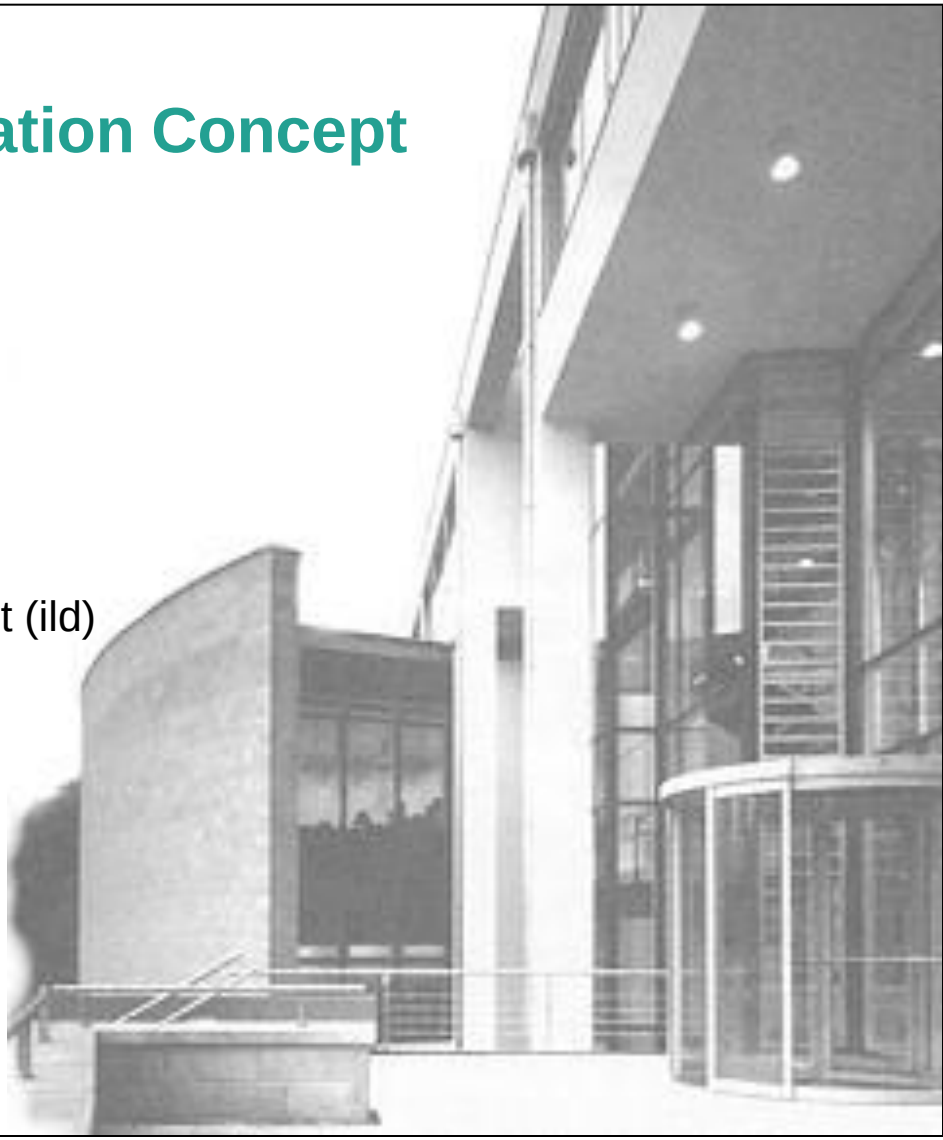
Institut für Logistik- & Dienstleistungsmanagement
der FOM University of Applied Sciences

Green Bullwhip Effect Simulation Concept



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25th European Simulation and Modelling Conference (ESM)
Guimaraes 24.-26. October 2011

