Impact of information exchange on supplier forecasting performance

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Key problem in supply chain management → **Bullwhip effect (BWE)** (Geary et al., 2006)

**BWE → Demand variability amplification when moving upwards in the supply chain**

**BWE leads to:**
1. Poor forecasts
2. Excessive stock
3. Poor customer service
4. Increased costs
What causes the Bullwhip Effect? (Lee et al., 1997)

1. Order batching → companies often group orders together

2. Rationing and shortage gaming → ordering behaviour in periods of supply shortage

3. Price fluctuations → promotions modify real buying behaviour

4. Demand forecast updating → demand forecasts are based on past demand → includes problems above

BWE increases the stochasticity of demand upstream in the supply chain
Collaboration in the supply chain has often been proposed to counter the BWE

Collaboration:
- Information sharing
- Find a global optimal solution for all members instead of sub-optimal solutions for each company

Collaboration can take the following forms (Holweg et al., 2005):

1. No collaboration → Traditional supply chain
2. Information exchange → Demand planning collaboration
3. Inventory collaboration → Vendor managed replenishment
4. Planning and inventory collaboration → Synchronised supply

Information transparency mitigates BWE (Geary et al. 2006)
Proposed models use inputs from multiple levels of the supply chain. Aim → Less Bullwhip → More accurate forecasts.
For a consumer goods chemicals company we have past historical sales and Point Of Sale (POS) data. We can forecast demand per SKU using:

1. **Conventional Time Series Models (univariate)**
   1. Random Walk (Naive)
   2. Moving Averages (MA)
   3. Single Exponential Smoothing (ETS)
   4. AR and ARIMA

2. **Models that use past supplier’s demand and retailers’ demand (multivariate)**
   1. Neural Networks (NAR - NARX)
   2. ARX (and ARIMAX)

Direct empirical comparison → Are multivariate more accurate?
Multivariate models better \(\rightarrow\) Collaboration impacts positively on accuracy!

Proposed supply chain models

Conventional demand planning models

+25.2% Improvement over best conventional model!
• Empirical evidence that information sharing positively affects forecasting accuracy

• Information sharing $\rightarrow$ reduced forecasting errors
  
  ➢ Mitigates Bullwhip Effect
  
  ➢ Reduce inventories $\rightarrow$ costs
  
  ➢ Reduce supply chain waste $\rightarrow$ costs
  
  ➢ Results considered in company that provided data

Detailed analysis, findings and references in the paper: