

Time will tell:
**The impact of production and planning delays on
customer order information sharing in supply chains**

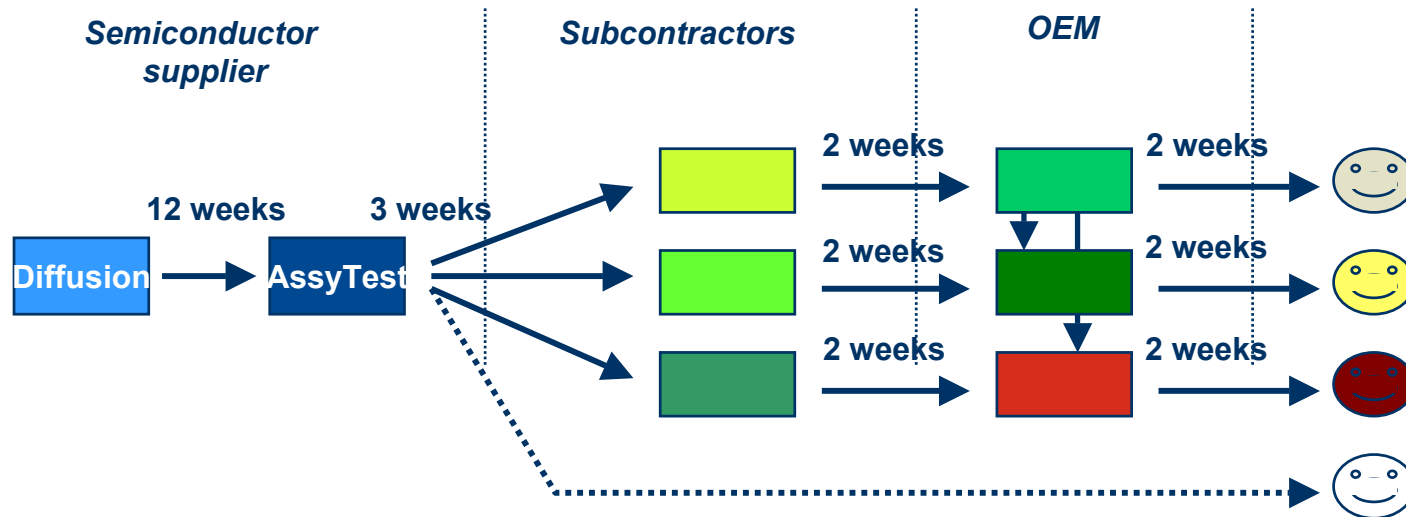
International System Dynamics Society Conference

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Henk Akkermans and Kim van Oorschot, Minase

Where is this coming from?

Decentralised supply networks in high-tech electronics



A typical HTE supply network: making DVD and CD-ROM Drives

- A component manufacturer,
- who partly uses an outside foundry
- An OEM, who has outsourced most production to
- 2-3 contract manufacturers with multiple factories on three continents
- But still does some final assembly himself
- Supplying to many different customers
- With several semi-finished products finding their way to other customers as well
- And the relevant parties change rapidly within a year

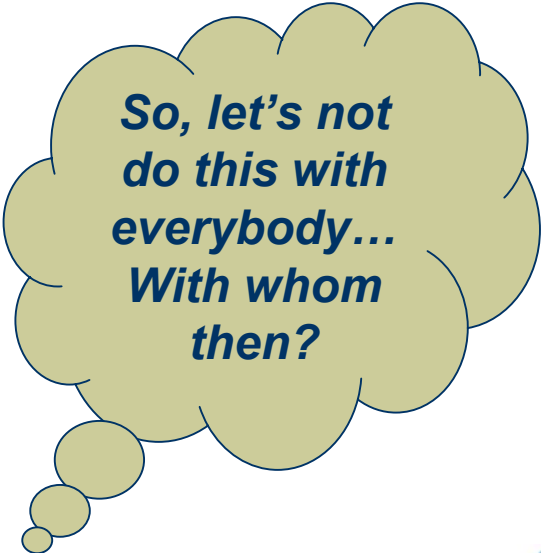
What is the problem?

Effective coordination of decentralised supply chains in turbulent markets

- ◆ **The volatility of the market place is greater than ever**
 - Product life cycles are shorter
 - New competition is emerging more rapidly
 - The market place is truly global
 - Technological innovations are more rapid and disruptive
 - Consumer tastes are ever-changing
 - Employee loyalty is project and people-bound
- ◆ **Managerial decision-making is more fragmented than ever..**
 - Typical product or service is supplied by many (a dozen?) independent companies
 - Internally, companies have set up independent units as well
- ◆ **..and not any better than before**
 - In these units, everybody is making decisions
 - Based upon the distorted info they get from all these players
 - And based on outdated and simplistic models of behaviour