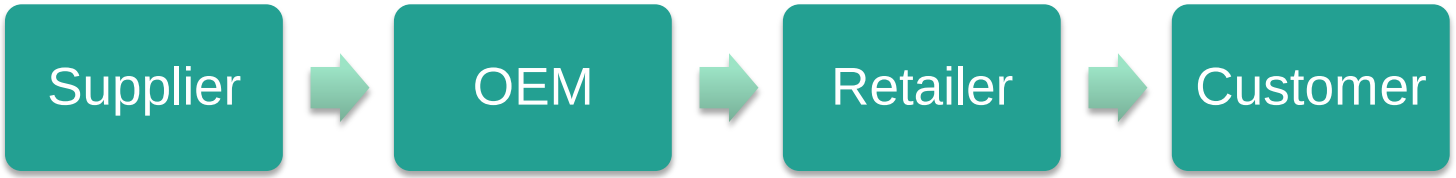
Agenda

1. Introduction
2. Bullwhip Effect
3. Green Logistics Instruments
4. Volatility Assessment
5. Conclusion

1. Introduction

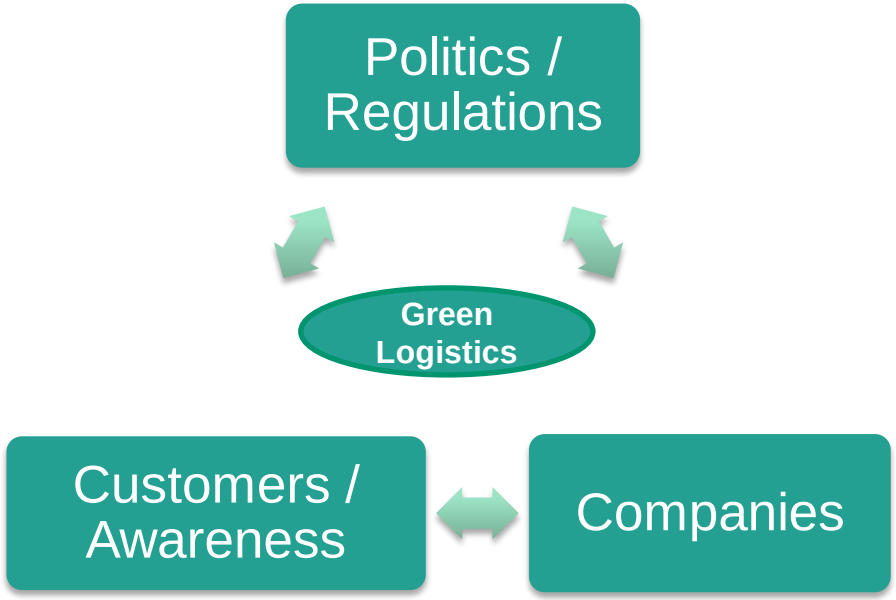
SCM Trends and Methods

- Logistics has evolved into the complex co-ordination of whole supply chains (supply chain management) searching for an optimum of operations of a multitude of companies working in the same line of a product or service flow towards an end customer.

