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Information Sharing in Supply Chain Management

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Abstract

Information sharing serves as an essential approach for the survival of enterprises and enabler of supply chain integration. Nowadays, with the advancement in information and communication technology, information sharing has become more conceivable. Furthermore, information sharing in supply chains has become more efficient by the global introduction of long-term cooperation and coordination which leads ultimately to the improvement of companies' competitive advantages. There is a lack of information sharing within companies nowadays, which results in inefficiency of coordinating actions within the units in the company or organization. The purpose of this study is to investigate and overview the effectiveness of information sharing in supply chain management, in order to increase the efficiency of the organizational performance in the manufacturing sector. This study elaborates the benefits and barriers of information sharing leading to enhanced supply chain integration among enterprises, as a result.

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Keywords: Information Sharing; Supply Chain Management (SCM); Supply Chain Integration (SCI); Manufacturing sector

1. Introduction

In order to survive and compete in today's global economy, manufacturing sector strongly needs to create, share and disseminate up-to-date and appropriate knowledge and information [1]. For competitive advantages, many

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companies have now focused more on their supply chains and hence have thought of ways to improve their supply chain management [2]. A supply chain is stays connected by flows of information, finance and material by the suppliers, producers, retailers, distributors and customers. [3].

Researchers have stated the need for an intimate, relationship between supply chain partners and manufacturers for a long time. However, a systematic approach to SCI has only recently been made. With the increase in global competition, organizations are forced to rethink their approach to information integration [4]. In a firm, supply chain integration can applied between different internal functions and departments, and also external trading supply chain partners as well. Zhao et al.[5] argue that external integration with customers and suppliers is concurrently subjective by internal integration and relationship commitment to customers and suppliers. They represented that internal integration enables external integration because firms first via system, data, and process integration have to develop capability of internal integration then appoint in significant external integration. Information sharing can be applied for internal and external integration among supply chains.

The true value of sharing information within a supply chain can be defined by the fact that benefits achieved outweigh the costs involved. These costs may include information systems investment and charges by customers or suppliers for providing the information. The coordination costs may include communication and administration costs. These costs can be dramatically reduced with recent developments in information technologies, such as Enterprise Resource Planning (ERP) and Web technologies [6].

Information sharing in a supply chain may bring a number of benefits to enterprises. For example, the products match the consumer's demand more closely and changes in the marketplace may be anticipated. The broad use of advanced information technologies in supply chains, such as Electronic Data Interchange (EDI) and Web technologies demonstrate that organizations have come to substantiate the importance of integrating information. Actually, many supply-chain related issues arise due to lack of sharing information within the members in a supply chain. [6]. This study attempts to make an overview of supply chain management, information sharing, types of shared information and, benefits and barriers of shared information in a supply chain.

2. Supply chain management

There has been a growing interest in Supply Chain Management (SCM) since 1990s [7]. Many unique definitions of SCM have since been published in articles and books; however, these can be explained in three main themes. First of all Activities,, then Benefits; and finally Constituents and/or Components. Each theme may be further divided into sub-themes. Activities include Flows (i.e. Material and Information) and internal and external Networks of Relationships. While benefits may be increasing in value, efficiency and customers' satisfaction [8].

Stadtler [9] defines Supply Chain Management (SCM) as, the act of sharing material, information and financial information within organizational units, so as to meet customer' needs and as a result, enhance the entire supply chain involved.

A supply chain can be described as a series of organizations that may be involved in different processes and activities to produce products and services for ultimate customers, both upstream and downstream. A supply chain, therefore, is made up of a number of companies including suppliers, distributions and the end-customers.

There are certain objectives to achieve in a supply chain management. Improving customer satisfaction and service and increasing competitiveness are a number of these objectives [10-14]. A supply chain management also aims to lower the costs and resources involved in the creation of products as well as improve efficiency and effectiveness [15-17]. SCM also focuses on reducing inventory levels and respective costs [18-20], increasing profits [21, 22] and improving cooperation [4, 23].

3. Information sharing

Manufacturing sector plans an essential role to enhance economic development. To survive in today's global economy, manufacturers need to definitely rethink their approach to cooperation and hence should provide ways to

share up-to-date information within the enterprises [1]. However, providing the software and hardware alone is not sufficient. The members should have the willingness to participate in information sharing activities [24]. Nowadays, enterprises do not operate alone; they have now been networked to many other partners [25].

Information sharing means distributing useful information for systems, people or organizational units. To enhance the results of information sharing, organizations should answer four main questions: First we ask what to share, then whom to share it with, then how to share, and finally when to share. The quality of answers will help to avoid redundancy, reduce sharing costs and improve responses [26]. The term 'Information Sharing' can also be referred to as 'Knowledge Sharing' or 'Information Integration'. There exists a myriad of information in a supply chain, such as, logistic, business, strategic, tactical and many more.

The impact of information sharing on supply chains has become more significant with recent advances in Information Technology (IT). Furthermore, some investigations have been conducted to focus on the impact of information sharing on product quality. However, there is still room for further studies to clarify exactly how and what information should be shared and the beneficial effects on quality improvement [27].

Coordination and integration in supply chain management (SCM) have long been the concerns of the academic community as well as the business world. To survive in today's economy, supply chain partners need to improve their competitive advantages by information sharing [28].

With advances in information technology, different network structures can be modeled to make the coordination within supply chain partners even closer. This partnership and coordination lead to a more beneficial and profitable supply chain. Information flows will increase, the uncertainty may be reduced and the ultimate customers will receive higher quality products with lesser costs in a shorter period of time [3].

In the framework represented by Pandey et al. [16] the types of Information to be shared are Purchases and Sales, Inventory status, Product development, Sales and forecasting, Market development, Future plan, Production cost, Technology know-how and Order tracking.

Polanyi and Sen [29] classified knowledge into two classifications: explicit and tacit. Explicit knowledge is, as the name suggests, affable knowledge. It can be put into numbers, words, charts and formulas. Tacit knowledge is ineffable knowledge. It is knowledge based on experience and hence can be really subjective and indescribable [29]. As it may be implied, explicit knowledge more palpable and easier to share and express [30]. However, researchers believe that sharing tacit knowledge is also included in information sharing as well as explicit information is [31-34].

Min et al. [35] represent information sharing as the heart of supply chain collaboration . This means that more attention needs to be given to information sharing. A bond made between two independent members in supply channels is called a supply chain partnership. It is formed by increasing the levels of information sharing in order to lower the total costs and inventories. [36].

3.1. Types of shared information in supply chain

There are many different types of information that can be shared within a supply chain, including logistics, business, strategic, tactical and so on. