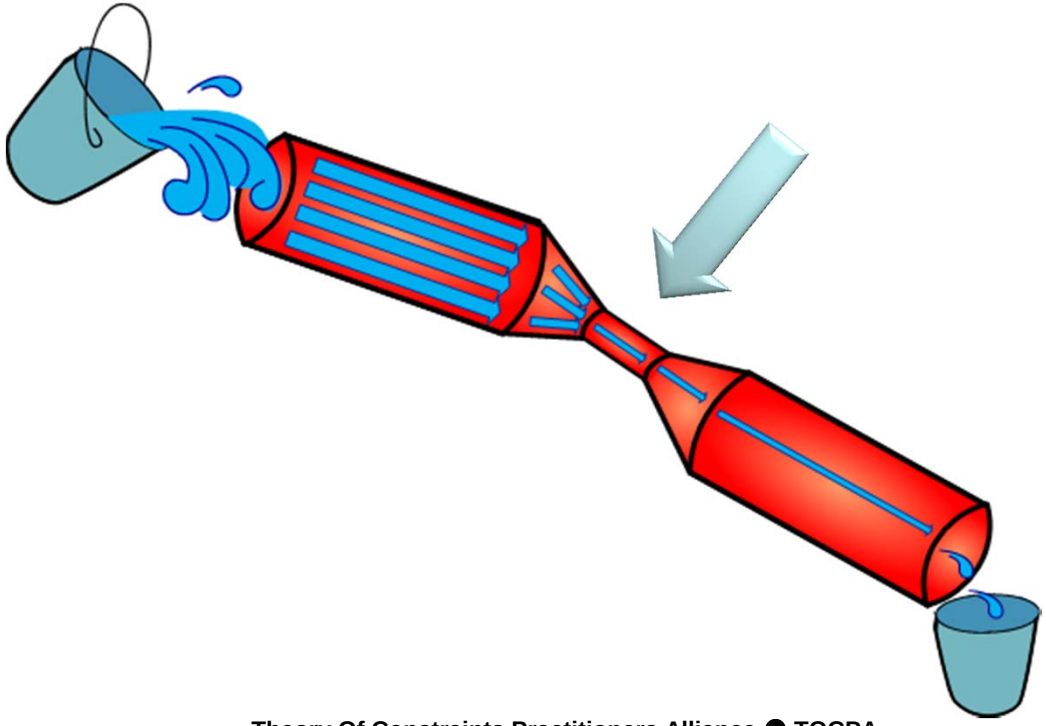
- Project consists of 3 Phases:
  - Phase 1 – Assessment: Understand where to focus
  - Phase 2 – Design: A solution in line with the focus areas
  - Phase 3 – Implementation: The design of Phase 2

