Analysing the Impact of Forecasting and Demand Patterns in Supply Chains

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Agenda

- Introduction
- Methodology
- Outputs
- Conclusion
- References

Introduction

Objectives

- Quantifying the impact of better forecasting on supply chain performance
- Integrating strategic growth targets to supply chain simulation
- Analysing system behaviour under demand increase or decreases for a certain period of time without updating forecasting methodology

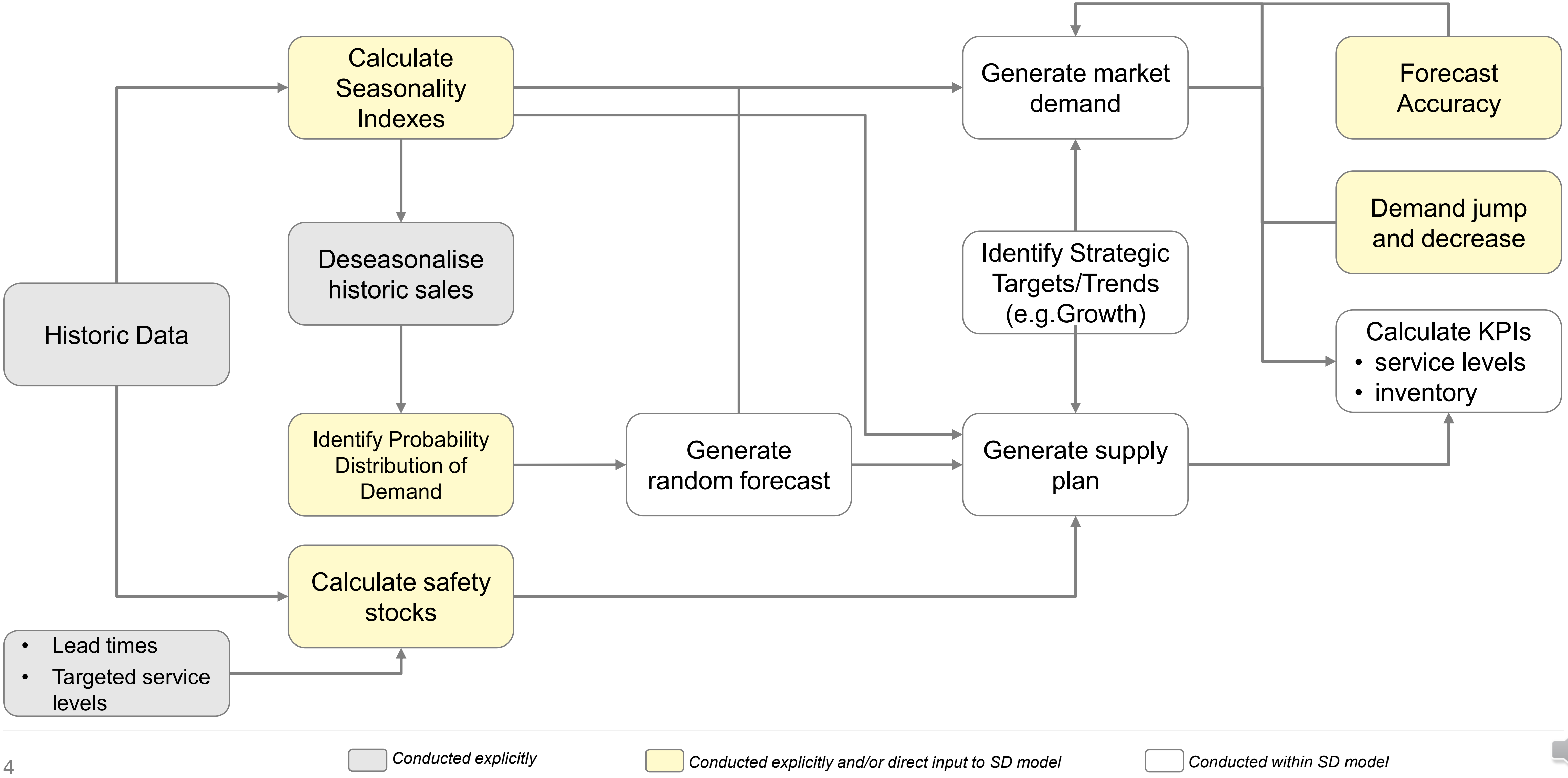
Applications

- A consumer electronics distributor with a single-echelon supply chain structure
- A major domestic appliances manufacturer with a two-echelon supply chain structure