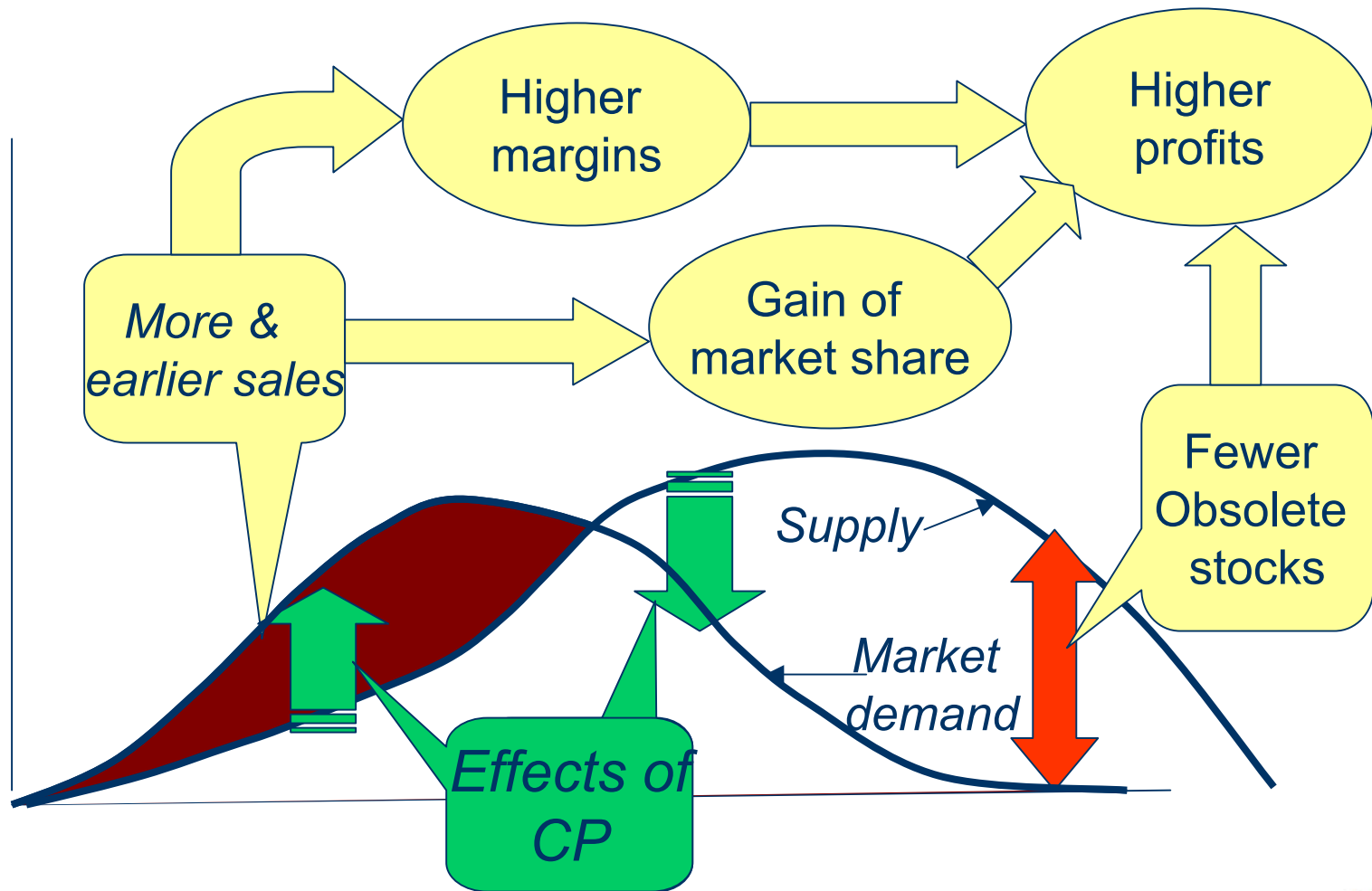
Sharing of customer order information between suppliers and customers comes at a price

- ◆ Lock-in with current supplier
- ◆ Cost of specialised IT system
- ◆ Synchronisation with internal planning cycles
- ◆ Lack of trust
- ◆ Lack of internal transparency
- ◆ Interdependencies of shared resources
- ◆ Effort required
- ◆ Scoping
- ◆ Knowledge/skills required
- ◆ Timing during the business cycle



*So, let's not
do this with
everybody...
With whom
then?*

On the benefits side, sharing of demand info shortens time-to-volume, leading to better margins, lower obsolescence and higher market share over time



The time-related aspects of the issue: “*With what suppliers/customers to set up collaborative SC coordination mechanisms?*” have been neglected so far

- ◆ Purchasing portfolio literature (e.g. Kraljic, Bensaou)
- ◆ Social exchange theory, resource-based view, trust: (e.g. Noteboom, Helper)
- ◆ IT perspective: lower transaction costs, EDI: (e.g. Holland)
- ◆ OR/MS/Game theory literature: mostly linear demand, stochastic variations, exogenous demand, retailing-warehousing settings
- ◆ SD-literature mainly focused on SC coordination *within* a firm

