E-Sourcing, Procurement and the Adaptive Supply Network

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Procurement and Strategy

- e-procurement: "*The use of electronic technologies to streamline and enable the procurement activities of an organisation*" (Hawking et al 2004)
- "*Internet-enabled and other B2B e-commerce mechanisms facilitate the integration and management of within-firm and cross-firm business processes… in these interactions, supply chain B2B e-commerce helps minimize complexity and increase flexibility while contributing to high degrees of collaboration and operational efficiency*" (Iyer et al 2004)
- "*To view procurement as a cost savings activity only is to sentence one's company to competitive failure. Many firms are only now recognizing that by leveraging the expertise of their supply base gains can be made that lead to a sustainable competitive advantage*" (Cousins & Spekman 2003)

e-Procurement as an Enabler

- In this presentation I will concentrate on procurement and sourcing within “collaborative” supply chain relationships.
- I will tend emphasise areas in which e-procurement is an enabler or “piece of the puzzle” for other supply chain management initiatives, such as:
  - mitigating the bullwhip effect
  - vendor-managed inventory
  - “next generation” supply network technologies: negotiated scheduling and collaborative logistics

The e-Procurement Experience

- The idea of using of electronic (computerised) technologies as the medium for trading goods and services is far from new
- Alongside success stories there are cautions to be found in the literature about e-procurement and e-supply-chains
- Pant et al (2003):
  - "*There is a great deal of excitement in the marketplace about how various supply chain software packages can integrate the operations of a firm's supply chain … However … it is often overlooked that creation and implementation of integrated supply chains requires overcoming tremendous challenges*."
  - "*…managers are advised to be aware of the substantial redesign of business processes … (many) will need to be redesigned jointly with business partners, who may not either see things the firm's way, or may lack the management skills to enforce such a change in their own.*"

Strategic Supply

- Cousins and Spekman (2003) interviewed and surveyed purchasing professionals in the US and UK:
  - "*Opportunistic relationships are focused mainly on short-term price reduction technique…Interviewees often reported cost savings of around 10–20% by using this approach. The problem, as the majority indicated, was that in the medium to long term this strategy could not be sustained. One cannot expect innovation or other value adding skills to be applied if the supplier is being forced to focus on price.*"
  - "*Strategic supply implies that supply chain wide skills, expertise and capabilities are brought to bear by the full set of supply chain partners. They are united in the belief that by working collaboratively they will accomplish goals that they could not otherwise have achieved. Procurement should and must play a central role in the process.*"