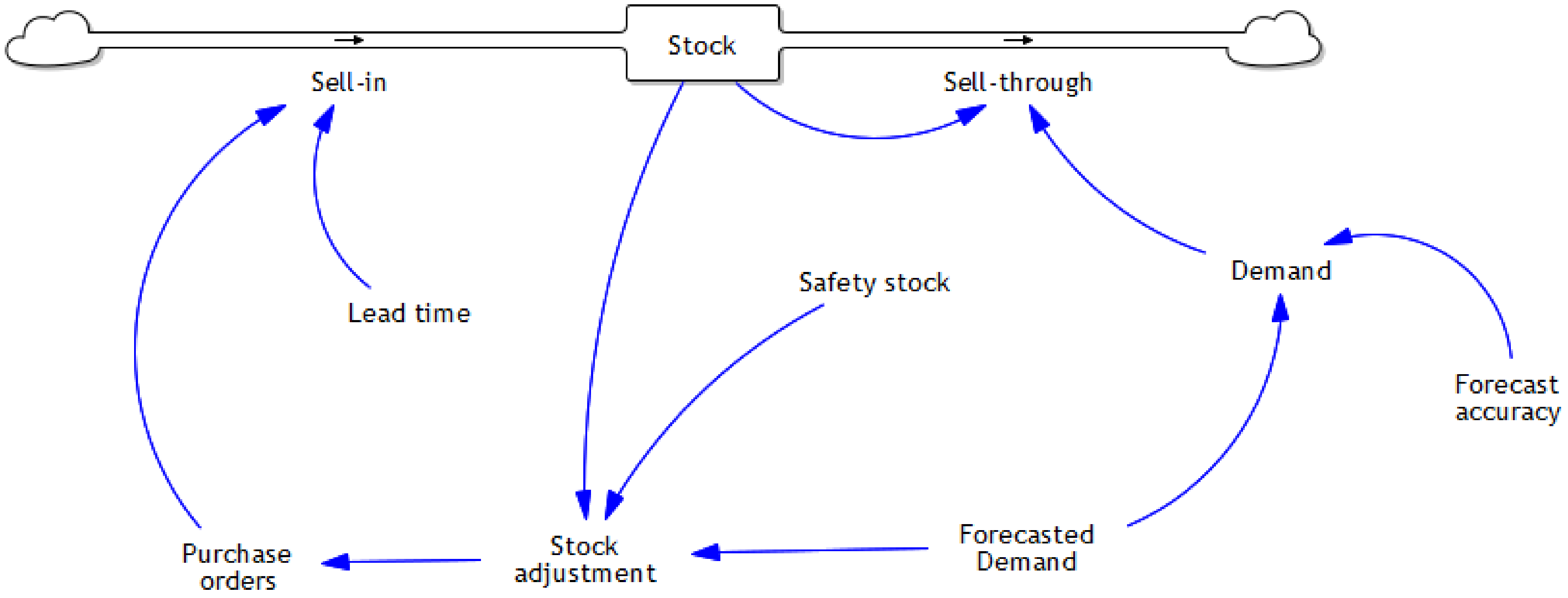
Methods

- Vensim® by Ventana Systems is used as simulation tool
- Forecast accuracy is involved in market demand as uniformly distributed within accuracy levels
- Strategy and demand increase and decreases are aligned by determining period and magnitude

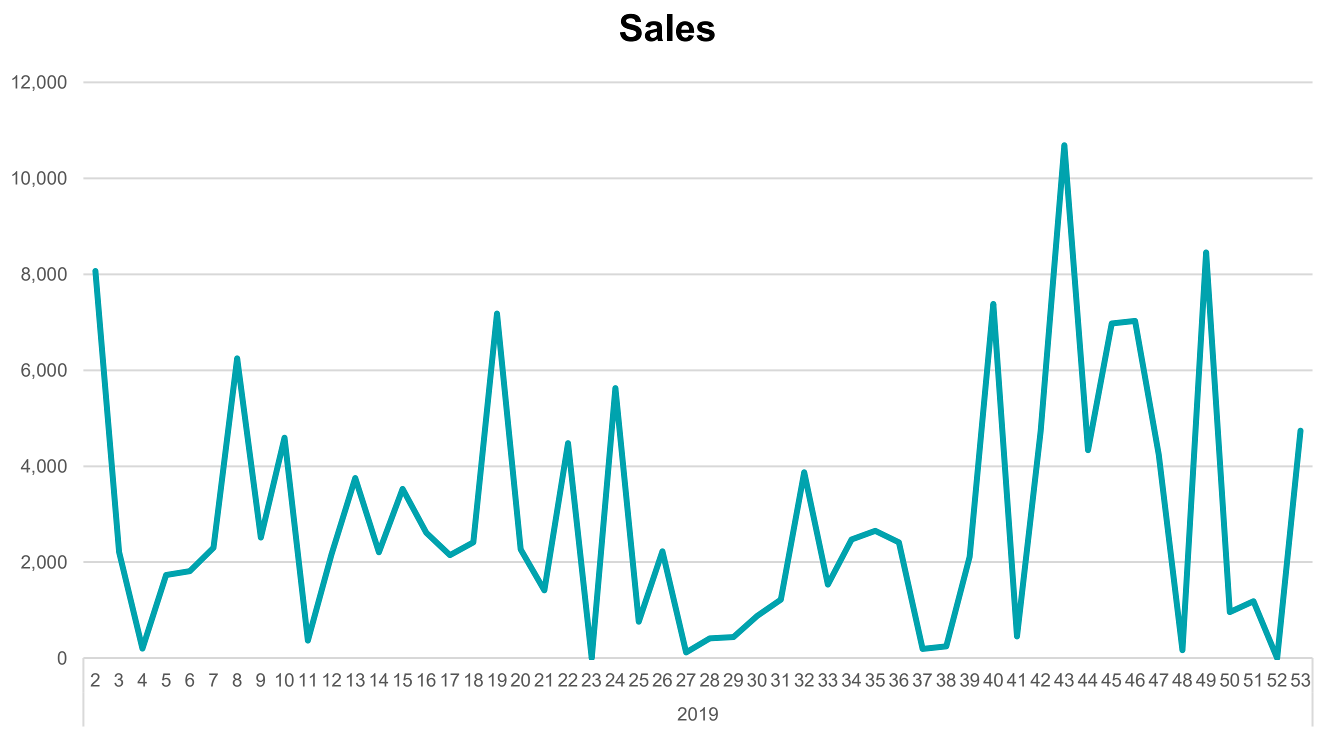
Flow of Calculation Steps in System Dynamics Model