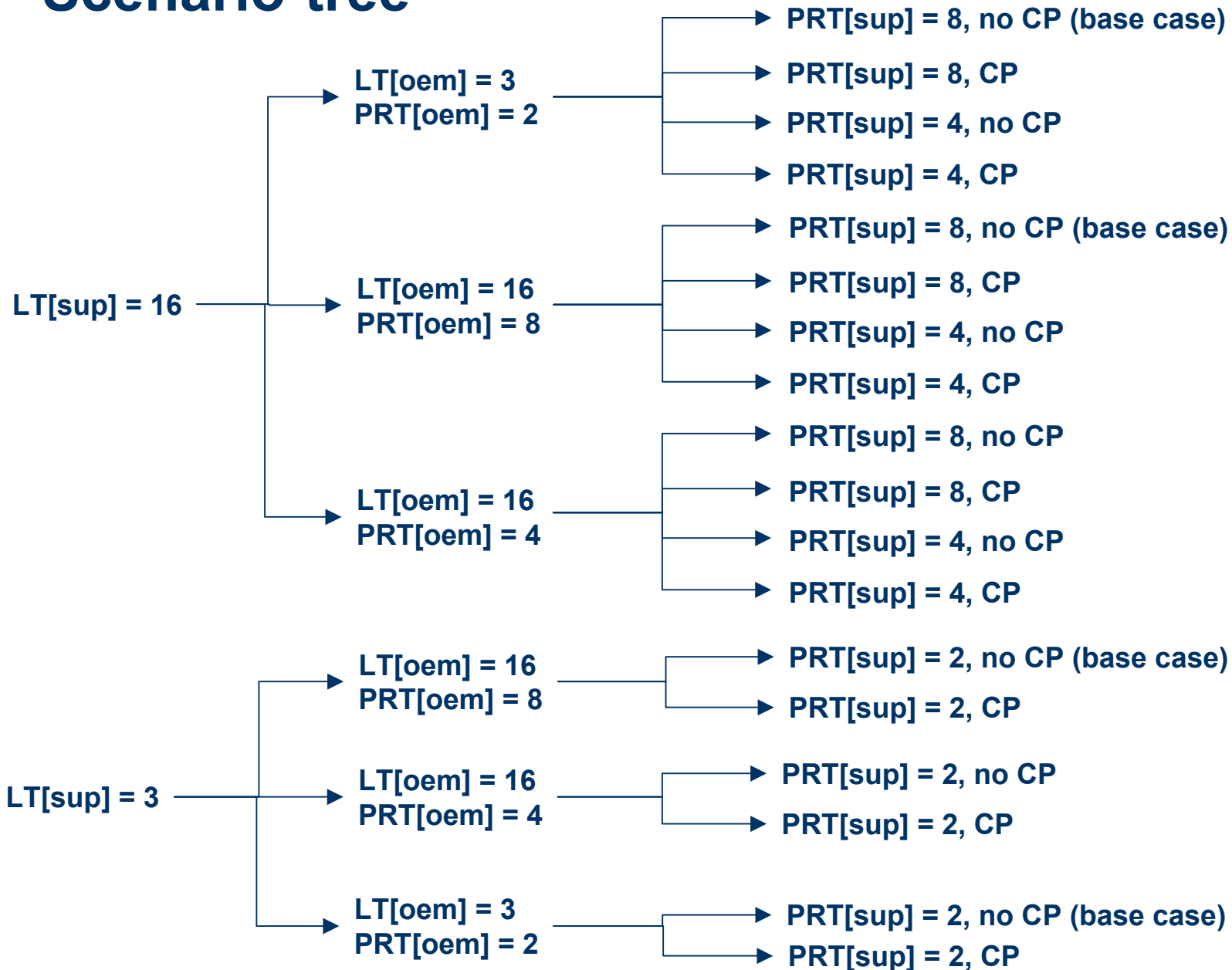
Time will tell

System Dynamics Simulation

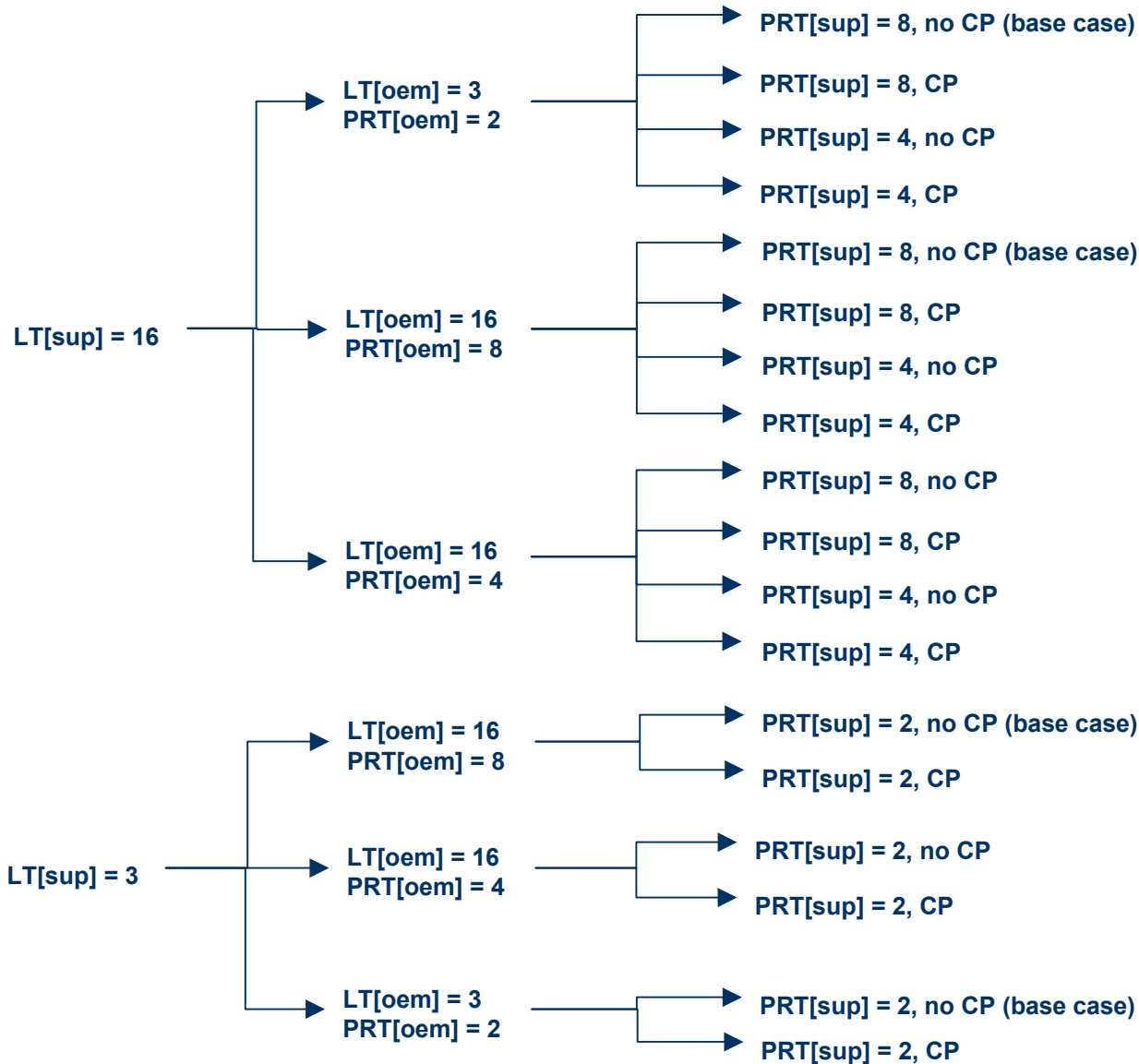
Experimental set-up: Playing with time

- ◆ **Two partners in the supply chain**
- ◆ **Both have identical structure (c.f. Sterman (2000) Chapter 18 + endogenous demand)**
- ◆ **Each partner can have two Production Leadtimes (LT) :**
 - Short = 3 weeks
 - Long = 16 weeks
- ◆ **In addition, the delay in which final inventory levels are adjusted (the planning delay) can be adjusted as well:**
 - PRT = 4 weeks (if production leadtime = 16 weeks)
 - PRT = 8 weeks (if production leadtime = 16 weeks)
 - PRT = 2 weeks (if production leadtime = 3 weeks, minimum level)
- ◆ **Partners can choose to either exchange customer order data or not. If they do, the customer order info becomes the input for the forecast of the supplier, and hence for its production start rate.**

Scenario-tree



And the winners are...