Phase 1: Assessment Phase

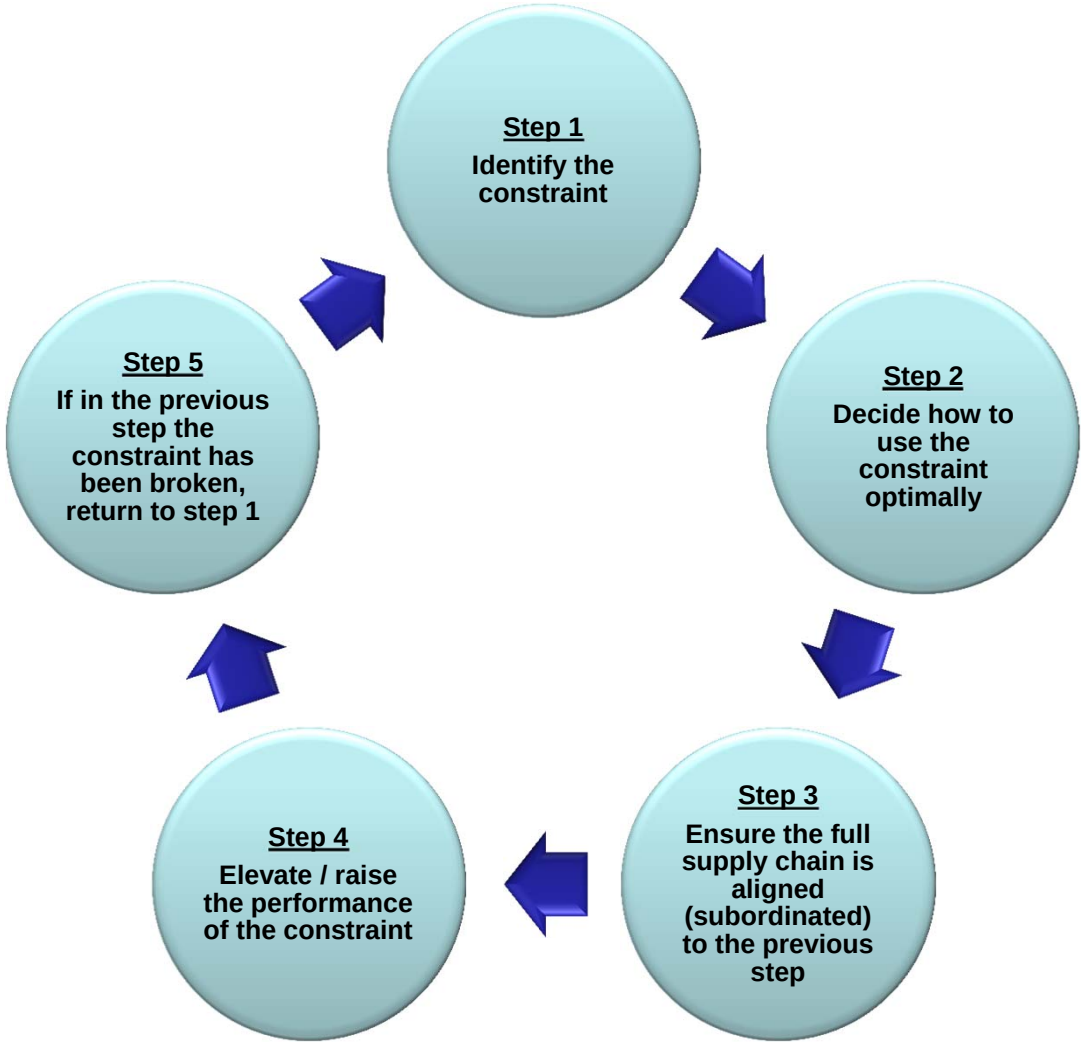
- Objective:
  - Understand and define current supply chain operations and determine key focus areas for Phase 2
- Approach:
  - Understand the business (completed through various discussions with key role players)
  - From the above understanding and information gathered, determine major areas in the supply chain that could inhibit growth and should be focused on during Phase 2 (Solution Design Phase. Objective: Design an optimized supply chain solution)