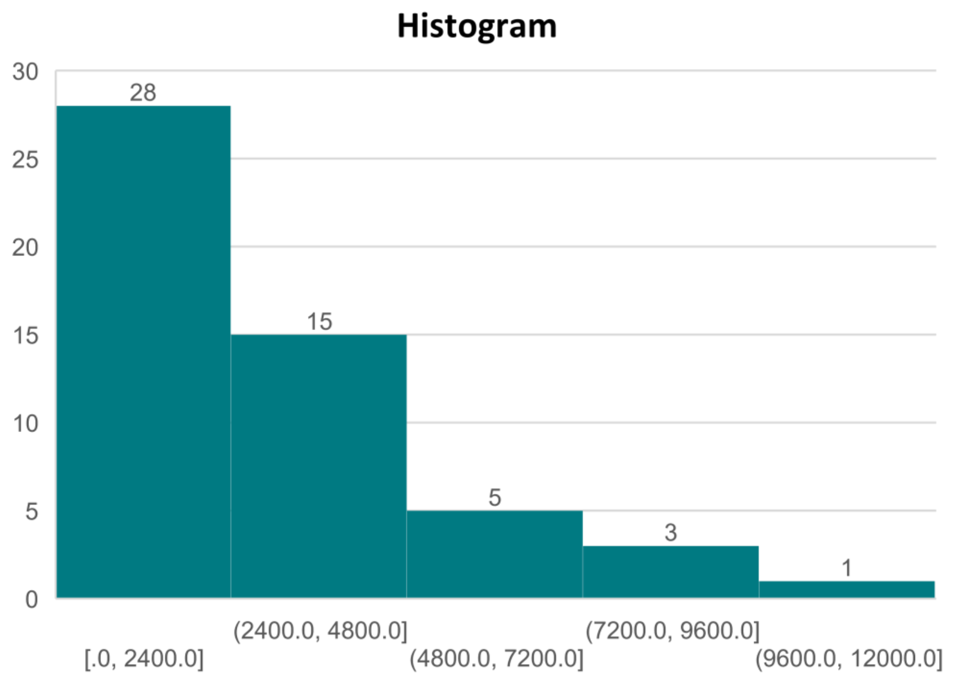


System Dynamics Model of a Consumer Electronics Distributor’s Single-Echelon Supply Chain



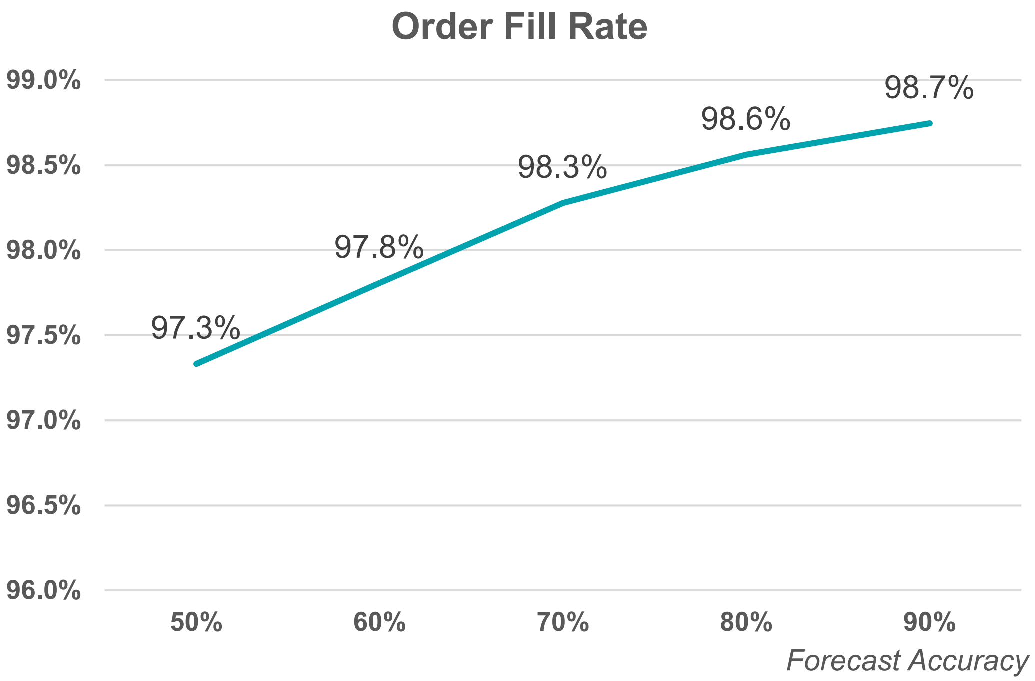
Historic sales of Product A fit to Gamma Distribution with parameters α=1.31 and β=2230.7

