International Review of Business Research Papers
Vol. 4 No.2 March 2008 Pp.1-12

Information Sharing in Supply Chains: A Survey of Australian Manufacturing

Imam Baihaqi*, Nicholas Beaumont** and Amrik Sohal***

Information sharing has been cited as one of major means of improving supply chain performance. It allows companies to better coordinate their activities with their supply chain partners and generate improved performance. This paper reports results from a survey of information sharing practices in Australian manufacturing companies. The results indicate that the level of coordination between members of a supply chain is quite low as firms only share information pertaining to day-to-day operation and each firm still acts independently. The results pose challenges both for practitioners and academics and warrant further investigation.

Field of Research: Supply Chain Management, Operations Management

1. Introduction

In modern highly competitive markets, there has been a reorientation of management practices toward collaboration between trading partners. Strong collaboration between supply-chain partners is an important way of sustaining companies' competitive advantages. Intensified competition is no longer between individual companies, but between supply chains (Cooper, Lambert et al. 1997; Blackwell and Blackwell 1999; Lambert and Cooper 2000). Companies must broaden their area of analysis and decision making to encompass not single business units but whole supply chains (Lee and Whang 2000). Supply chains comprise three important flows: material, information and finance. Managing the coordination and integration of these flows within and across companies is essential to achieving effective supply chain management. Effective supply chain management is a pre-requisite to quality of service and profitability.

The foundation for close coordination and collaboration in supply chains is information sharing amongst supply chain members (Lee, 2000). Information provides linkages amongst members of a supply chain that can be used to

*Imam Baihaqi, Department of Management, Monash University and Department of Industrial Engineering, Sepuluh Nopember Institute of Technology Indonesia. E-mail:ibaihaqi@gmail.com

**Dr. Nicholas Beaumont, Department of Management, Monash University.
E-mail: Nicholas.beaumont@buseco.monash.edu.au

***Prof. Amrik Sohal, Department of Management, Monash University.
Email: amrik.sohal@buseco.monash.edu.au

orchestrate all activities across the supply chain. The visibility of information to all supply chain members can overcome coordination problems (manifest in high inventory costs, poor customer service, and low utilisation of capacity) (Croom et al., 2000; Disney & Towill, 2003). Lee et al. (1997a; 1997b) argue that sharing information amongst partners is one way to mitigate the well-known Bullwhip effect phenomenon. Poor information flows can add 10-20 percent to manufacturing cost (Childerhouse et al., 2003). Indeed, a 5 percent reduction in supply chain costs can yield a 50 percent increase in profits (Taylor, 2003). Therefore, managing information flows and synchronizing with other flows within and across companies in a supply chain are essential in sustaining competitiveness (Lee, 2000).

The advanced development of information technology provides many opportunities for companies to achieve seamless integration with their supply chain partners at relatively low cost (Huang et al., 2003; Siau & Tian, 2004). Many types of technology are now available, for example, Electronic Data Interchange (EDI), the Internet, Wireless Application Protocol (WAP), mobile computing, web service and Extensible Mark-up Language (XML). As those technologies are easily available, the question of whether to share information or not is obsolete; the real question is deciding what information to share, appropriate mechanisms for sharing, and how to better exploit information to stay competitive. Some forward thinking companies have achieved excellent supply chain by sharing information with their partners. Seven-Eleven Japan – the largest convenient store chain in Japan – captures the point-of-sales data from its stores along with shoppers' demographic data to better understand customers buying behaviour. By doing so, Seven-Eleven Japan can closely match supply with changing customers preferences and achieve the highest sales per square foot in the industry (Lee & Whang, 2000). Dell can achieve as little as four days of inventory supply by sharing its sales information with its several tiers of suppliers (Fawcett et al., 2007). Sport Obemeyer – a design ski-wear company – have invested a system that can capture demand information from retailers (Kopczak & Johnson, 2003). This allows the company to increase forecast accuracy and reduce mismatches between supply and demand. Literature on information sharing in supply chains is dominated by the theoretical (analytical and/or simulation) approach and there is comparatively little empirical research (Huang et al., 2003). The objective of this paper is therefore to assess the current practice of information sharing amongst Australian manufacturing companies.