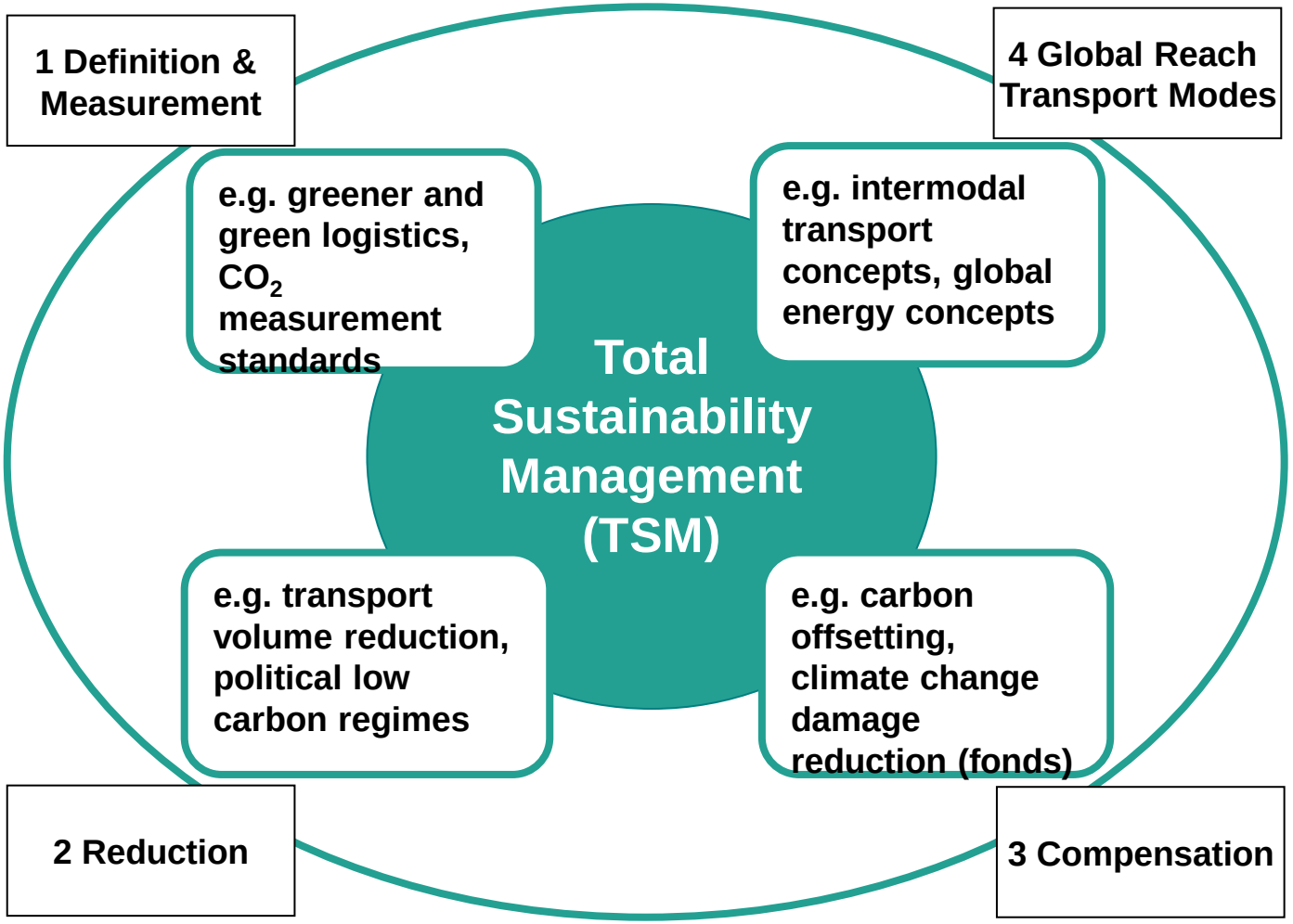


SCM Trends and Methods

- Furthermore recent trends in logistics favour and even demand sustainable solutions for transport flows termed green logistics



1. Introduction

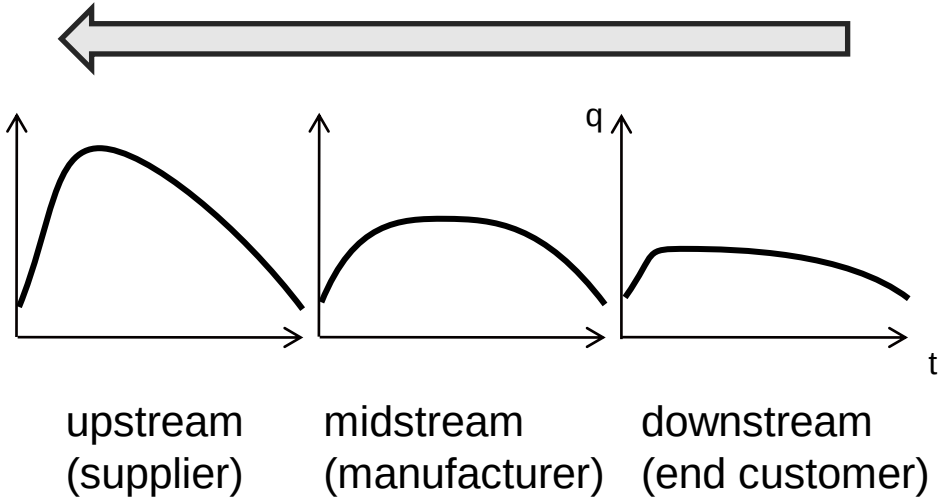


→ How do such concepts and their measures influence the supply chain volatility / bullwhip effect?