Approach to understand areas that could limit growth

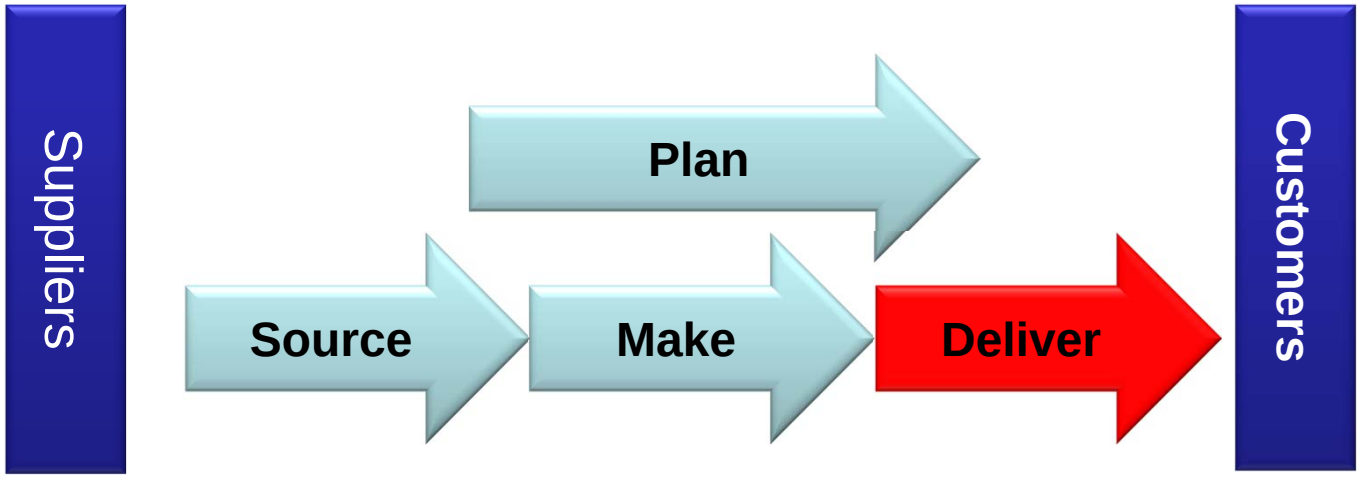
- Need a focused improvement process to improve flow of product through the supply chain
- Best practice way (from a supply chain perspective) is to follow a constraint management approach



Best practise approach to managing SC limiting factors or constraints



Step 1: Supply chain constraints



- Current limiting process appears to be in the “Deliver” section of the supply chain. Specifically availability of finished goods storage capacity in the correct location. Should sales volume increase significantly finished goods storage capacity will become a significant concern

Step 2: Decide how to use the constraint optimally

- Constraining process appears to be available finished goods storage capacity. Step 2 implies available storage capacity should be use optimally. Implications:
  - Ensure available storage capacity is used optimally and not inadvertently wasted. Wastage occurs if:
    - incorrect items are stocked or
    - if items are stocked in the incorrect locations or
    - if inventory levels are too high (i.e. protection is unnecessarily high for the required customer service level resulting in less storage space available for other items) or
    - a combination of all three points.

Is there a way to minimize wastage???

TOC distribution solution

Phase 1: Summary

- Step 1: Identify the constraint:
  - Constraining process appears to be the availability of storage capacity
- Step 2: Decide how to use the constraint optimally
  - Reduce replenishment time as much as possible
  - Appropriately prioritize replenishment through Buffer Management
  - Use Buffer Management to manage buffer sizes (or inventory levels) and use Demand Management only to change buffers if there is a structural change in demand. Additional changes in buffer sizes are managed by Buffer Management
  - Replenish daily (or as frequently as possible) based on actual daily consumption
  - Keep finished goods in a central locations as long as possible (to prevent distributing inventory to locations where it is not required) – i.e. only replenish on ACTUAL consumption
  - Enable real time inventory visibility (to ensure levels are accurate)
  - Enable real time consumption visibility (or Point of Sales information) to ensure quick replenishment based on actual requirements
  - Ensure slow movers / obsolete stock are managed or removed as quickly as possible

Phase 1: Summary

- Step 3: Ensure the full supply chain is aligned to the previous step
  - Ensure capacity flexibility in Production and Distribution. Possible approaches:
    - Evaluate optimal levels of capacity flexibility with simulation modeling
- Step 4: Elevate / raise the performance of the constraint
  - Possible approach: Invest in additional storage capacity (test with network modeling and simulation modeling)
- Step 5: If in the previous step the constraint has been broken, return to Step 1