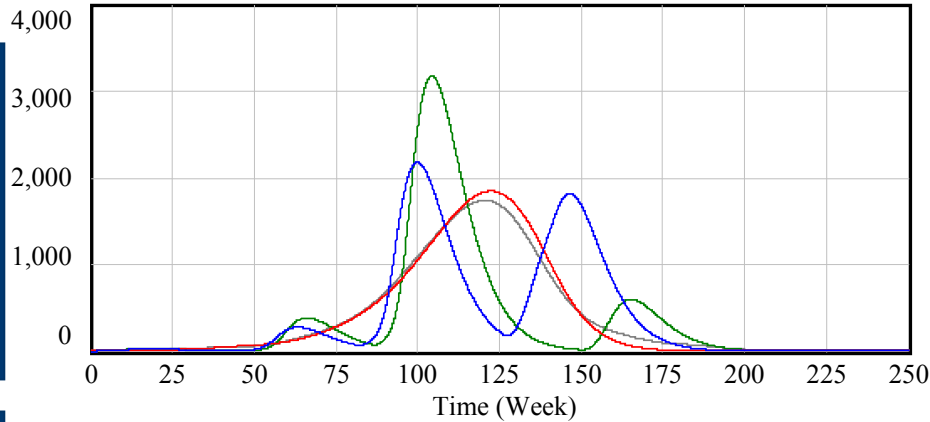


| | % tov BASE CASE | |
|------------|-----------------|----------------|
| | SR cum | FI avg |
| OEM | | |
| SUP | | |
| OEM | 16.33% | -9.01% |
| SUP | 16.25% | -65.00% |
| OEM | 2.47% | -1.70% |
| SUP | 2.46% | -27.61% |
| OEM | 16.64% | -13.36% |
| SUP | 16.56% | -74.93% |
| OEM | | |
| SUP | | |
| OEM | 0.62% | 1.83% |
| SUP | -15.68% | -42.45% |
| OEM | 1.28% | -0.50% |
| SUP | -15.12% | -47.61% |
| OEM | 2.86% | -1.51% |
| SUP | -13.80% | -63.77% |
| OEM | 0.93% | -22.56% |
| SUP | -14.88% | -11.34% |
| OEM | -1.01% | -22.56% |
| SUP | -17.04% | -45.67% |
| OEM | 5.34% | -26.91% |
| SUP | -11.43% | 43.05% |
| OEM | 2.14% | -24.95% |
| SUP | -14.42% | -69.62% |
| OEM | | |
| SUP | | |
| OEM | 0.31% | -0.54% |
| SUP | 0.31% | 122.69% |
| OEM | 3.75% | -25.32% |
| SUP | 3.83% | -5.15% |
| OEM | 3.11% | -25.79% |
| SUP | 3.11% | 45.03% |
| OEM | | |
| SUP | | |
| OEM | -1.17% | 1.19% |
| SUP | -1.17% | 23.58% |

Setting A: slow supplier, fast OEM: customer info sharing gives much improvement

SUP leadtime = 16 weeks; OEM leadtime = 3 weeks

Graph for PR

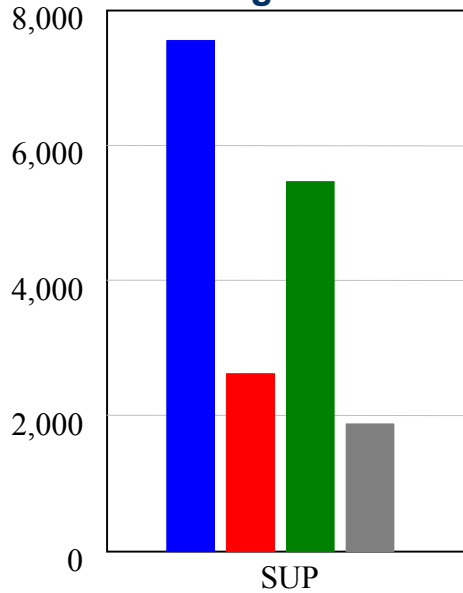


Only shortening the planning delay yields modest benefits for supplier (blue and green lines)...

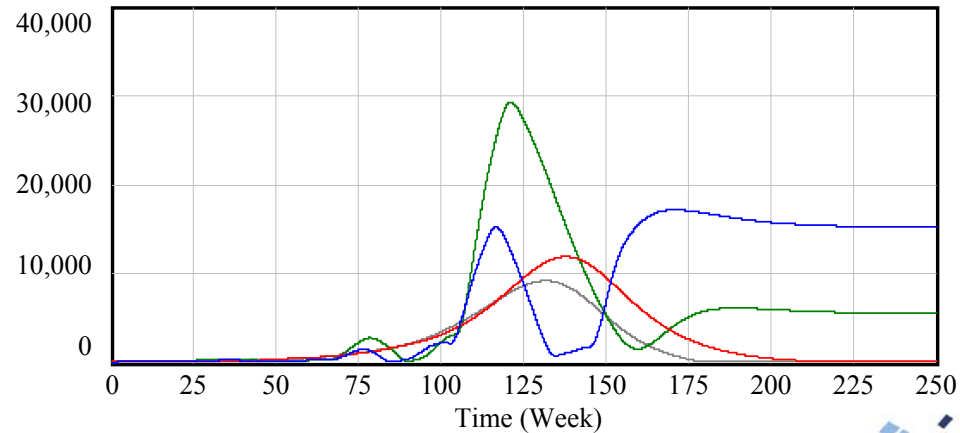
- PR[SUP] : 14 LS16LO3 AS8AO2 noCP — Units/Week
- PR[SUP] : 14 LS16LO3 AS8AO2 CP — Units/Week
- PR[SUP] : 14 LS16LO3 AS4AO2 noCP — Units/Week
- PR[SUP] : 14 LS16LO3 AS4AO2 CP — Units/Week

However, major improvements are achieved with customer info sharing (CP, red and grey lines)

Average FI



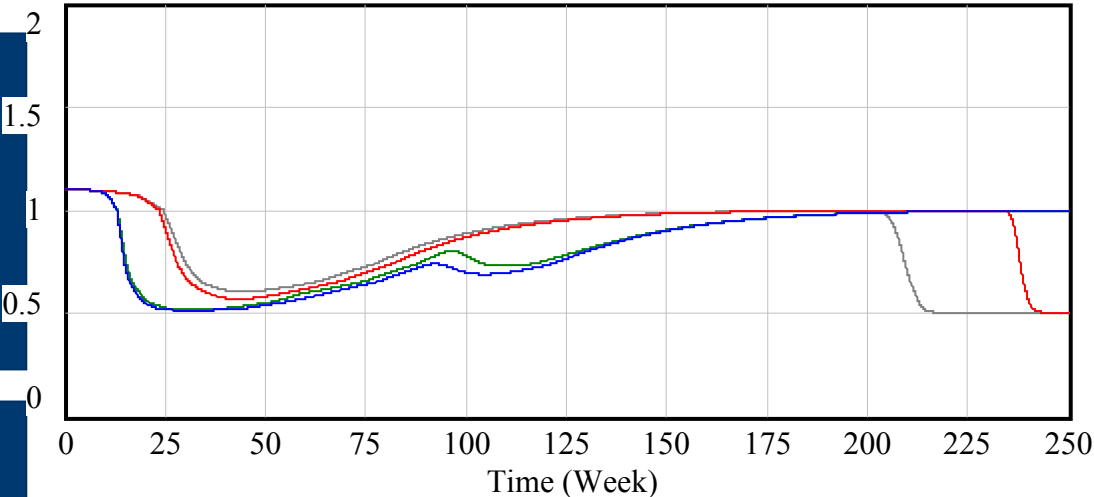
Graph for FI



- FI[SUP] : 14 LS16LO3 AS8AO2 noCP — Units
- FI[SUP] : 14 LS16LO3 AS8AO2 CP — Units
- FI[SUP] : 14 LS16LO3 AS4AO2 noCP — Units
- FI[SUP] : 14 LS16LO3 AS4AO2 CP — Units