2. Bullwhip Effect

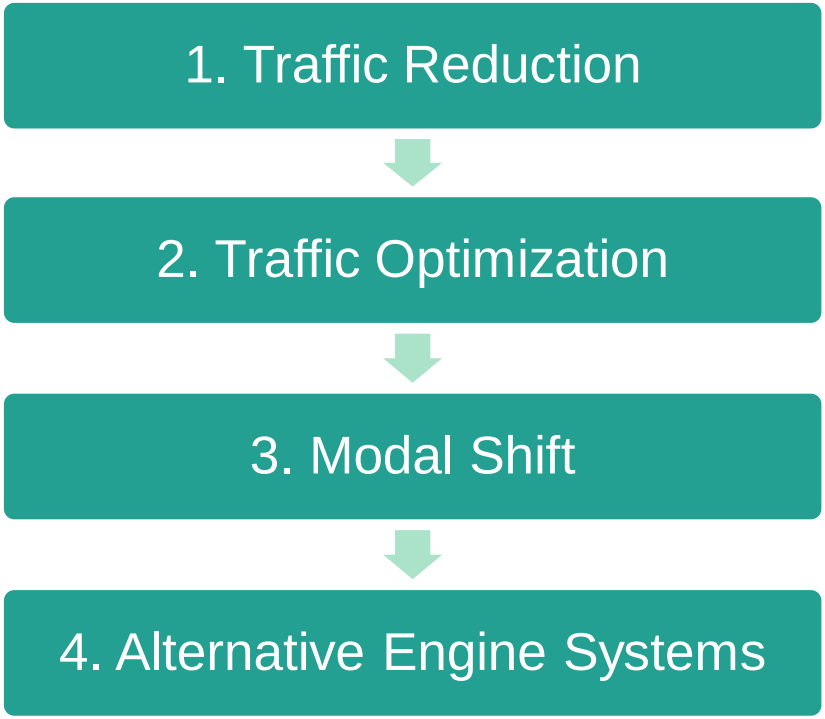
Existing Bullwhip Effect Literature and Data

- Supply chain research includes ample knowledge about increasing stock and order levels upstream in supply chains induced by small changes in customer demand (bullwhip effect).
- This is mainly caused by information gaps and missing co-ordination among supply chain companies and deciders.



3. Green Logistics Instruments

Green Logistics Instrument Levels



3. Green Logistics Instruments

Timetable European trading scheme for aviation sector:

1. Submission of a monitoring plan for the reporting of t-km data and annual emission by 31 August, 2009

2. Monitoring of t-km and annual emission during the calendar year 2010 and submission of independently verified t-km and annual emission by 31 March, 2011

3. Member states submit all valid applications to the European commission by 30 June, 2011

4. Member states shall issue to each aircraft operators the number of allowances by 28 February, 2012

Concerns all flight in the EU community are covered by the scheme:

- Flights within a member state
- Flights between member states
- Flights between a member state and third country
- Detailed guidelines for the interpretation of aviation activities