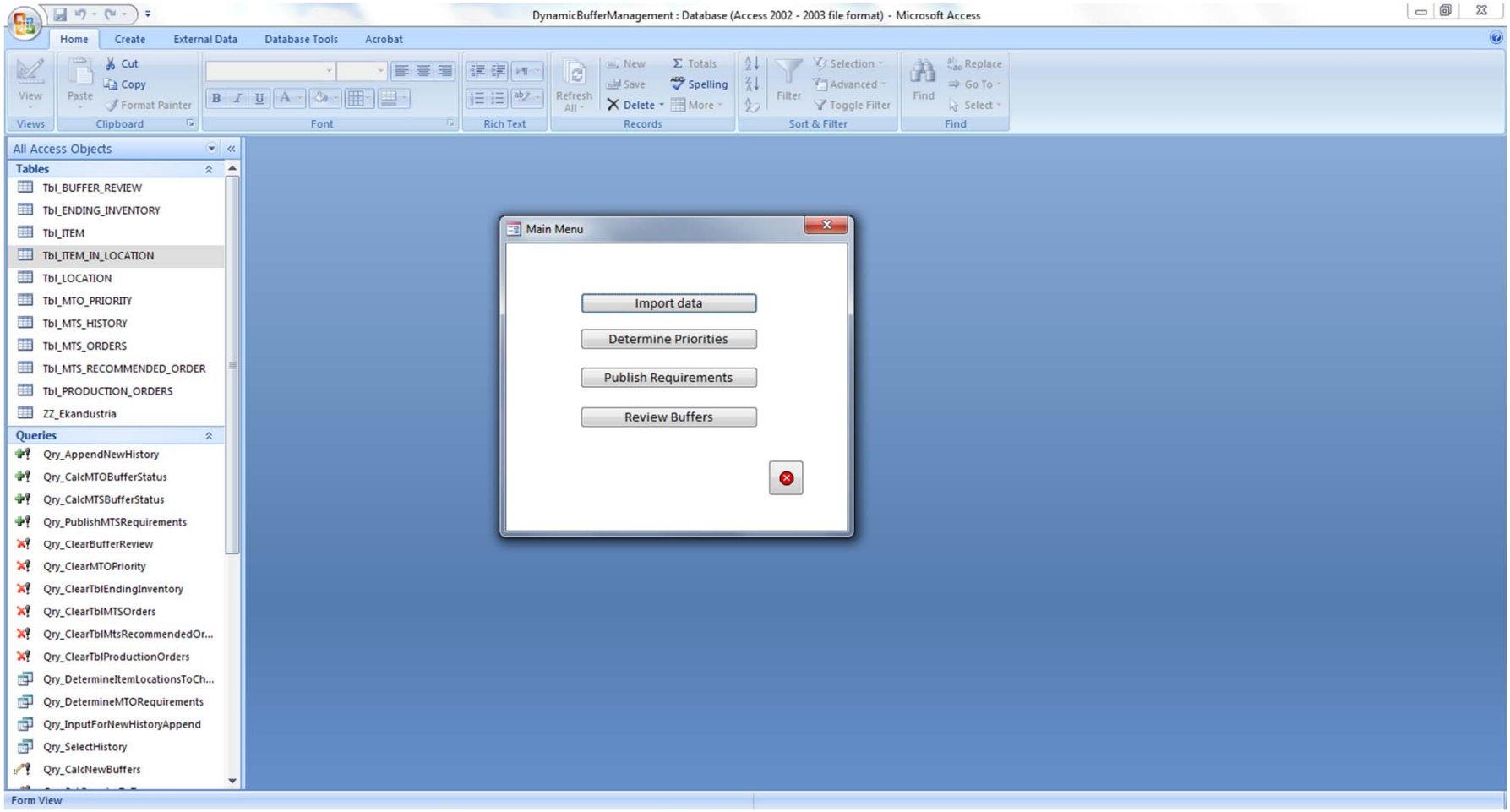
Phase 2: Design Phase

- Objective:
  - Design a supply chain solution based on the focus areas identified during Phase 1
    - Investigate options to reduce replenishment time
    - Investigate options to replenish as frequently as possible based on actual consumption
    - Investigate required capacity flexibility in Production and Distribution to ensure full supply chain alignment
    - Investigate approach to systemize management of inventory buffers and ensure correct inventory at correct location and correct priority for replenishment