SUP leadtime = 16 weeks; OEM leadtime = 3 weeks

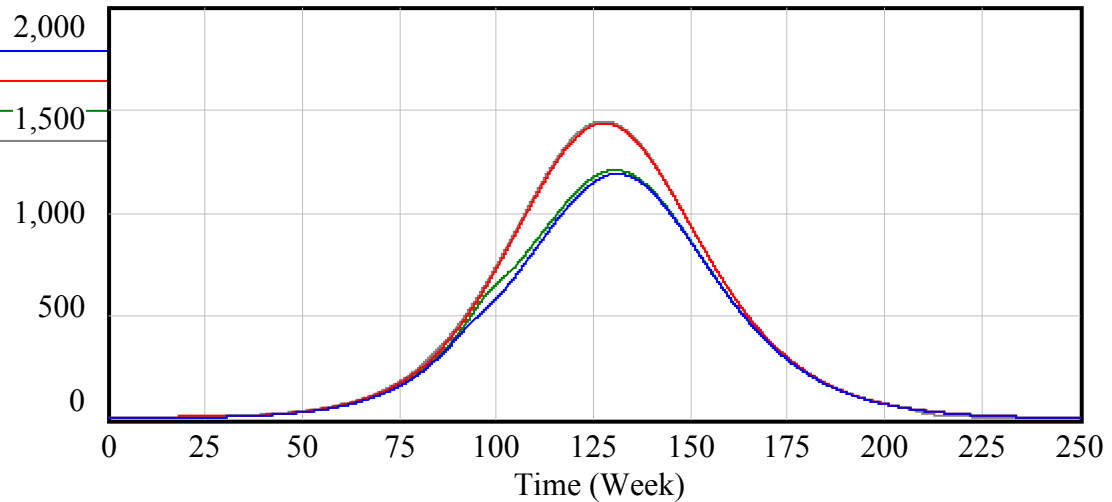
Graph for Effect DD



For the OEM, the benefits of shorter planning delays are minimal. Information sharing leads to higher sales as delivery delays to customers are shorter.

- Effect DD : 14 LS16LO3 AS8AO2 noCP
- Effect DD : 14 LS16LO3 AS8AO2 CP
- Effect DD : 14 LS16LO3 AS4AO2 noCP
- Effect DD : 14 LS16LO3 AS4AO2 CP

Graph for COR



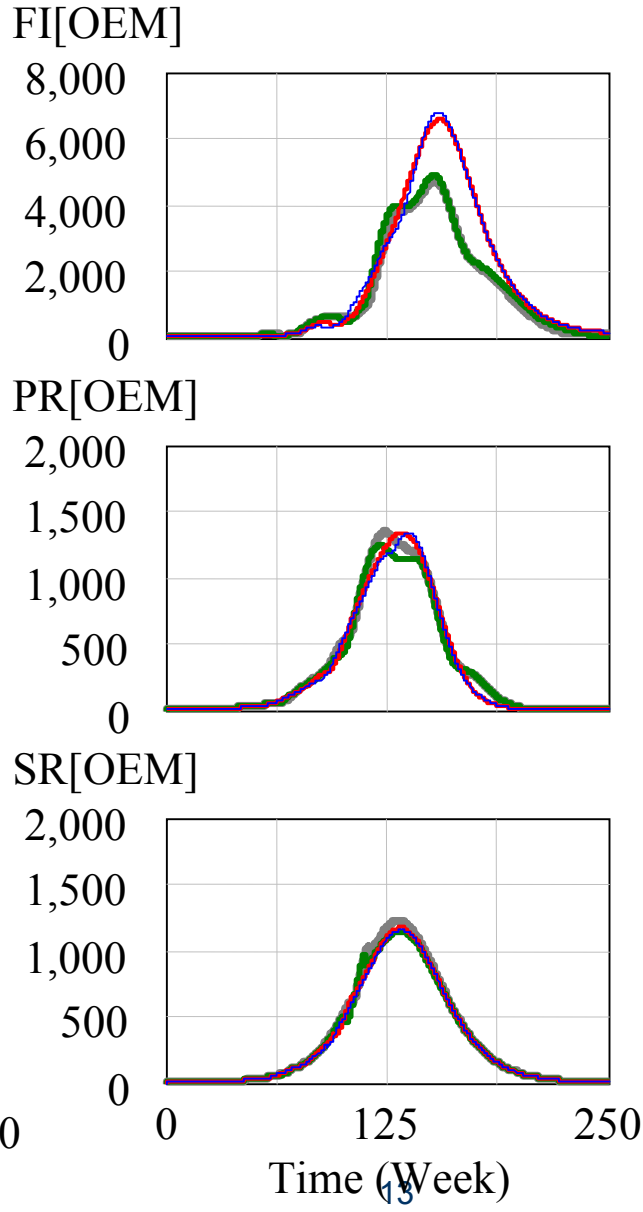
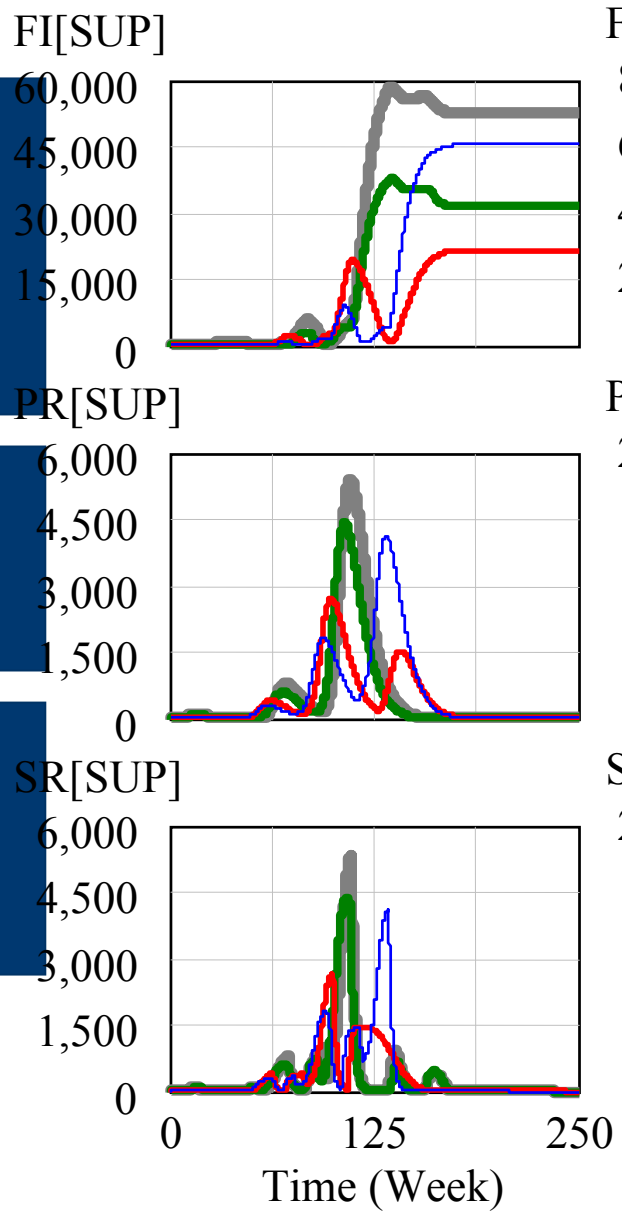
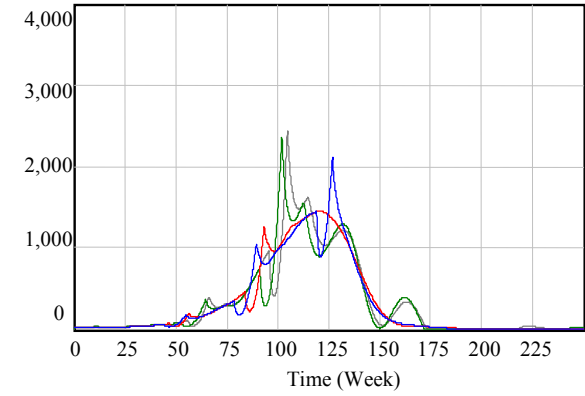
- COR : 14 LS16LO3 AS8AO2 noCP
- COR : 14 LS16LO3 AS8AO2 CP
- COR : 14 LS16LO3 AS4AO2 noCP
- COR : 14 LS16LO3 AS4AO2 CP