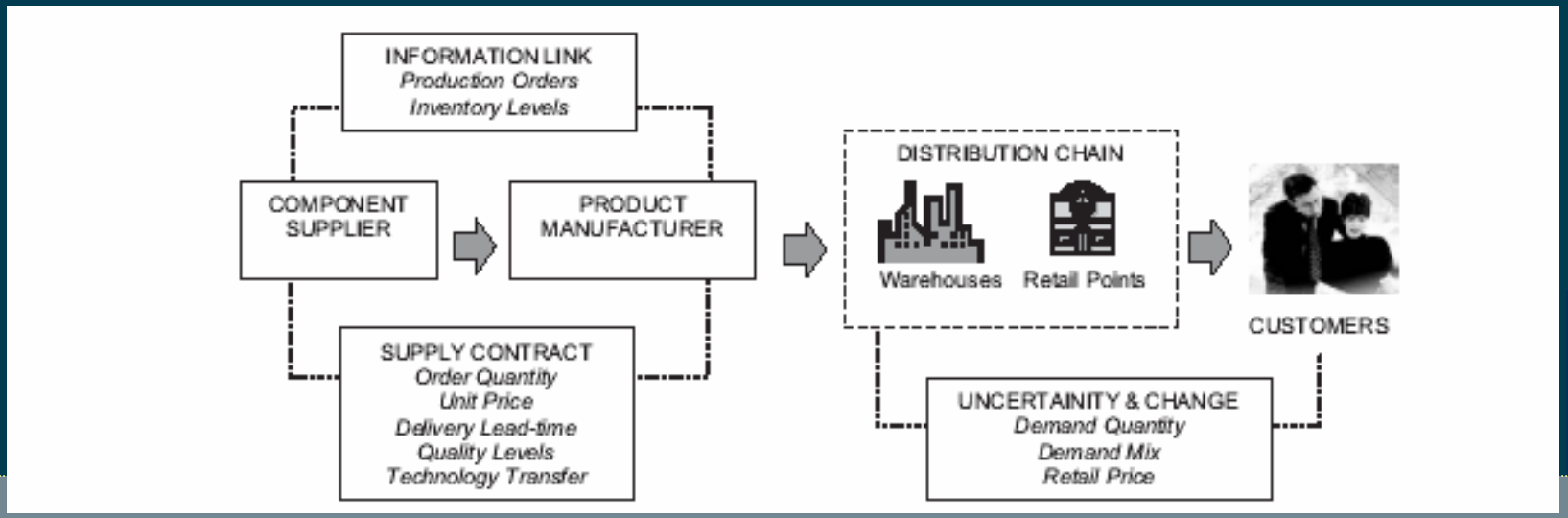
Collaboration

- Brna (1998): Collaboration as a state has the following five characteristics:
  - Mutual agreement to collaborate
  - Maintenance of a model of other parties
  - Possessing a shared goal or intent
  - Holding beliefs about the shared goal
  - Maintaining a shared understanding of the problem
- Nezamirad et al (2004): Collaboration is a holistic view of the form of interaction, whereas cooperation is the management of (positive and negative) interferences.
- In an industrial context, cooperation does not require a shared intent (aside from a basic requirement to coordinate activities).
- For collaborative procurement/sourcing there must be a shared intent and a common frame of reference.

Examples of Published Research

Supplier Selection under Uncertainty

- Das & Abdel-Malek (2003): "*The underlying assumption of a good supply chain is that buyers and suppliers are willing to accommodate the uncertainties and variations in each other's businesses*."
- Das & Abdel-Malek take a buyer's view and mathematically investigate the effect of major supply contract parameters. They link market uncertainty, risk sharing and supply contract parameters to estimate the annual procurement cost in a buyer–supplier relationship.



e-Difficulties

- Williamson et al (2004) : "*a survey of 33,000 companies worldwide by IBM shows that most businesses are still in the initial stages of e-business with 80% of them using the Internet to extend their markets and provide information. They also found that fewer than 5% of businesses were at the stage of integrating their information systems with external partners. The key difficulty was integrating work processes, such as purchasing and customer relations, across disparate computing platforms, applications and operating systems*"

Table 2
Internet applications by logistics decision area application (Lancioni et al., 2003a,b)

	1999% Using	2001% Using
Purchasing/procurement	45.2	86.7
Inventory Management	30.1	48.5
Transportation	56.2	84.3
Order Processing	50.7	63.4
Customer Service	52.5	67.1
Production Scheduling	12.3	19.5
Relations with suppliers	45.3	57.2

Implementation Sequence

- Marquez et al (2004) used system dynamics methods to evaluate the importance of the sequence in which e-collaboration tools are adopted in a supply chain.
  - "*Our computational results also show that it is risky to install e-collaboration tools for electronic payment when collaborative forecasting is not in place in the SC. Decreases in financial constraints could lead to unnecessary increase in inventories without improving SC performance. Local financial constraints can heavily impact the operational and financial performance of the entire supply chain.*"

Conclusions from the Literature

- There is an enormous number of articles relating to procurement, sourcing and supply chain issues in the academic literature.
- The coverage ranges from surveys and case studies to theoretical and analytical results.
- The empirical evidence shows successes and horror stories.
- The literature generally validates an intuition that procurement initiatives need to be part of a broader supply chain strategy.
- Software packages are part of the solution.
- There are many technical and change-management challenges to overcome.
- The literature offers appreciable knowledge and insight into what these challenges are and what general strategies can be used to succeed.

e-Procurement in the Supply Chain

The Bullwhip Effect

- The phenomenon of the supply chain *bullwhip effect* was identified many years ago
- Two broad types: *demand amplification* and *rogue seasonality*
- Lee et al (1997) study the bullwhip effect mathematically:
  - "*One important mechanism for coordination in a supply chain is the information flows among members of the supply chain…(have a) direct impact on the production scheduling, inventory control and delivery plans of individual members in the supply chain… orders to the supplier tend to have a larger variance than sales to the buyer*"
  - They identify causes and counter-measures
  - Several of the counter-measures have an e-procurement basis