2. Literature Review

The Global Logistics Research Team defines information sharing as "The willingness to exchange key technical, financial, operational and strategic data" (Global Logistics Research Team, 1995 p. 151). The shared information should be in a form that is usable and meaningful to other parties, otherwise the shared information will not make any difference to the supply chain's processes (Handfield & Nichols, 2002; Mason-Jones & Towill, 1997). Seidmann & Sundararajan (1997) identify four level of information sharing based on the impact of shared information on each participating party. Higher levels of information sharing subsume lower levels. The first level of information sharing involves the sharing of only transactional data such as order and

price. There are no joint decisions and each party acts independently to improve its own efficiency. The second level involves the sharing of some operational

information such as inventory levels. An example of this level of information sharing is a Vendor Managed Inventory system in which a supplier is responsible for buyer inventory management. The supplier can gain benefits from better production schedules and lower inventory and the buyer benefits from better product availability hence increasing service level and lowering inventory costs. The next level is sharing strategic information. The shared information has minimal values to the party that owns information but can bring benefits when used by other party. Sharing point-of-sales data is an example of this level of information sharing. By sharing actual sales data, the supplier can increase forecast accuracy and operational efficiency that can be valuable for both parties. The fourth level is sharing both strategic and competitive information. At this level, shared information has minimal value to the party who owns the information but can provide significant strategic and competitive benefits to the other party who receives the information.

The information in a supply chain can be classified in different ways e.g.: strategic or tactical; logistical; or pertaining to consumers (Mentzer 2004). Lee and Whang (2000) discuss various types of shared information and their potential benefits. For example, sharing order status can improve the quality of customer service, reduce payment cycles, and reduce labor cost. Sharing retail sales data can mitigate the bullwhip effect. Sharing inventory level allows companies to lower inventory levels for the whole supply chain hence reducing the total supply chain cost. Information sharing on capacity can avoid the impact of shortage gaming of other parties. Sharing production scheduling allows companies to synchronize their production schedules with downstream and upstream partners, therefore ensuring supply continuity (Lee et al., 1997b; Lee & Whang, 2000). Huang et al (2003) sort information into six categories pertaining to product, process, resource, inventory, order, and planning. Table 1 presents types of information that have been discussed in the literature of information sharing in supply chains.

Table 1 Types of shared information in the literature

Authors	Shared Information
Boone et al. (2002)	demand, forecast
Bourland et al. (1996)	Demand
Cachon and Fisher (2000)	demand, inventory
Cachon and Lariviere (2001)	demand, demand forecasts
Chen (1999)	inventory, order
Chen et al. (2000)	Demand
Croson and Donohoue (2003)	Sales
Huang and Gangopadhyay (2004)	Demand
Karaesman et al (2002)	advance order
Kulp et al (2004)	inventory level, warehouse, consumer info
Lau et al. (2002)	demand, order, inventory
Lee and Whang (1999)	Demand
Lee et al. (2000)	Demand
Mitra and Chatterjee (2004)	Demand
Owen and Levary (2002)	demand, inventory
Ozer (2003)	advance demand
Raghunathan (2003)	Demand
Simchi-Levi and Zho (2003)	Demand
Smaros et al. (2003)	Demand
Waller et al (1999)	inventory level , demand
Wang and Seidmann (1995)	Demand
Xu et al. (2001)	Demand
Yu et al. (2001)	demand, order
Yu et al. (2002)	demand, order

Many studies have analysed the value of sharing information in supply chains. Raghunatahan (2003) studied demand information sharing in a two-level supply chain finding that sharing demand information result in reduction in inventory costs. Lee, So and Tang (2000) found that sharing demand information can reduce inventory and manufacturing costs if the underlying demand processes are auto-correlated over time and demands amongst retailers are independent. In multi-level supply chains, various studies found that increasing the degree of information sharing can reduce total supply chain costs (for example in Småros et al (2003), and Huang & Gangopadhyay (2004)). Most research has analysed only information flowing upstream i.e. suppliers. Lee and Whang (2000) advocate that information from upstream could help downstream members in adjusting their production. Zhang et al (2006) found that sharing shipment information can help downstream members adjust their ordering policy. However it is still unclear what types of information should be shared amongst supply chain members. As a supply chain comprises many tiers, it is still not clear from the literature how far up and down information should be shared (Huang et al., 2003).

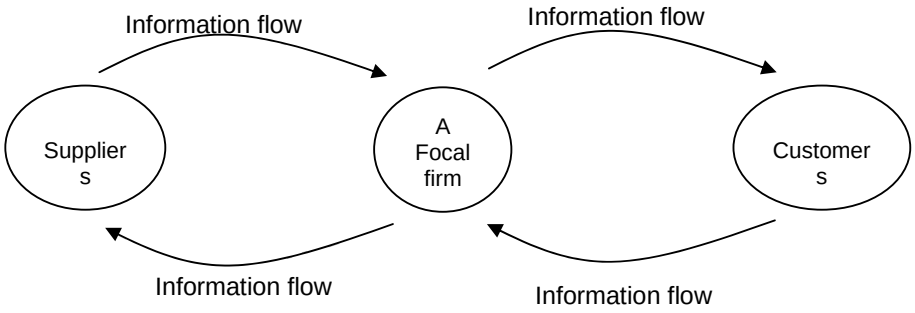
3. Methodology

A mail survey and an online web-based survey were utilized for data collection. The target sample was randomly selected from the list of Australian manufacturing companies in Business Who's Who Australia and from members of the Supply Chain and Logistics Association of Australia. A total of 1000 surveys were mailed out and

125 were returned with 'return-to-sender' message because of the addressee had left the company and in a few case, the company had not been in business. 150 usable responses were received, representing a response rate of 17.14%. The respondent profile is presented in Appendix 1. A survey instrument was designed to examine how companies share information with their trading partners. A set of questions regarding different type of shared information were derived from the previous literatures (Huang et al., 2003; Lee & Whang, 2000; Moberg et al., 2002; Simatupang & Sridharan, 2005). A draft of questionnaire was examined by academics and pre-tested by industry practitioners.

After incorporating suggested amendments, the final questions asked respondents the extent to which the following types of information were shared with business partners: forecasts of demands, inventory levels, production schedules, forthcoming promotions, costs information, customer information, supplier information, quality information, market analysis of new products, and new product specification. Following Barut et al. (2002), a company receives information from and provides information to both its suppliers and its customers (see Figure 1), therefore the respondents were asked to answer the extent to which those kinds of information were received from and provided to both customers and suppliers using five point Likert scale anchored by "1 - not at all" and "5 - very large extent".

Figure 1. The flows of information



4. Result

4.1. Information Sharing with Suppliers

Table 2 summarise the degree of information sharing that respondents provided to their suppliers. As shown in the table, the surveyed firms reported noticeably low scores on most information types. The highest scores were reported on information pertaining to forecast of demands, quality information, and new product specification.

Table 2 Level of information provided to suppliers

Item	Mean*	Std. Deviation
Forecasts of demands	3.59	.941
Inventory levels	2.86	1.137
Production schedules	2.89	1.237
Forthcoming promotions	2.42	1.296
Customer information	2.30	1.063
Quality information	3.65	.999
Market analysis of new products	2.45	1.037
New product specification	3.08	1.187

*) 5-point Likert Scale: 1=not at all, 2 = small extent, 3= some extent, 4 = large extent, 5= very large extent

Sharing information on new product specification and quality information to suppliers has become a common practice in manufacturing companies. These two types of information help to ensure that suppliers deliver parts or products of the right quality and specification requirements. The survey also indicates that surveyed firms place greater emphasis on forecasts of demands to synchronize their supply chain operations with their suppliers. Unless there is joint forecasting, relying on forecast demands from downstream can increase the possibility of independent multiple forecasts throughout a supply chain (Lee & Whang, 2000). The profile that emerges from the survey portrays the very early stage of partnership development between supplier and buyer. Firms may be reluctant to share some kinds of information because they still treat them as proprietary or because they may not see potential benefits by doing so. In regard with information that firms receive from suppliers, the surveyed companies received a considerable amount of information pertaining to order status, delivery schedules, supply disruptions, quality information, and new product specification (see Table 3). Information regarding production capacity and schedules were shared at slightly below average. Similar scores were reported for information regarding cost and market analysis of new products. Other types of information were shared at much lower level.