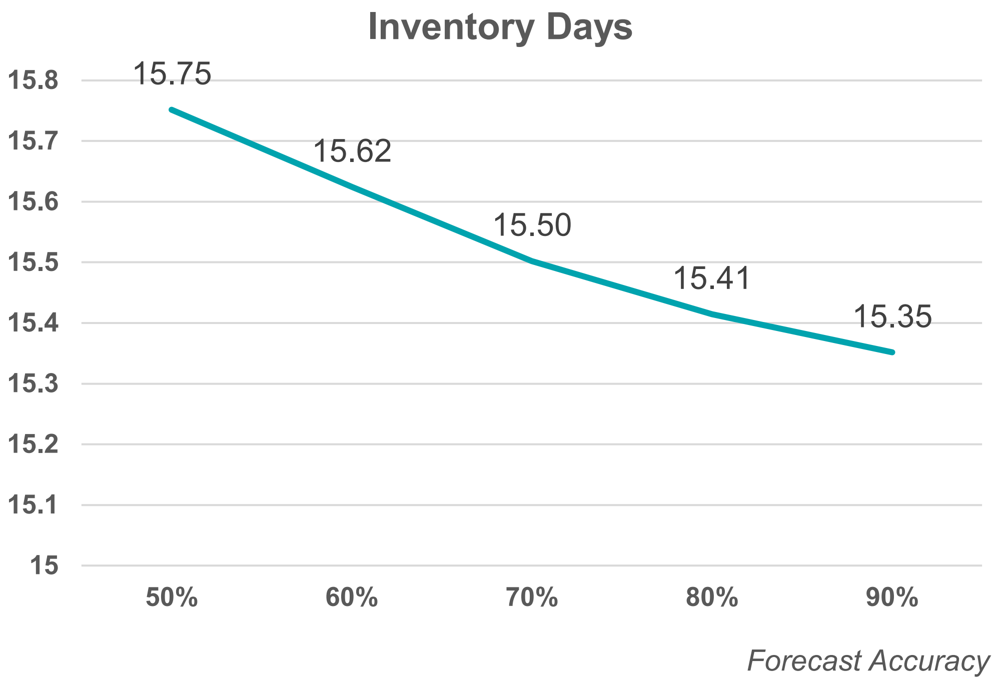




Cluster	Observed	Min	Max	Gamma-Min	Gamma-Max	Diff	Expected	Chi Square
1	28	0	2400	0	0,52966135	0,52966135	27,5423904	0,20940651
2	15	2400	4800	0,52966135	0,81496061	0,28529926	14,8355613	0,0270401
3	5	4800	7200	0,81496061	0,93050212	0,11554151	6,00815834	1,01638324
4	3	7200	9600	0,93050212	0,97449619	0,04399407	2,2876916	0,50738326
5	1	9600	12000	0,97449619	0,99077171	0,01627553	0,84632751	0,02361523
	52						51,5201292	1,78382834

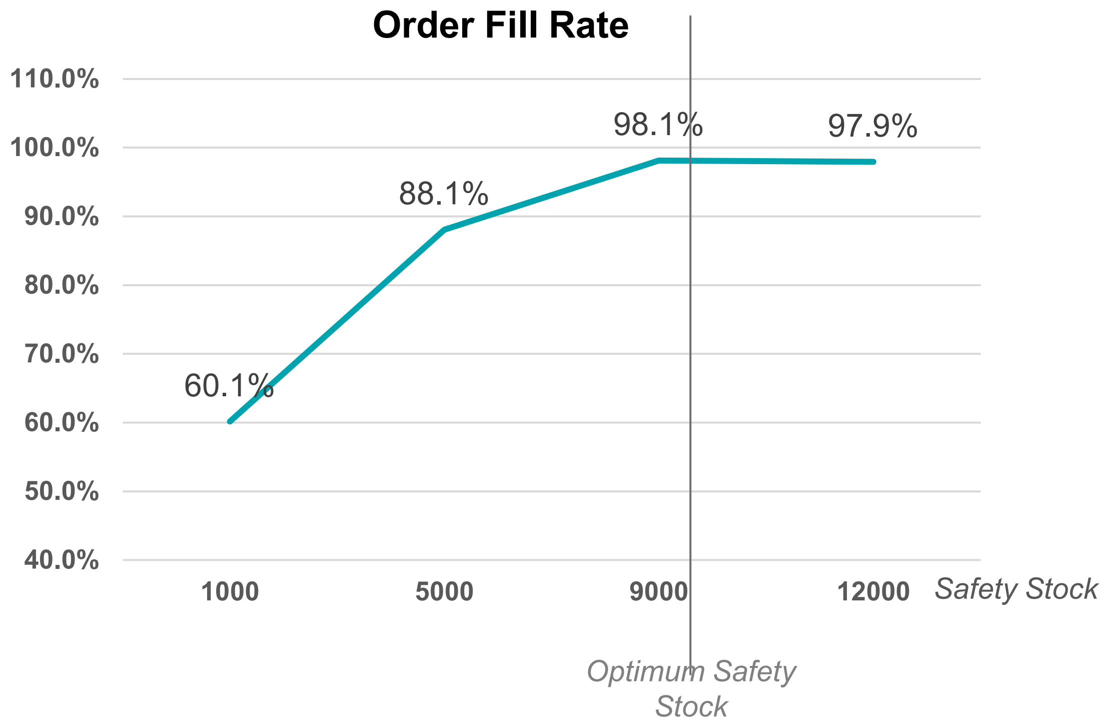
Supply Chain KPIs differ at different forecast accuracy levels