- Approach
  - MS Access database (practical proof of concept):
    - Implement dynamic buffer management at an identified area in the business
    - Ensure a more structured approach to planning
  - Simulation model (theoretical analysis):
    - Investigate options to reduce replenishment time
    - Investigate options to replenish as frequently as possible based on actual consumption
    - Investigate required capacity flexibility in Production and Distribution to ensure full supply chain alignment

MS Access database

Automate the buffer management process



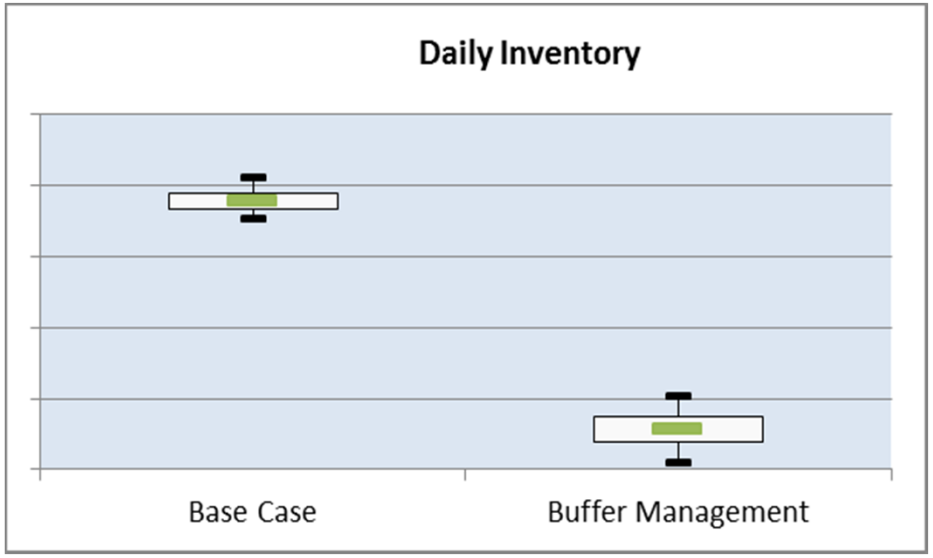
System capability

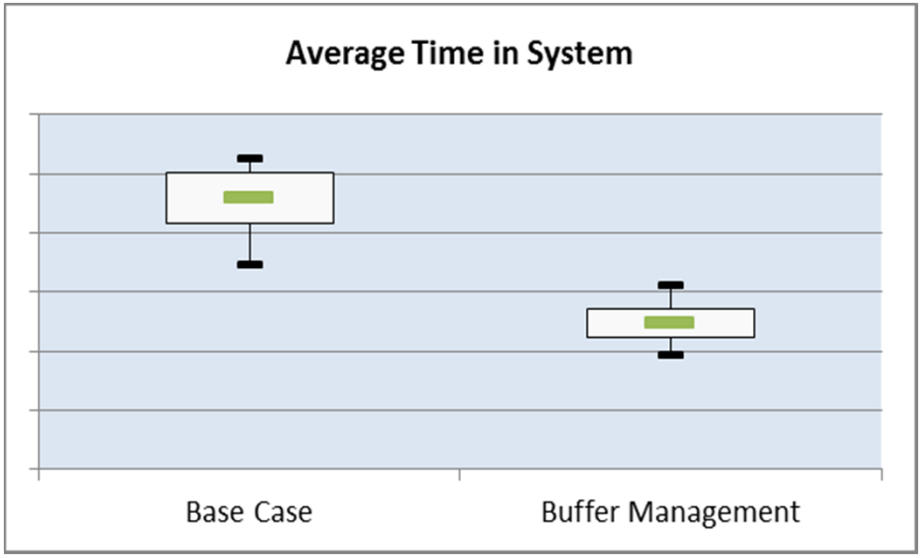
- Import daily ending inventory and open production orders
- Determine priorities for replenishment to all stock locations in the supply chain (i.e. Main production facility and all remote depots) and for MTO production orders
- Publish MTS and MTO priorities
- Determine if MTS buffers in each location are too large or too small based on a review period of actual consumption over a predetermined review period and a comparison of this consumption to the current buffer levels
- Suggest changes to buffers if buffers are too large or too small based on the output of the previous step and allow the user to accept or reject these changes
- Implement changes based on user input
- Track history of buffer level changes and history of actual inventory levels for analysis
- Report on production capacity required to support the plan