Demand Amplification

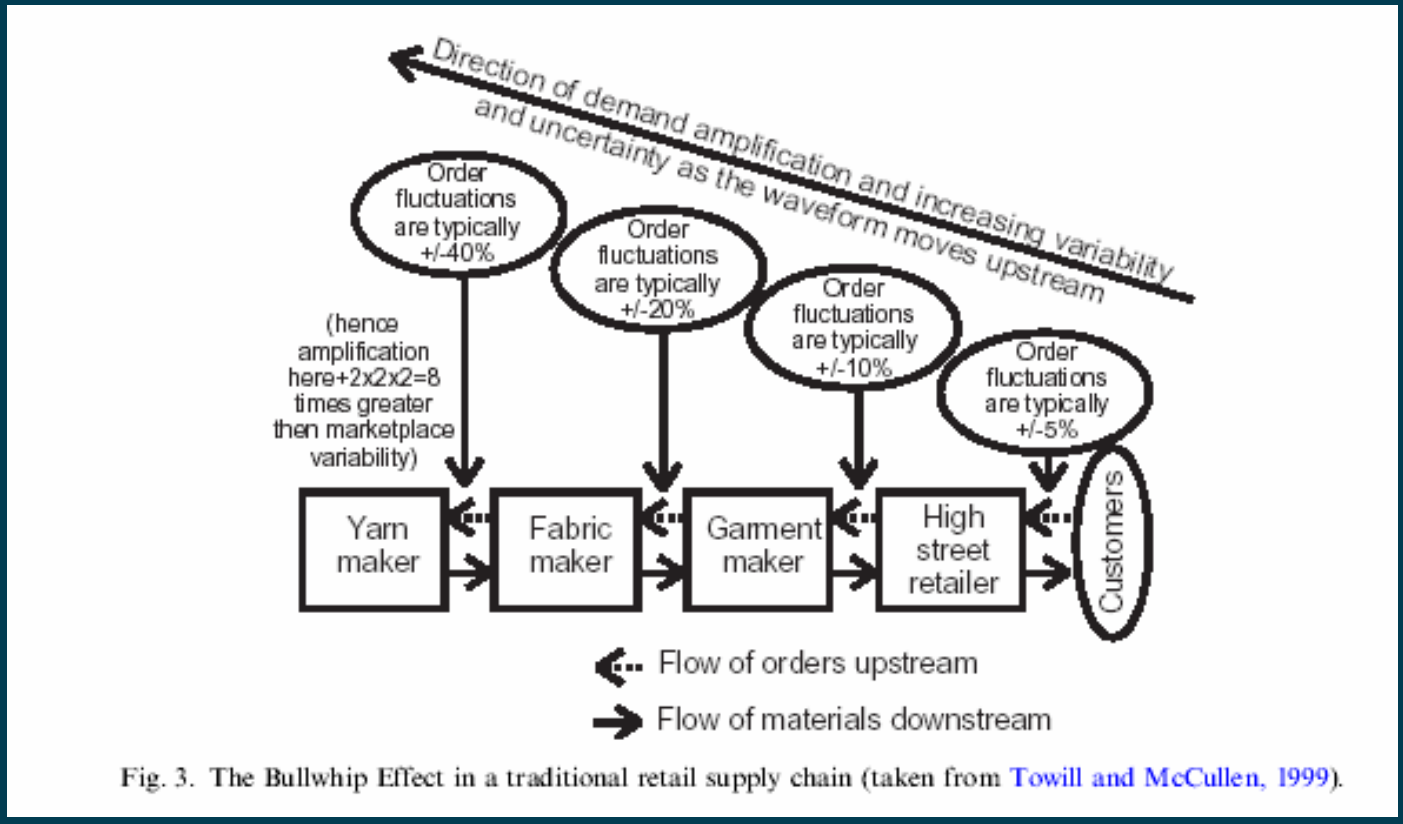


Fig. 3. The Bullwhip Effect in a traditional retail supply chain (taken from Towill and McCullen, 1999).

Source: Disney et al, IJPE, 2003

Bullwhip Causes and Counter-Measures

- Lee et al 1997 offer the following summary

Causes	Contributing Factors	Counter Measures
Demand Signalling	No visibility of end demand	* Access sell-thru or POS data
	Multiple forecasts	** Single control of replenishment (VMI)
	Long lead-time	Lead-time reduction
Order Batching	High order cost	*** e-procurement
	Full truckload economics	** Assorted truckloads, consolidation by 3PL
	Random or correlated ordering	Regular delivery appointment
Fluctuating Prices	High-low pricing	** Everyday low price
	Delivery and purchase asynchronized	Special purchase contract
Shortage/Rationing	Ignorance of supply conditions	** Shared capacity and supply information
	Proportional rationing scheme	Allocate based on past sales
	Unrestricted orders and free return policy	Flexibility limited over time, capacity reservation