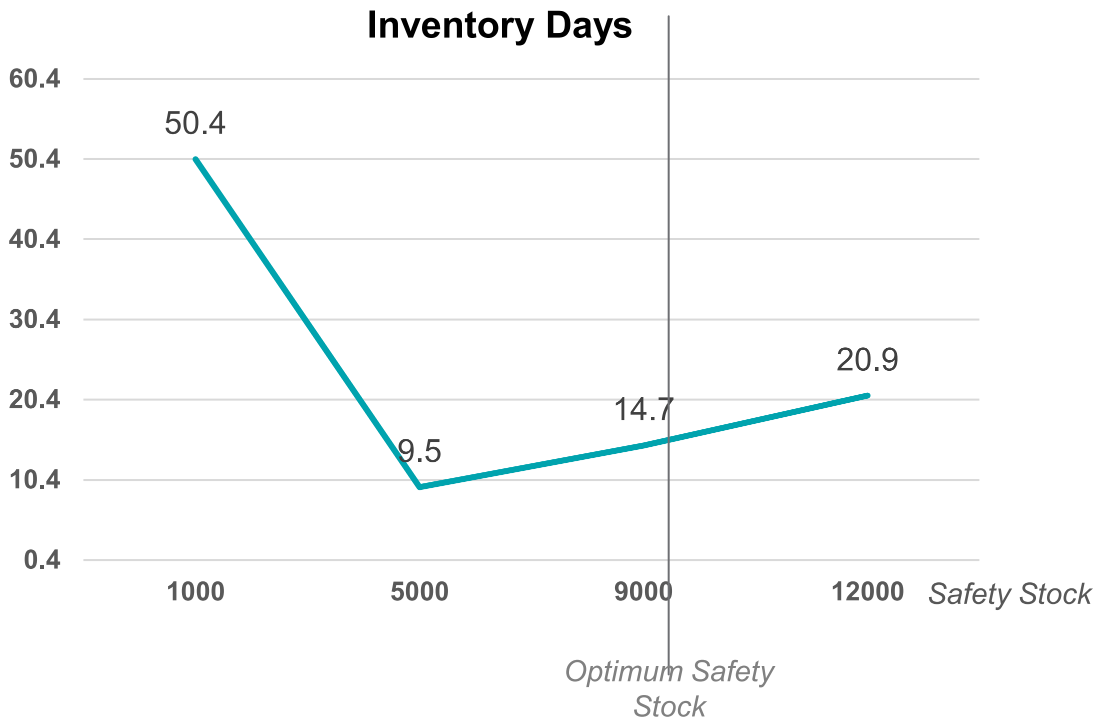




9412 pcs of safety stock corresponding to 95% service level is included in simulation.
Better forecasting affecting supply chain KPIs namely order fill rates and inventory days

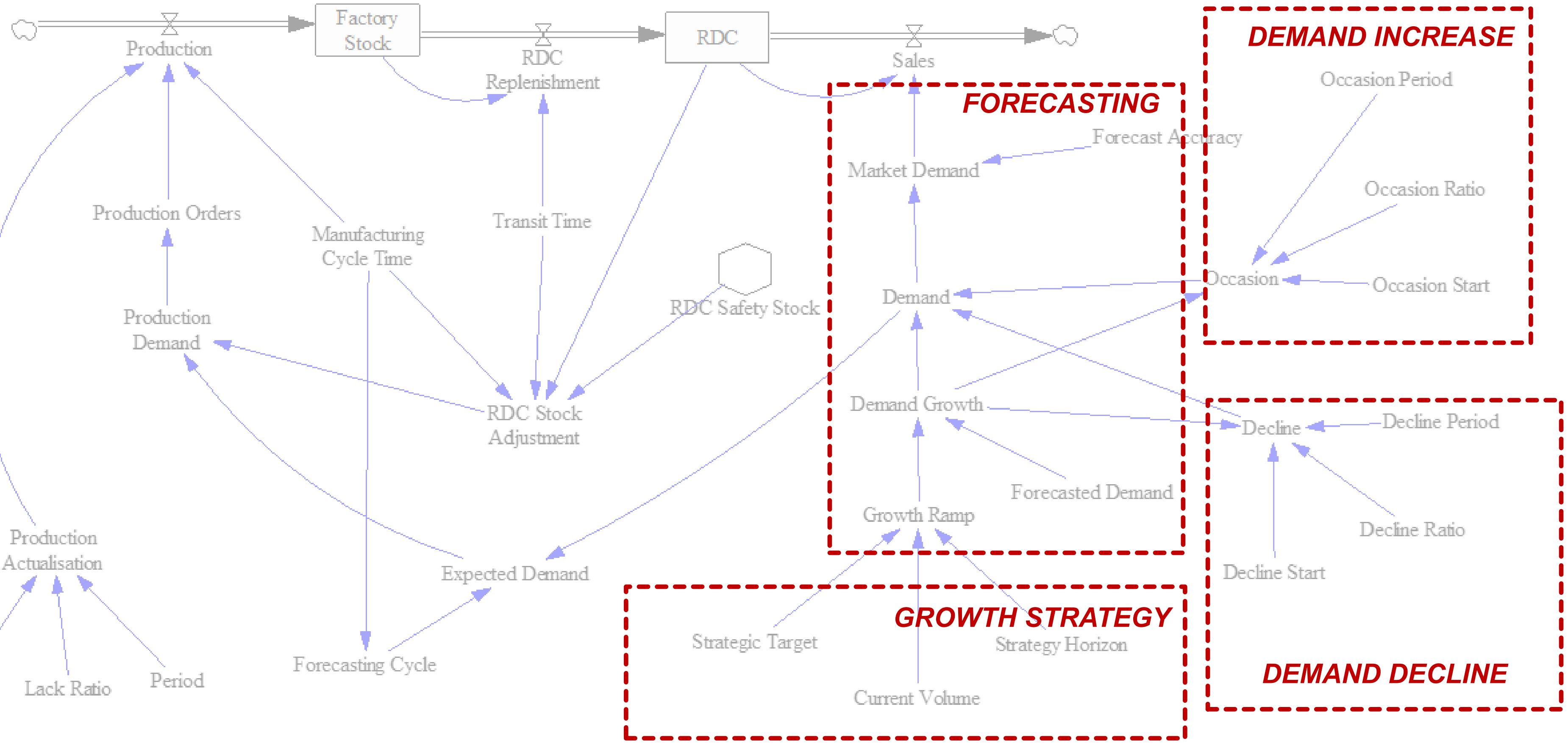
Different safety stock calculation indicate different outcomes in terms of service level and inventory turns





Figures are obtained at 80% forecast accuracy which is taken constant for all runs.
Change of supply chain KPIs confirming the robustness of the model