Setting B: Both supplier and customer are slow

SUP leadtime = 16 weeks; OEM leadtime = 16 weeks

No info sharing!

Graph for PSR[OEM]



When the OEM replans more frequently, the chain becomes more nervous, leading to higher inventory at the supplier.

- 14 LS16LO16 AS8AO8 noCP — blue line
- 14 LS16LO16 AS4AO8 noCP — red line
- 14 LS16LO16 AS8AO4 noCP — green line
- 14 LS16LO16 AS4AO4 noCP — grey line

Setting B again, but now with info sharing

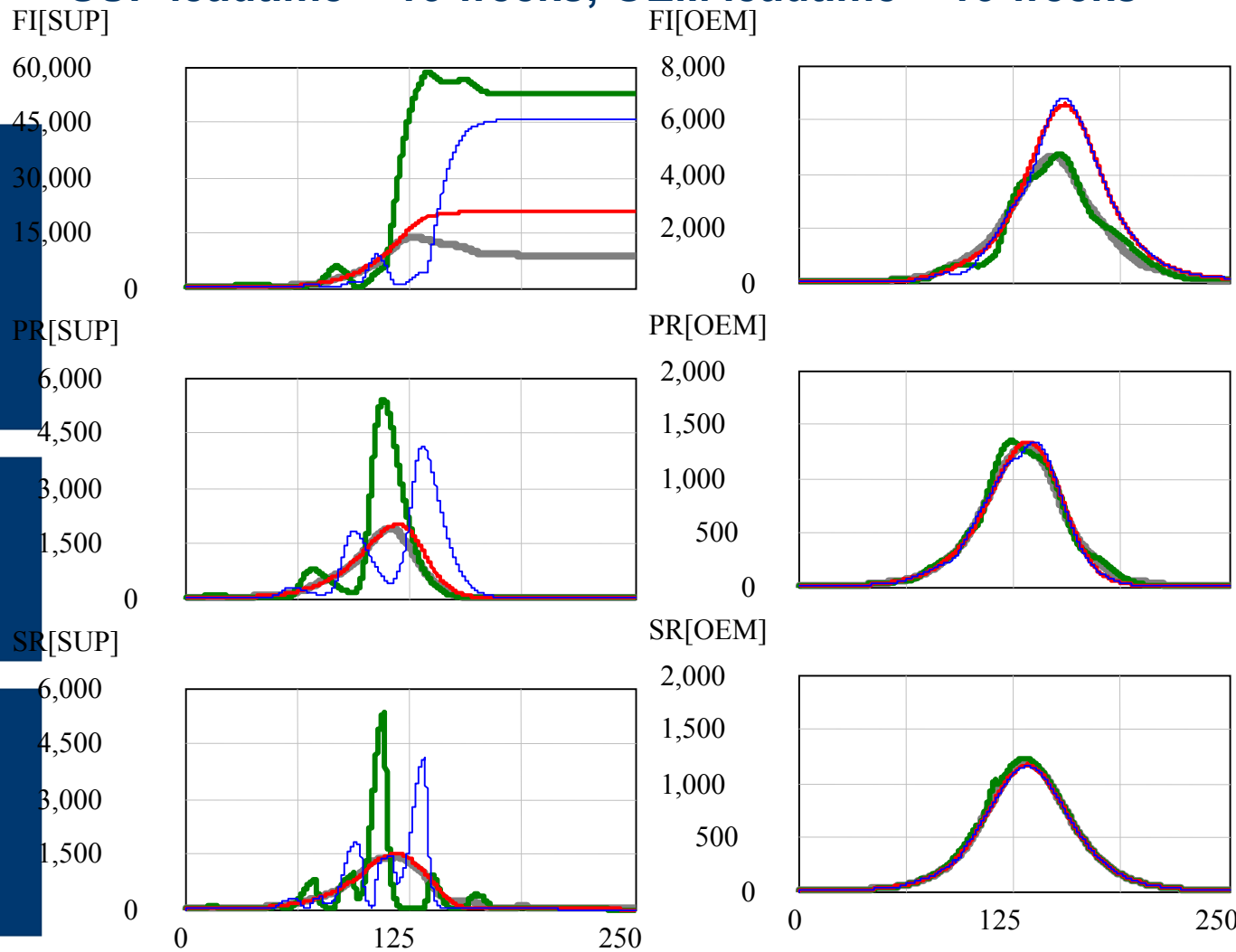
SUP leadtime = 16 weeks; OEM leadtime = 16 weeks

Info sharing!

Information sharing in combination with more frequent replanning works best..

FI[SUP] goes down enormously, FI[OEM] considerably, and , Sales of the OEM go up 2%.

However, the Supplier sells less. What is the net result of 15% lower sales vs 70% less obsolescence?