Table 3 Level of information received from suppliers

Item	Mean*	Std. Deviation
Order status	3.18	1.047
Inventory levels	2.45	1.063
Production capacity	2.78	1.070
Supply disruptions	3.33	.949
Production schedules	2.67	1.134
Forthcoming promotions	2.33	1.127
Delivery schedules	3.40	1.042
Costs information	2.81	1.230
Quality information	3.44	1.009
Market analysis of new products	2.81	1.177
New product specification	3.25	1.172

*) 5-point Likert Scale: 1=not at all, 2 = small extent, 3= some extent, 4 = large extent, 5= very large extent

The results indicate that the surveyed firms receive a considerably amount of information on order tracking (i.e. order status, delivery schedules and supply disruptions). For manufacturing companies, order tracking information can help companies to ensure production continuity. Similar to the information flow toward the suppliers, the surveyed firms put large emphasis on day-to-day operations for the relationship with the suppliers. Information on operations and supply chain planning such as inventory and capacity is still treated as proprietary information by firms' suppliers. This result is consistent with that previous section in which relationship of surveyed firms with their supplier is still in early stage of information sharing. At this stage firms only share transactional information and only small amount of operational information, focusing only on logistics process improvements, which can be achieved by each firm acting independently (Samaddar et al., 2006; Seidmann & Sundararajan, 1997).

4.2. Information sharing with customers

Table 4 presents the mean scores and standard deviations on the extent to which each type of information is provided to customers. As shown in the table, information pertaining to the flow of products such as delivery schedules, supply disruptions, and order status have above average score, while information on production schedule and production capacity have slightly lower scores.

Table 4 Level of information provided to customers

Item	Mean*	Std. Deviation
Order status	3.59	1.132
Inventory levels	2.81	1.264
Production capacity	2.87	1.252
Supply disruptions	3.48	1.046
Production schedules	2.82	1.265
Forthcoming promotions	3.05	1.389
Delivery schedules	3.67	1.107
Costs information	2.39	1.267
Quality information	3.85	.975
Market analysis of new products	3.07	1.207
New product specification	3.64	1.156

*) 5-point Likert Scale: 1=not at all, 2 = small extent, 3= some extent, 4 = large extent, 5= very large extent

In regard to relationship with customers, the findings suggest a profile of information sharing similar to that information sharing with suppliers. Surveyed firms tend to maintain their customer satisfaction by providing customers with information pertaining to order tracking (i.e. order status, supply disruptions, and delivery schedules). It appears that respondent firms are still reluctant to provide their customers with information regarding operational planning such as inventory, capacity and production schedules. Table 5 presents the mean score and standard deviation on the extent the amount of information that surveyed firms received from their customers. Similar to information sharing with suppliers, data shows that the surveyed firms largely depend on information on forecast of demands to coordinate

their operation. As described previously, relying on forecast information from downstream could lead to multiple independent forecasts that could severely effect overall supply chain performance.

Table 5 Level of information received from customers

Item	Mean*	Std. Deviation
Forecasts of demands	3.19	1.076
Inventory levels	2.58	1.137
Production schedules	2.48	1.257
Forthcoming promotions	2.66	1.202
Customer information	2.74	1.166
Quality information	3.19	1.115
Market analysis of new products	2.69	1.047
New product specification	2.80	1.24

*) 5-point Likert Scale: 1=not at all, 2 = small extent, 3= some extent, 4 = large extent, 5= very large extent

The profile that emerges in regard with information sharing with customers is that the surveyed firms are still in the early stage of information sharing.