System Dynamics Model of Major Domestic Appliances Manufacturer's Two-Echelon Supply Chain

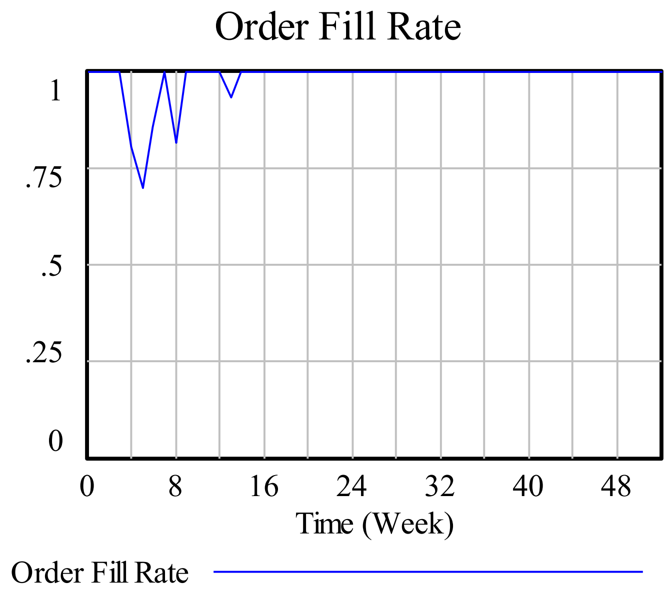


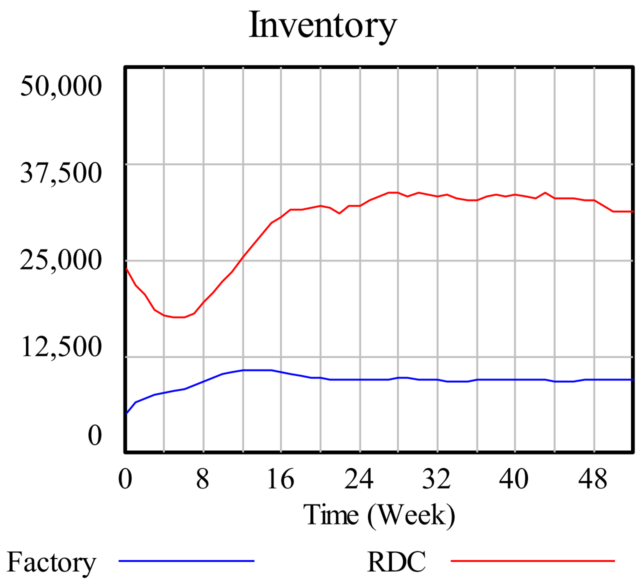
Scenario 0: «Sterile» conditions

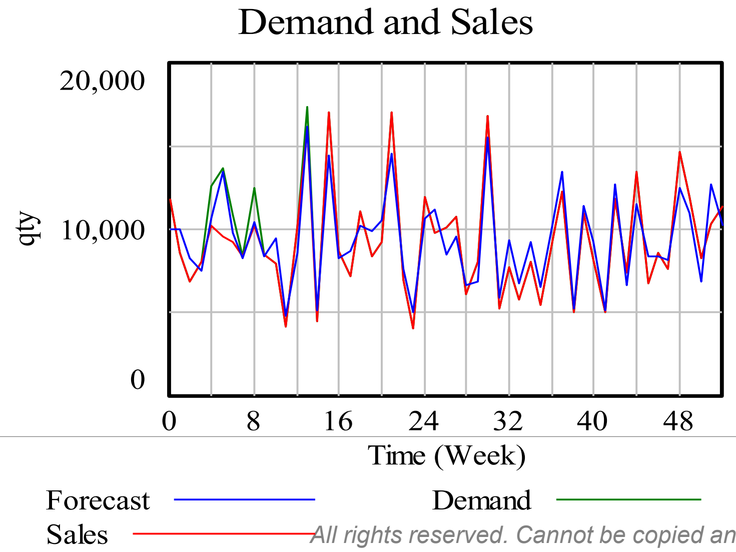
Simulation Setup for Product Group 1

- Forecast accuracy: 80%
- Manufacturing cycle time: 4 weeks
- Strategic growth: None
- Demand increase: None
- Demand Decline: None
- Explicitly calculated safety stock @RDC: 19000 pcs
- Initial factory stock: 5000
- Initial RDC stock: 19000 (balance)