Simulation model

Simulation of Facilities.avi

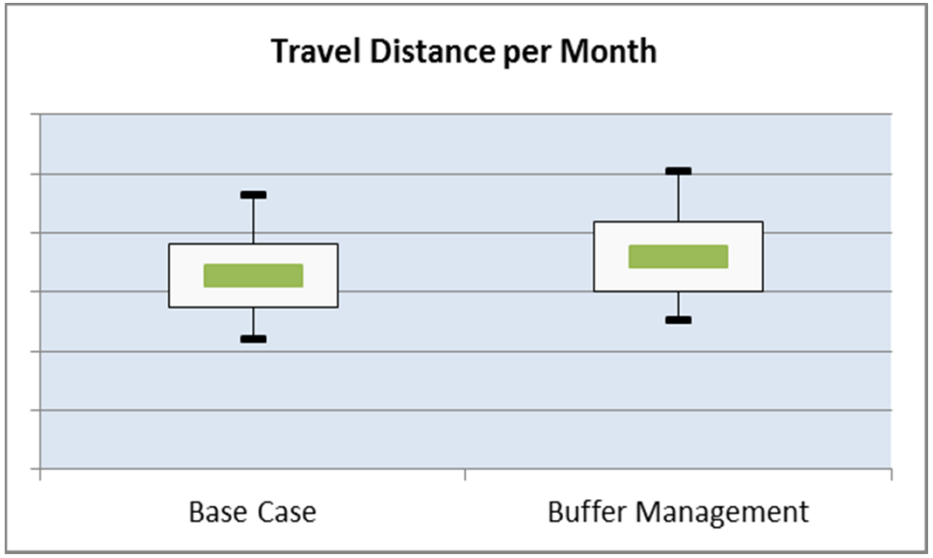
Simulation model results…1

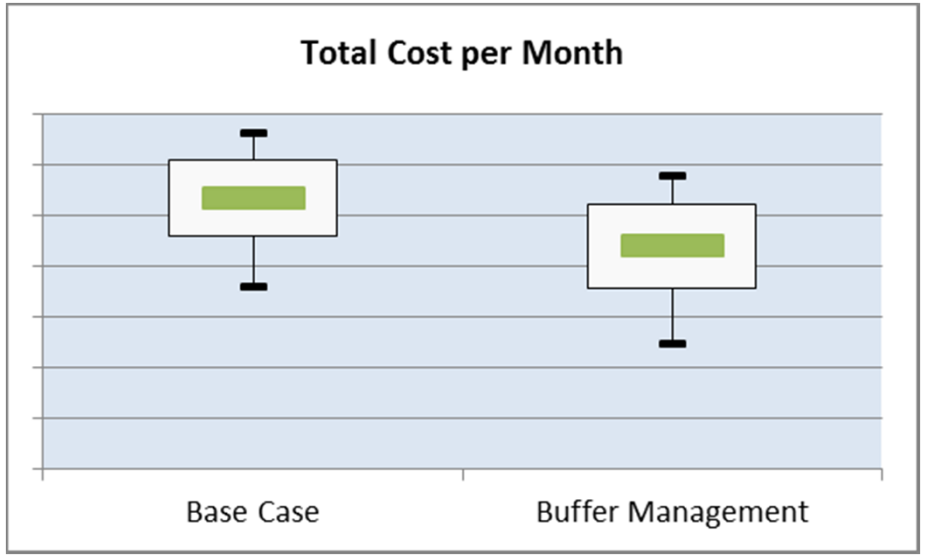




- Significant reduction in inventory levels (-28%) and product time in system (-22%) can be expected with the new buffer replenishment methodology.