4. Volatility Assessment

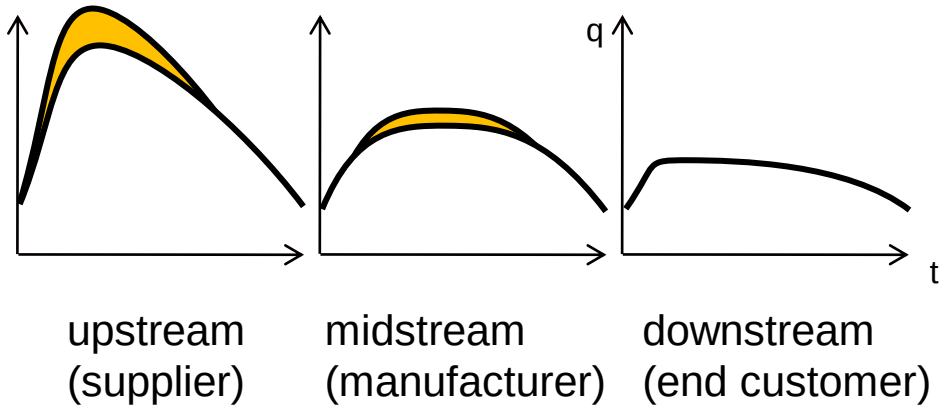
Volatility Assessment of Specific and Selected Instruments

Green Logistics Instrument	Transmission Character	Influence on Flexibility	Influence on Volatility *V*
(a) Electric-driven trucks	Restriction of transport range	*Negative* influence due to shorter range	*Increasing V* due to feared shortages
(b) Reduction of empty tours (trucks)	Reduction of shipment intervals	*Negative* influence due to longer spacing	*Increasing V* due to feared shortages
(c) Slow steaming (ships)	Longer travel period & more ships needed	Negative influence - increased travel time	*Increasing* V due to feared shortages
(d) Use of biofuel (planes)	Change of speed and range	Positive influence due to higher range	*Decreasing V* due to less shortage fear
(e) Carbon dioxide emissions trading (airlines)	Reduction of flight intervals	Negative influence due to decrease in capacity	*Increasing V* due to restricted capacity and rising prices

4. Volatility Consequences

Overall Volatility Assessment and Green Bullwhip Effect

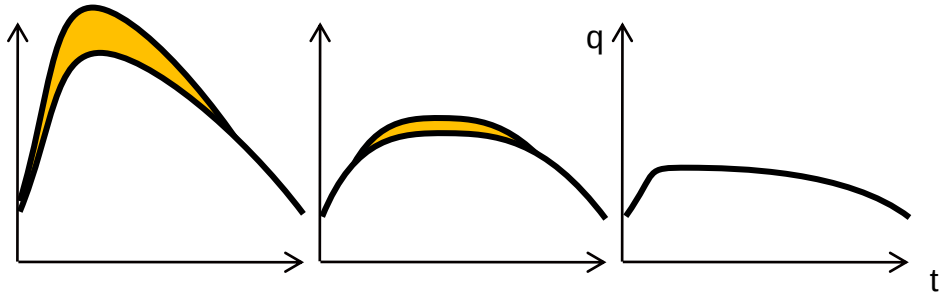
- An increasing volatility in existing supply chains amplifying bullwhip effects due to green logistics measures can be expected and termed a „green bullwhip effect“.
- Most analyzed green logistics instruments have a high probability in leading to increased volatility and therefore amplifying the general bullwhip effect.



4. Volatility Simulation

Outlook

- In 2012 a simulation and analysis will be feasible using the air cargo data from 2011 (with EU Carbon Certificate Scheme) in comparison to 2010 to evaluate the practical existence of the proposed green bullwhip effect by asking the following in-detail questions:
  - (a) Are there higher degrees of capacity use in air cargo flights?
  - (b) Is there a lower number of cargo flights in general?
  - (c) Do average weights and sizes of shipments change?



5. Conclusion

In general a **green bullwhip effect** or added volatility **by green logistics instruments** has to be expected though other areas of green measures will have a mitigating effect.

→ Specific industries as e.g. fashion and electronics should be prepared to **expect longer travel and lead times** and strategically increase stock levels.

→ Second an **overall strategy concept and simulation analysis** for green logistics instruments should be implemented in order to assume better understanding of supply chain-wide consequences of green logistics instruments.

→ Third further **case studies and simulations** are necessary in specific fields and industries in order to prove the existence of the described green bullwhip effect in business practice.

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Thank you for your attention!

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