Challenges for Achieving Supply Chain Resilience and Transparency within CoyPu
Challenges for Achieving Supply Chain Resilience

1. **Tactical Demand**
   - Customers reporting demand tactically
   - Leads to strong Bullwhip

2. **Domain Complexity**
   - Cause-effect relationships difficult to evaluate
   - Complex supply chains and production lines

3. **Transparency**
   - Lack of transparency in the supply and demand direction
   - Who are my Tier-x customers?

4. **Heterogenous Crisis**
   - Crisis are rare and not comparable (e.g. COVID-19 and economic crisis)

5. **Explainability**
   - Business stakeholders do not trust blackbox decisions

6. **Data Quality / Volume**
   - Distributed data sources and knowledge silos
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Semiconductor market growth de-coupled from crash caused by COVID

Bullwhip reduced from >5 to 2-3 but still significant with higher impact

*I-Ref-M = Infineon Reference Market – Total semiconductor US-Dollar based market revenues excl. DRAM, NAND Flash, MPU. – Real GDP = Inflation adjusted (real) Gross Domestic Product of all countries of the world; total of local values converted with in each case current US-$ exchange rates. World real GDP is from chain-weighted index. Quarterly data (year-over-year growth rates)
Sources: WSTS Bluebook for Historical Data, 30 November 2020 & Forecast Update, November 2020; based on or includes content supplied by IHS Markit Economics & Country Risk, Comparative World Overview Tables, 17 November 2020
Specific disclaimer for Omdia and IHS Markit data: Information is not an endorsement of Infineon Technologies AG. Any reliance on these results is at the third party’s own risk
Excerpt of major actors from an automotive supply chain

- **OEM**: Companies producing cars and reacting to the end market demand
- **Tier 1 Supplier**: Companies delivering components and parts for the cars
- **Tier 2 Semiconductor**: Companies delivering needed semiconductors

Each actor is highly connected to subsequent tiers on a global scale influencing each other.
After the demand for semiconductors collapsed orders harshly recovered during end market demand recovery

The results of the simulation model show a clear amplification of the change in the end market for light vehicle sales. The more upstream in the supply chain, the larger the drop in the received demand signal during the crisis.

The recovery phase in end market demand shows high amplification of demand increase. The incoming demand for the semiconductor echelon exceeds end market demand by about 40% with a doubled amplification compared to Tier-2.
Tactical Demands are Bullwhip Drivers in Supply Chains

› Collaboration and communication along the semiconductor supply chain allow us to get a better understanding of the current situation (demand, overheating)
› Precise forecasts are important in semiconductor supply chains for the planning of production
   – Semiconductors have a very long lead time
   – Semiconductor production cannot be parallelized

Problem

› Companies strategically do not want to disclose their true demand to competitors or suppliers
› Instead they communicate a tactical demand to suppliers
› Goal is to make sure the own demand will be fulfilled
› The result is an inflated demand amplified by the Bullwhip Effect
Bias and Noise Hindering Collaboration

Highly fluctuating Semiconductor Demand

- True Demand
- Noisy Demand
- Biased Demand

Bias
Systematic Deviations
- During start of Pandemic, orders were cancelled in large quantities
- After Demand Recovery, customers order higher quantities as a tactical demand

Noise
Random Scatter
- Bullwhip Effect amplifies any noise from upstream the supply chain

Hindering Collaboration
- Decision Observer does not work in the current setting. Competitors do not want to share their True Demand among each other
- Noisy and biased Data is not suitable for AI algorithms, clean data is required to allow for better forecasting
- With better forecasts, faster demand fulfillment is possible
Possible Solution Approaches to mitigate the Bullwhip Effect

Demand Understanding

Marketing Demand

› Capture complex interdependencies in semiconductor supply chains in knowledge graphs based on external factors
› Understanding influence factors and demand drivers besides customer demand itself

Anonymous True Demand

› Remove incentive to communicate tactical demands with anonymous surveys to come to a true(r) demand on a high level
› Decoupled of ordering system for benchmarking
› Identify overheating and smoothening of demand
Importance of Semantics for Solution Approaches

Semantic Web for Complexity Management

- Semantic Web can be used to
  - break the high level forecast down to the needed level (graph structure)
  - provide services based on the enhanced demand on fine granularity
  - provide common understanding across supply chain tiers (vocabulary & ontologies)

Collaboration, Communication & more Transparency
Thank you!
Part of your life. Part of tomorrow.