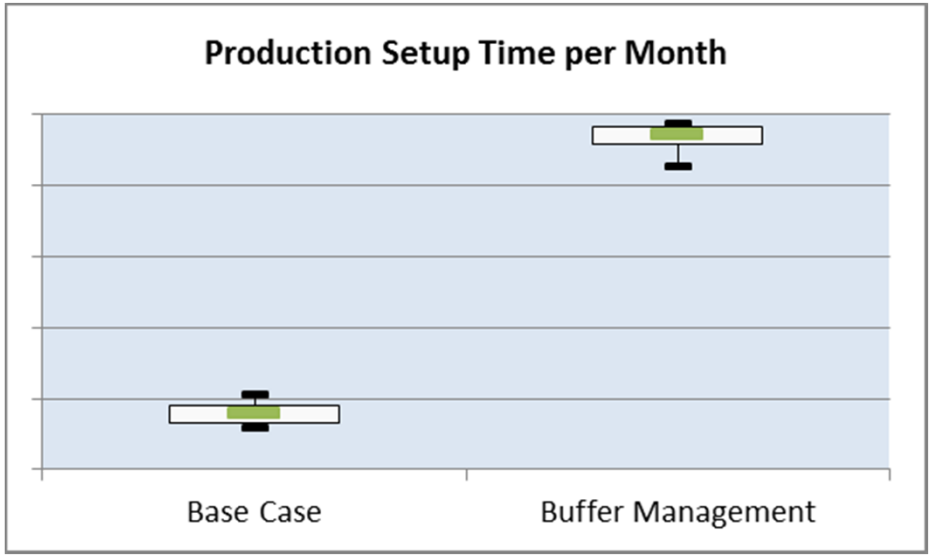
Simulation model results…2

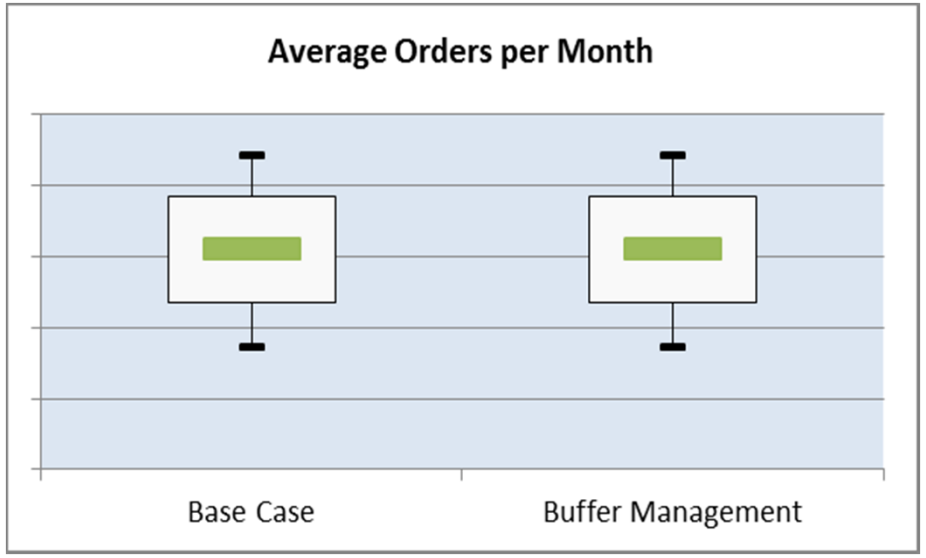




- Travel distance increases slightly. The cost implication thereof is however offset by savings created in inventory holding cost. Thus, total cost remains similar.