Time (Week)

14 LS16LO16 AS8AO8 noCP



14 LS16LO16 AS8AO8 CP



14 LS16LO16 AS4AO4 noCP



14 LS16LO16 AS4AO4 CP

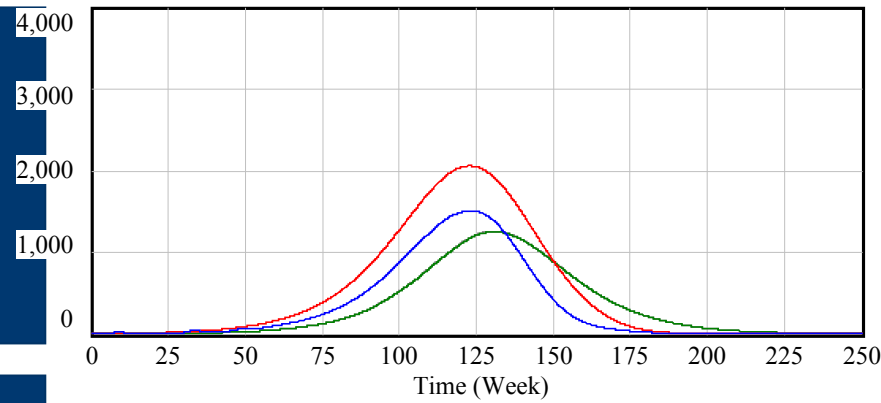


Time (Week)

Setting C: fast supplier, slow OEM

SUP leadtime = 3 weeks; OEM leadtime = 16 weeks

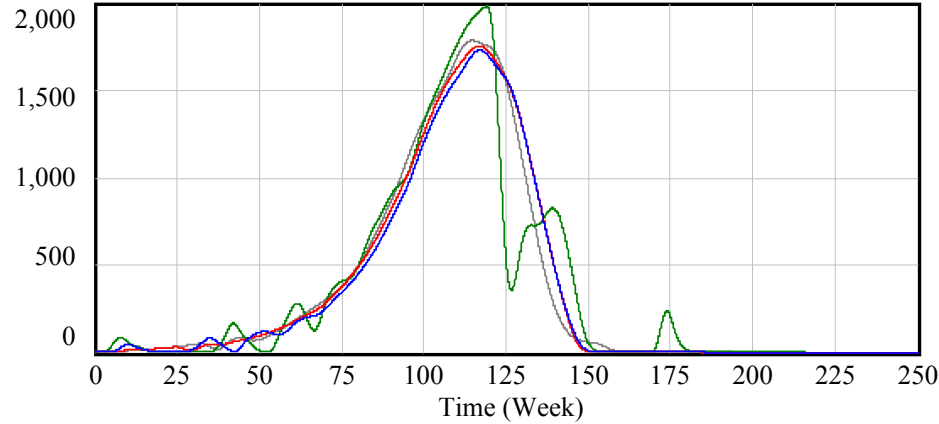
GRAPH



EOR[SUP] : 14 LS3LO16 AS2AO8 noCP — Units/Week
 PSRF : 14 LS3LO16 AS2AO8 CP — Units/Week
 COR : 14 LS3LO16 AS2AO8 noCP — Units/Week
 COR : 14 LS3LO16 AS2AO8 CP — Units/Week

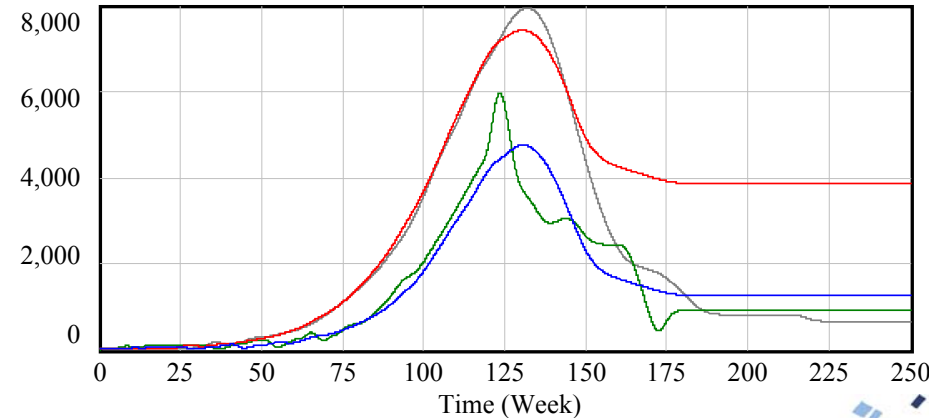
If the supplier can respond fast, there is no need for anticipation through prediction. Production rates do become more varied. No information sharing is better for the supplier

Graph for PR



PR[SUP] : 14 LS3LO16 AS2AO8 noCP — Units/Week
 PR[SUP] : 14 LS3LO16 AS2AO8 CP — Units/Week
 PR[SUP] : 14 LS3LO16 AS2AO4 noCP — Units/Week
 PR[SUP] : 14 LS3LO16 AS2AO4 CP — Units/Week

Graph for FI



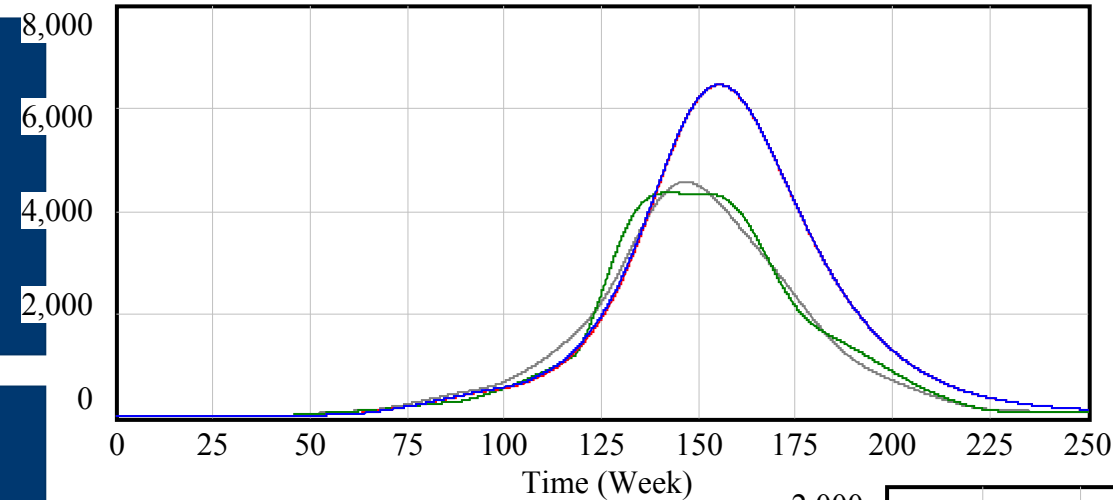
FI[SUP] : 14 LS3LO16 AS2AO8 noCP — Units/Week
 FI[SUP] : 14 LS3LO16 AS2AO8 CP — Units/Week
 FI[SUP] : 14 LS3LO16 AS2AO4 noCP — Units/Week
 FI[SUP] : 14 LS3LO16 AS2AO4 CP — Units/Week