5. Discussion and Conclusion

This paper presents results of a survey examining information sharing practices in supply chains in the Australian manufacturing industry. We found that the most information that are commonly shared with upstream and downstream partners are forecasts of demand, order status, supply disruption and delivery schedule. Despite the benefits of information sharing reported in the literature, the finding shows that firms did not intensively share some operational and planning information. Information on forecast of demands was shared at a considerably high level. Sharing demand forecast information needs to be complemented with other types of information as there is risk in which downstream partners overstate their demand to induce suppliers to carry more inventories (Lee & Whang, 2000). Quite high level of information sharing on order tracking data reveals that joint decision and planning between firms was not well applied in the firms practice. Firms seem to act independently to achieve their own operational efficiency and neglecting the system wide view of a supply chain. Information pertaining to operational planning such as inventory levels, capacity and production scheduling is still treated as proprietary and firms are reluctant to share it. Recurrent themes in the literature are that the potential benefits of sharing these types of information are enormous. However, firms seem to be reluctant to share these types of information; they may feel that doing so could place them at a great risk. Potential benefits from sharing these kinds of information may be sacrificed because of this behaviour.

Supply chain management emphasises the potential advantages of establishing linkages that can orchestrates suppliers and customers in the entire supply chain. Firms need to develop capabilities that can leverage and exploit their partners' superior capabilities so as to increase the competitive advantage of all members of the supply chain. This requires sharing information that might previously have been considered proprietary information. Information sharing not only can help companies

to improve their supply chain efficiency and effectiveness but also can also increase their supply chain's agility and responsiveness to changing markets thereby sustaining their competitive position (Lee, 2004). As the potential benefits of information sharing is highly valuable in achieving supply chain efficiency as well as high operational performance for companies, the results from this survey pose several challenges for both academics and practitioners that warrant further investigation, including: (1) How can benefits of information sharing be better understood by practitioners?, and (2) What are the barriers and key success factors of information sharing practice? We hope that our further study will illuminate these questions.

References

Barut, M., Faisst, W., & Kanet, J. J. 2002. Measuring supply chain coupling: an information system perspective. *European Journal of Purchasing & Supply Management,* Vol. 8, pp. 161-171.

Childerhouse, P., Hermiz, R., Mason-Jones, R., Popp, A., & Denis, R. T. 2003. Information flow in automotive supply chain - present industrial practice. *Industrial Management & Data Systems,* Vol. 103 No. 3, pp. 137-149.

Croom, S. R., Romano, P., & Giannakis, M. 2000. Supply chain management: an analytical framework for critical literature review. *European Journal of Purchasing & Supply Management,* Vol. 6, pp. 67-83.

Disney, S. M., & Towill, D. R. 2003. The effect of vendor managed inventory (VMI) dynamics on the Bullwhip Effect in supply chains. *International Journal of Production Economics,* Vol. 85, pp. 199-215.

Fawcett, S. E., Osterhaus, P., Magnan, G. M., Brau, J. C., & McCarter, M. W. 2007. Information sharing and supply chain performance: the role of connectivity and willingness. *Supply Chain Management: An International Journal,* Vol. 12 No. 5, pp. 358–368.

Global Logistics Research Team. 1995. *World class logistics : the challenge of managing continuous change*. Oak Brook, IL: Council of Logistics Management.

Handfield, R. B., & Nichols, E. L., Jr. 2002. *Supply Chain Redesign: transforming supply chains into integrated value systems*. Upper Sadlle River, NJ: Financial Times Prentice Hall.

Huang, G. Q., Lau, J. S. K., & Mak, K. L. 2003. The impact of sharing production information on supply chain dynamics: a review of the literature. *International journal of Production Research,* Vol. 41 No. 7, pp. 1483-1517.

Huang, Z., & Gangopadhyay, A. 2004. A Simulation Study of Supply Chain Management to Measure the Impact of Informotion Sharing. *Information Resources Management Journal,* Vol. 17 No. 3, pp. 20-32.

Kopczak, L. R., & Johnson, M. E. 2003. Supply chain management effect. *MIT Sloan Management Review,* Vol. 44 No. 3, pp. 27-34.