Demand Signalling

- The availability of electronic “channels” between supply chain partners opens up many data and information sharing possibilities
- Clearly, piggybacking sell-through and other data in e-procurement transactions is an attractive idea
- On the other hand, achieving the necessary data richness and quality is not altogether easy, for example:
  - “*If retailers and suppliers don’t clean up their data, investing millions in RFID will be a complete waste of time, experts have warned. Speaking at a conference in London, Deloitte head of European consumer business Lawrence Hutter said RFID had to be underpinned by good quality, consistent data.*” – from a MSI news article, Oct 8 2004.
- In CSIRO’s experience, many businesses have a lot of data but a limited ability to extract information from it.

Information Paths

- In a supply chain context, the ideal is seamless electronic links between demand and supply, resulting in reliable demand signal transmission through the firm.
- Competitive advantage comes from achieving supply chain efficiency and adaptability through smarter information use.
- Electronic methods for the buy-sell transaction yield cost savings, but smarter information use in procurement means tying internal processes (e.g. production and logistics) to procurement processes.
- In many organisations the dynamic state of the system is often inadequately represented in electronic form.
- This leads to a disconnection between procurement and internal operations: the electronic information path is broken.
- This is a particularly pressing concern when a firm must grapple with complex resource scheduling considerations.

VMI and the Bullwhip Effect

- Disney & Towill 2003, reporting on the use of simulation experiments: "*We have compared the bullwhip performance of a number of VMI supply chains with two-level supply chains. In all cases there is substantial reduction in bullwhip (typically halving the effect).*"
- This conclusion is in line with the analysis of Lee et al (1997). As noted by Disney & Towill, it is intuitively obvious that better sight and hence understanding of both information flow and material flow should lead to better business performance.
- VMI is best achieved using e-procurement foundations.
- Where VMI makes good sense as a business strategy (e.g. where demand amplification or rogue seasonality is a appreciable problem), the case for adopting e-procurement processes is strengthened.

Dynamic Pricing

- Muylle & Basub (2004), discussing retail websites "…*the strongly hyped dynamic pricing opportunity of the Internet has not materialized. Indeed, the extent of support for valuation customization is barely 5%.*"
- Pricing signals should be part of the procurement process in a collaborative supply network context: price is a well-understood and unambiguous measure to use within electronic negotiations.
- Airlines and hotels are masters of dynamic pricing.
- These leaders have good knowledge about the dynamic state of their assets and the market: in many other industries, this is not the case.

Adaptive Supply Networks

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Adaptive Supply Networks (ASN)

- CSIRO Partnership Research into “a move from linear value (supply) chains to *adaptive networks*”.
  - Partnering with industry to develop advanced decision support technologies for tomorrow’s supply chains.
  - Achieving decision harmony in supply networks.
  - Managing resources, goods, services and information with speed and flexibility.
- Adaptive supply networks: partners collaboratively adapt to the challenges in their shared environment
- CSIRO’s contribution: technologies for decision harmony where there is appreciable diversity in stakeholder capabilities and goals
- High-impact R&D targets: where the supply network must address a particularly complex activity coordination requirement