- Average order fill rate: 97%
- Average inventory days: 33.9



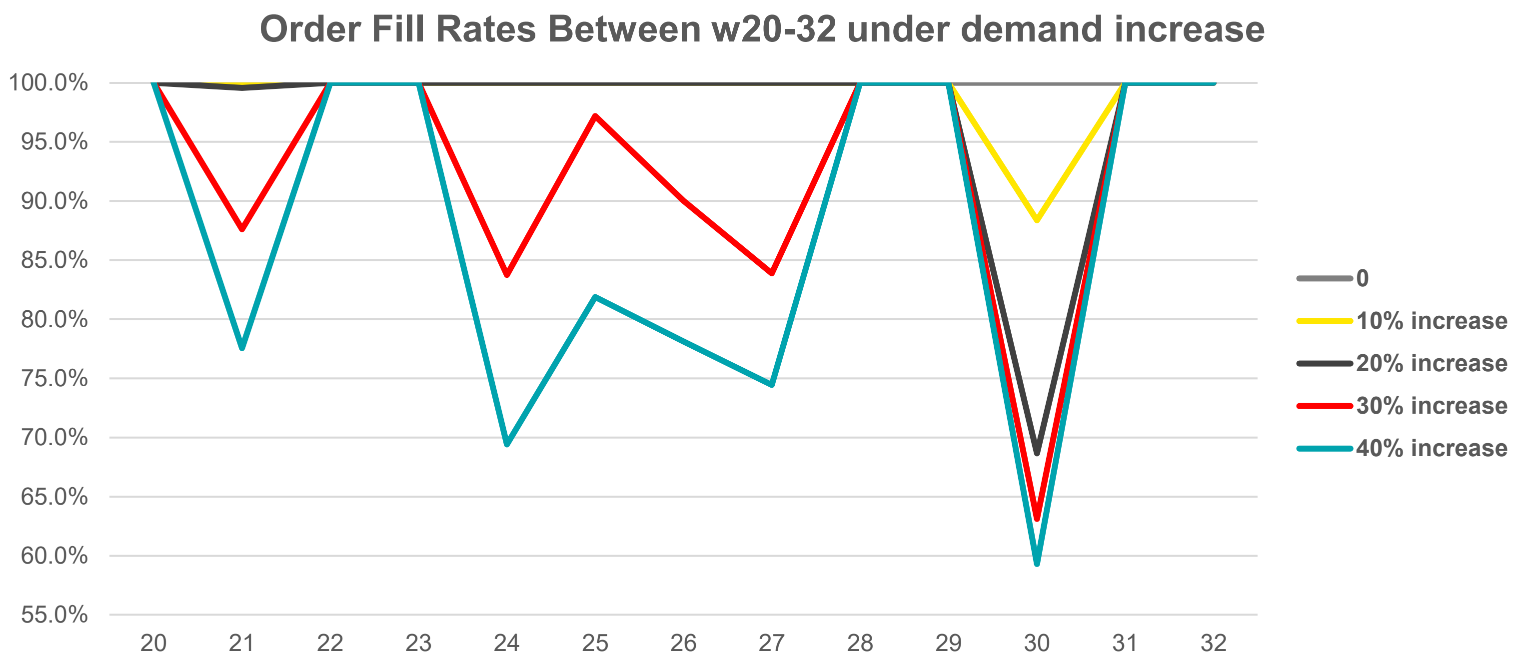




Demand Increase Scenarios

Simulation Setup for Product Group 1

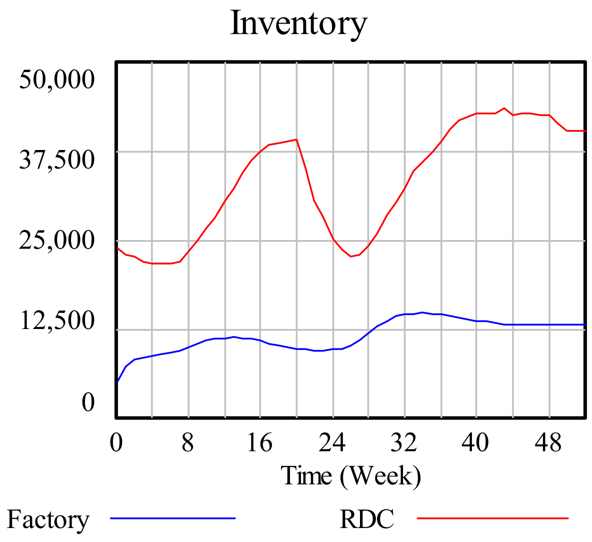
- Forecast accuracy: 80%
- Manufacturing cycle time: 4 weeks
- Strategic growth: None
- Demand increase: Parametric
- Demand Decline: None
- Explicitly calculated safety stock @RDC : 19000 pcs
- Initial factory stock: 5000
- Initial RDC stock: 19000
- Demand has jumps and downs in addition to forecast

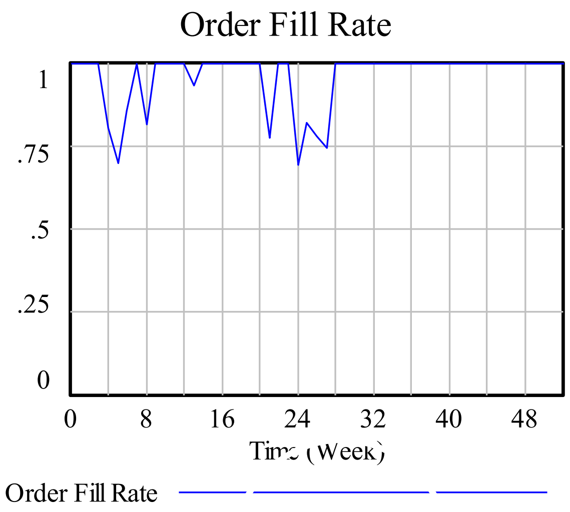


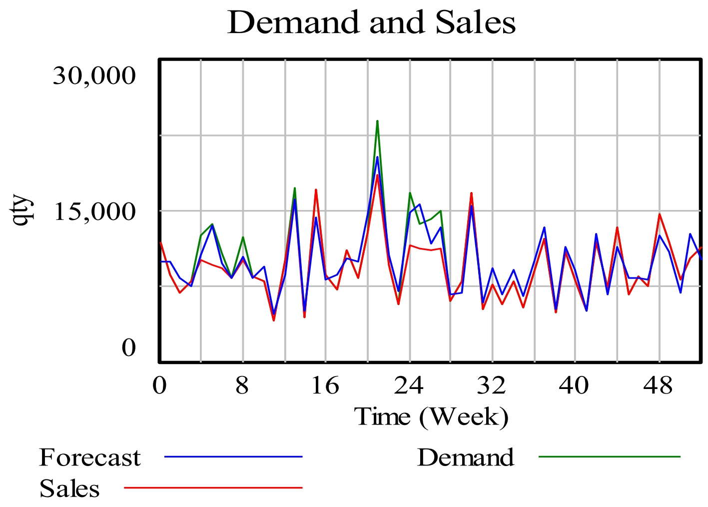
Demand Change Btw. W20-32	Avg.Order Fill Rate Btw. W20-32
None	99.8%
10% increase	99.1%
20% increase	97.6%
30% increase	92.7%
40% increase	87.7%