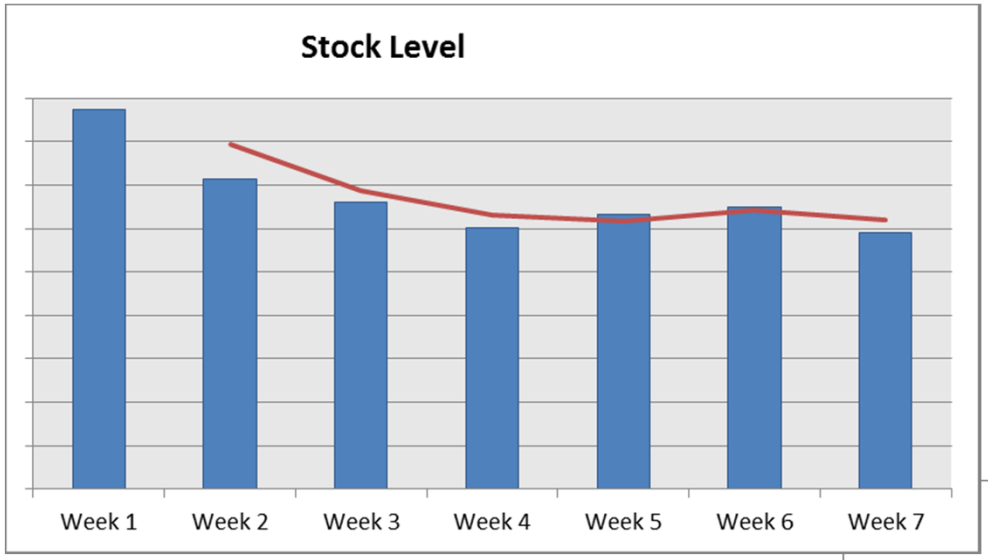
Simulation model results…3

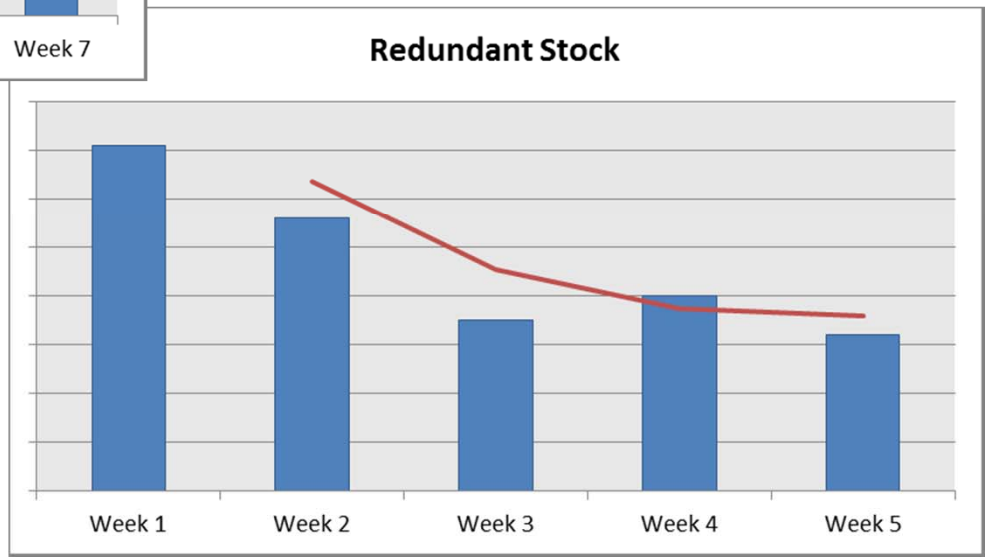




- Increase in production setup time of 68%, which translates to 3% reduction in available production time. This can however be absorbed by the system due to spare production capacity.

Stock levels after Buffer Management implementation





Summary

Measurement	Simulation Results	Buffer Management in Practice
Reduction in Inventory levels	28%	31%
Reduction in redundant stock levels	N/A	44%

- Actual reduction in inventory similar to predicted value from simulation.
- Increase in supply chain throughput capacity without additional storage capacity.
- Demonstrated benefits of maximising product flow across supply chain rather than optimising each area separately.
- Minimise production of wrong products / unnecessary products.
- Relatively simple planning process. (System immediately added value by being able to be used by new planner in unfamiliar environment with great success).