Lee, H. L. 2000. Creating value through supply chain integration. *Supply Chain Management Review,* Vol. 4 No. 4, pp. 30-36.

Lee, H. L. 2004. The triple-A supply chain. *Harvard Business Review,* October 2004, pp. 102-112.

Lee, H. L., Padmanabhan, V., & Whang, S. 1997a. The Bullwhip Effect in Supply Chains. *Sloan Management Review,* Spring 1997, pp. 93-102.

Lee, H. L., Padmanabhan, V., & Whang, S. 1997b. Information distortion in a supply chain: The bullwhip effect. *Management Science,* Vol. 43 No. 4, pp. 546-558.

Lee, H. L., So, K. C., & Tang, C. S. 2000. The Value of Information Sharing in a Two-Level Supply Chain. *Management Science,* Vol. 46 No. 5, pp. 626-643.

Lee, H. L., & Whang, S. 2000. Information sharing in a supply chain. *International Journal of Technology Management,* Vol. 20 No. 3/4, pp. 373-387.

Mason-Jones, R., & Towill, D. R. 1997. Information enrichment: designing the supply chain for competitive advantage. *Supply Chain Management,* Vol. 2 No. 4, pp. 137-148.

Moberg, C. R., Cutler, B. D., Gross, A., & Speh, T. W. 2002. Identifying antecendents of information exchange within supply chains. *International Journal of Physical Distribution & Logistics,* Vol. 32 No. 9, pp. 755-770.

Raghunatahan, S. 2003. Impact of demand correlation on the value of and incentives for information sharing in a supply chain. *European Journal of Operational Research,* Vol. 146 No. 3, pp. 634-649.

Samaddar, S., Nargundkar, S., & Daley, M. 2006. Inter-organizational information sharing: The role of supply network configuration and partner goal congruence. *European Journal of Operational Research,* Vol. 174 No 2, pp. 744-765.

Seidmann, A., & Sundararajan, A. 1997. *Building and sustaining interorganizational information sharing relationships: the competitive impact of interfacing supply chain operations with marketing strategy.* Paper presented at the Proceedings of the eighteenth international conference on Information systems, Atlanta, Georgia, United States.

Siau, K., & Tian, Y. 2004. Supply chain integration: architecture and enabling technologies. *Journal of Computer Information Systems,* Vol. 44 No. 3, pp. 67-72.

Simatupang, T. M., & Sridharan, R. 2005. The collaboration index: a measure for supply chain collaboration. *International Journal of Physical Distribution & Logistics Management, 35*(1), 44-62.

Småros, J., Lehtonen, J.-M., Appelqvist, P., & Homström, J. 2003. The impact of increasing demand visibitily on production and inventory control efficiency. *International Journal of Physical Distribution & Logistics Management,* Vol. 33 No. 4, pp. 336-354.

Taylor, D. A. 2003. *Supply Chains: A Manager's Guide*: Addison Wesley.

Zhang, C., Tan, G.-W., Robb, D. J., & Zheng, X. 2006. Sharing shipment quantity information in the supply chain. *Omega,* Vol. 34 No. 5, pp. 427-438.

Appendix 1 Profile of Respondents

Variables	Frequency	Percent
Position of respondents		
CEO/President/Vice President	31	20.7
Director	27	18.0
Manager	82	54.7
Other	10	6.7
Total	150	100.0
Industry Sector		
Food, Beverage, Tobacco Manufacturing	28	18.7
Textile, clothing, footwear, leather manufacturing	5	3.3
Wood and paper product manufacturing	5	3.3
Printing, publishing and recording media	9	6.0
Petroleum, coal, chemical and associated product manufacturing	25	16.7
Non-metallic mineral product manufacturing	10	6.7
Metal product manufacturing	21	14.0
Machinery and equipment manufacturing	25	16.7
Other	22	14.7
Total	150	100.0
Annual Sales (in AU$)		
< 20 millions	28	18.7
20 – 99 millions	33	22.0
100 – 299 millions	35	23.3
300 – 499 millions	15	10.0
500 million – 1 billions	17	11.3
> 1 billion	19	12.7
Missing	3	2.0
Total	150	100.0