Setting C: fast supplier, slow OEM: the OEM view

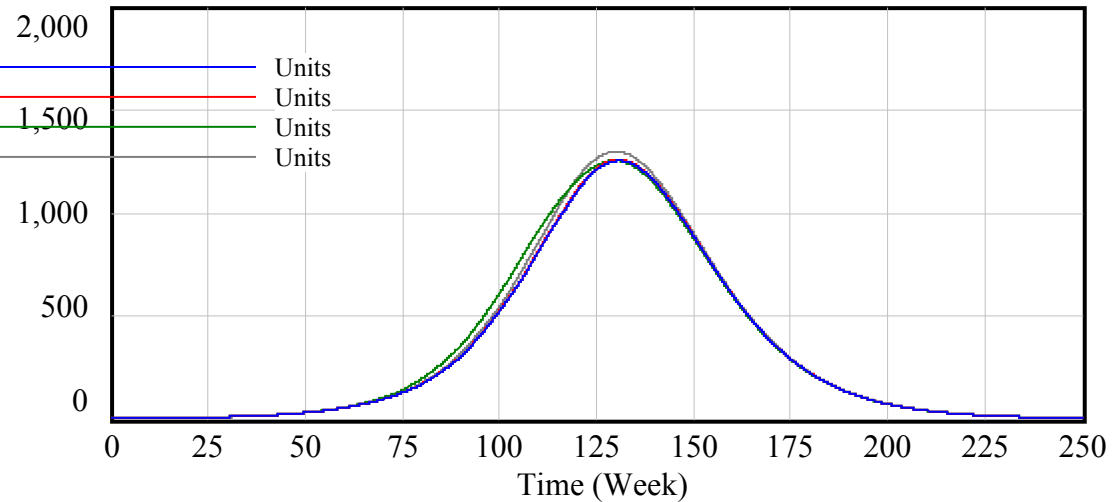
SUP leadtime = 3 weeks; OEM leadtime = 16 weeks

Graph for FI



FI[OEM] : 14 LS3LO16 AS2AO8 noCP
 FI[OEM] : 14 LS3LO16 AS2AO8 CP
 FI[OEM] : 14 LS3LO16 AS2AO4 noCP
 FI[OEM] : 14 LS3LO16 AS2AO4 CP

Graph for COR



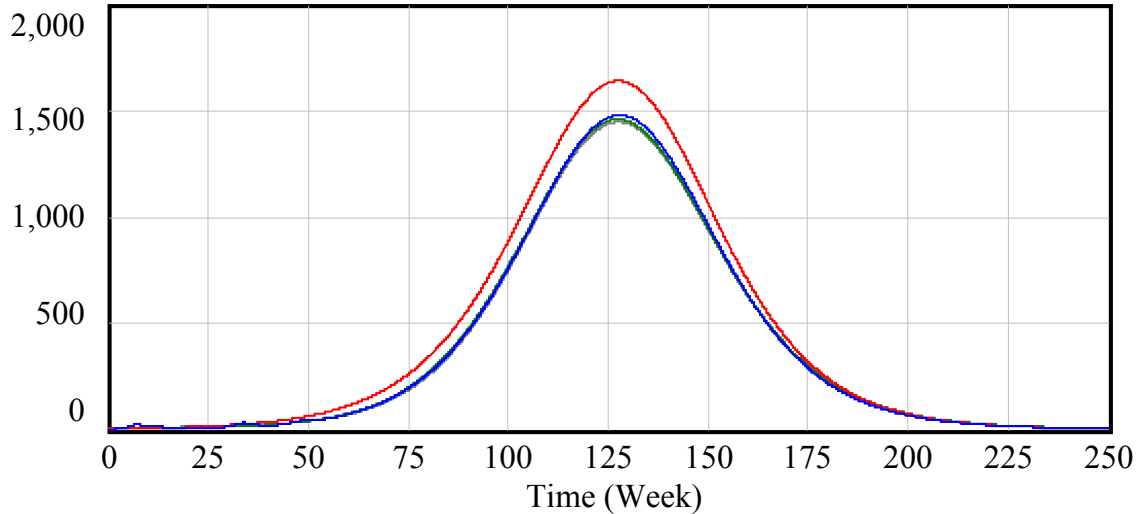
COR : 14 LS3LO16 AS2AO8 noCP Units/Week
 COR : 14 LS3LO16 AS2AO8 CP Units/Week
 COR : 14 LS3LO16 AS2AO4 noCP Units/Week
 COR : 14 LS3LO16 AS2AO4 CP Units/Week

Also, the OEM has no benefits from info sharing, but is better of shortening planning delays

Setting D: fast supplier, fast OEM

SUP leadtime = 3 weeks; OEM leadtime = 3 weeks

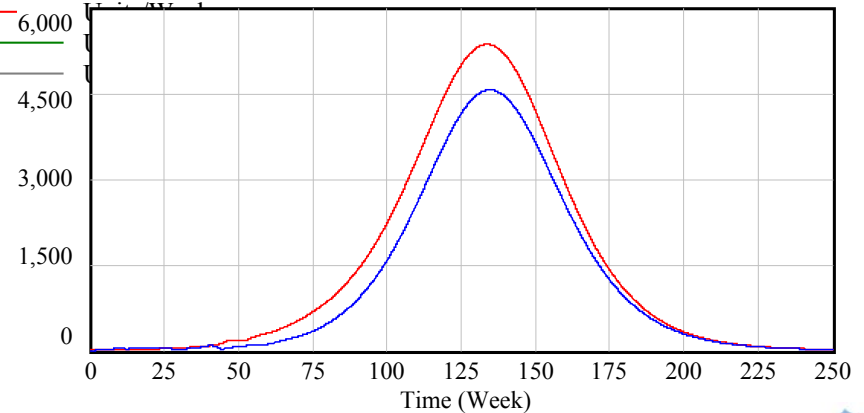
GRAPH



There are no benefits of info sharing for the Supplier or for the OEM

EOR[SUP] : 14 LS3LO3 AS2AO2 noCP ————— Units/Week
 PSRF : 14 LS3LO3 AS2AO2 CP ————— 6,000
 COR : 14 LS3LO3 AS2AO2 noCP —————
 COR : 14 LS3LO3 AS2AO2 CP —————

Graph for FI



FI[SUP] : 14 LS3LO3 AS2AO2 noCP ————— Units
 FI[SUP] : 14 LS3LO3 AS2AO2 CP —————

Conclusion: Time will tell a great deal indeed...

| | | Production leadtime OEM | |
|-------------------------|-------|---|---|
| | | Short | Long |
| Production leadtime SUP | Short | <i>Setting D:</i> No info sharing, Planning delays already short | <i>Setting C:</i> shorter planning delays for OEM |
| | Long | <i>Setting A:</i> info sharing | <i>Setting B:</i> shorter planning delays for both <i>and</i> info sharing |