Advance demand sharing would enable proactive actions for any occasion higher than 20%

Demand Increase Scenarios – Outputs for 40% increase for 8 weeks







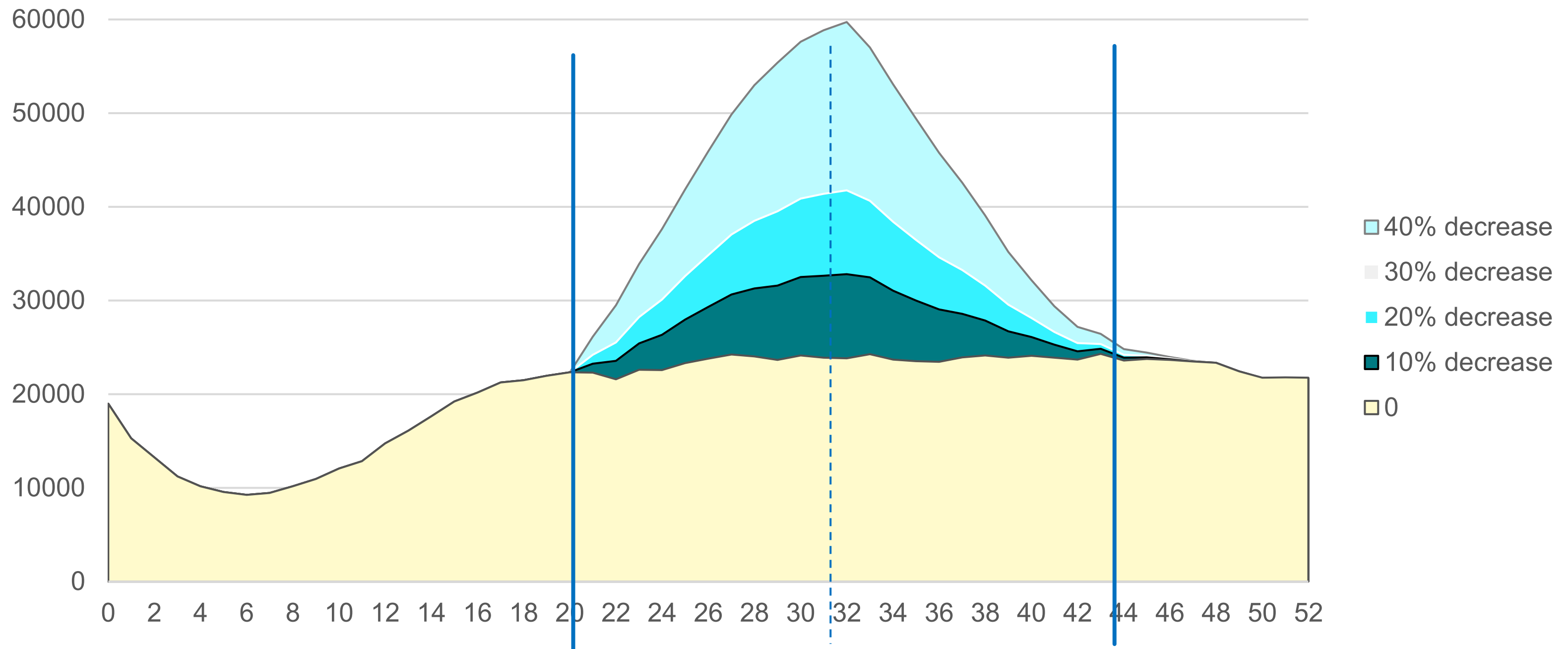
- Demand increase of 40% between w20-w28
- Service level decreases to 75% level during jump period
- Adjustment of stock levels occur with phase lag

Demand Decrease Scenarios

Simulation Setup for Product Group 1

- Forecast accuracy: 80%
- Manufacturing cycle time: 4 weeks
- Strategic growth: None
- Demand increase: None
- Demand Decline: None
- Explicitly calculated safety stock @RDC : 19000 pcs
- Initial factory stock: 5000
- Initial RDC stock: 19000

Inventory Levels Between w20-32 under demand decrease



Demand Change Btw. W20-32	Avg.Inventory Days Btw. W20-32
None	36.5
10% decrease	44.8
20% decrease	55.0
30% decrease	68.1
40% decrease	85.3

Recovery period of inventory lasts twice of decline period when no action taken for forecasting and safety stock management

Conclusion

Analysed

- Impact of forecast accuracy
  - Generate market demand based on forecast
  - involve accuracy with uniform distribution
- Strategic target alignment
  - Strategy horizon and target
  - RAMP function
- Demand increase or decrease for a specific period of time
  - Change period and ratio
  - PULSE function

Findings

- Accuracy of forecasts have a direct impact on supply chain performance in terms of inventory and service levels
- Inventory policies try to stabilize the supply chain system even in low forecast accuracy
- Stock adjustment takes more time in demand decrease scenarios

Further studies

- Can be applied for better forecasting models
- Forecast accuracy may not be uniformly distributed, analysis of historic data may yield more precise results

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Thank you…

Q&A