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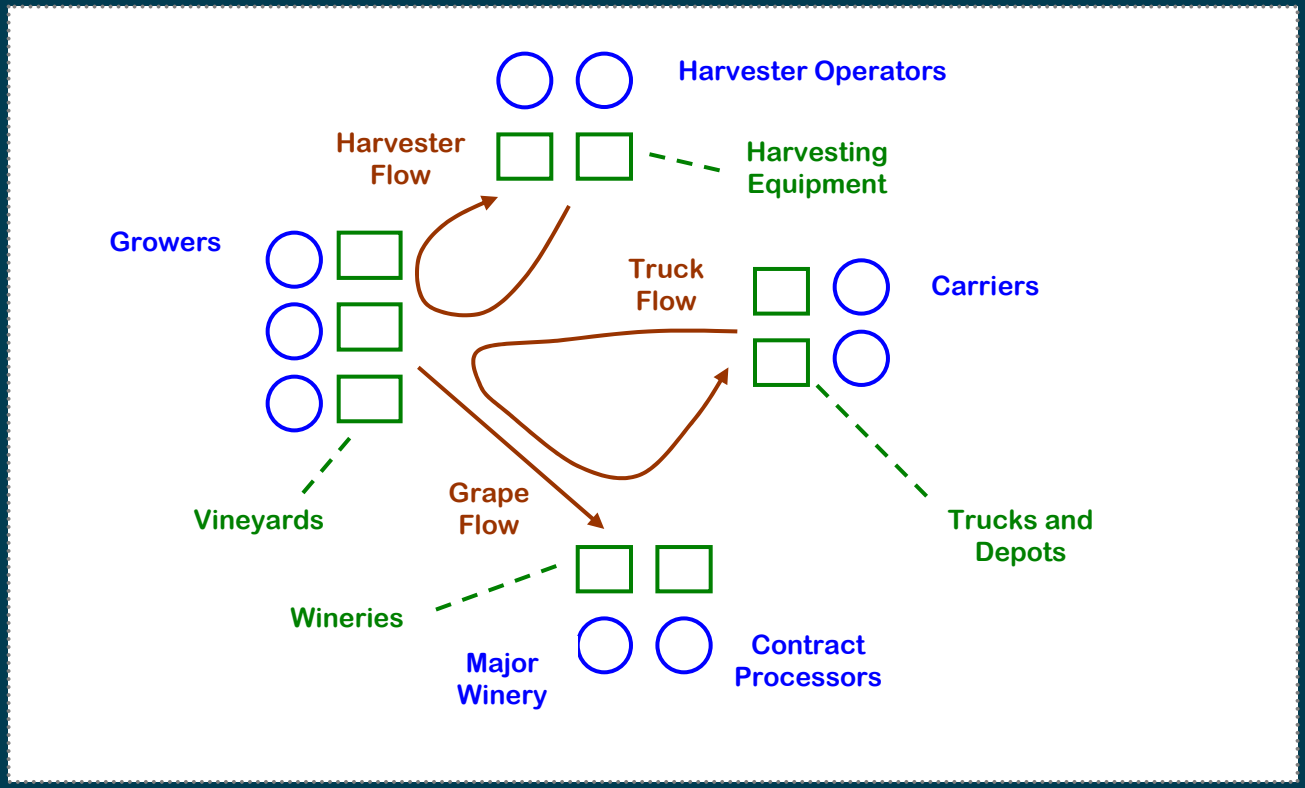
Negotiation in e-Procurement

- CSIRO's researchers are working on an emerging area of operations research known as *negotiated scheduling*
- The idea is that partners in a supply network dynamically integrate operational procurement (placing orders) with production and logistics scheduling
- The partners arrive at mutually acceptable interaction schedules by simultaneously undertaking order placement and acceptance within a negotiation framework that also supports the formation of detailed operational schedules
- We will be deploying a prototype system in the Orlando Wyndham Group (OWG) winery intake supply network by early 2005

Winery Intake Supply Network

- A complex network of stakeholders.
- Procurement is a two-part process: contracting and scheduling



Negotiated Scheduling for OWG

- Core issue: dynamically coordinate the activities of participants.
- Numerous logistical and contractual complexities.
- Urgency due to rapid grape deterioration after harvest.
- Grower payment is based on quality, and equalisation/ compensation mechanisms are used during procurement.
- Drivers:
  - Extend winemaking focus/visibility throughout supply network.
  - Increase perishable-asset value realisation.
- Major deliverable:
  - Agent-based system for grape-intake planning and scheduling that achieves decision harmony for the stakeholders.
- “Internal” system in 2005, true B2B in later years.

Other Relevant CSIRO Initiatives

- *eMARA*: Modelling and computation engine for multi-attribute reverse auctions
- *Collaborative Logistics*: bringing financial and GHG considerations to bear in a study of new methods for load consolidation, assembly and routing when multiple independent parties ship to multiple destinations
- *Distributed electricity demand management*: using pricing signals and activity coordination strategies to moderate electricity demand via consumer and retailer software agents
- *e-sourcing of labour services*: working with a major labour hire company to build new on-line systems for matching supply and demand, then working towards dynamic pricing and B2B negotiated scheduling

Conclusions

- Procurement, sourcing and supply chain management are inextricably linked
- Electronic methods of procurement can be cost-effective and reliable, but the literature shows that there are many practical challenges to overcome during implementation
- Procurement processes are a major channel for demand signals and therefore should allow for rich and insightful information exchange
- In the future, supply networks will develop strong competitive advantages in efficiency and adaptability by integrating procurement and activity coordination processes

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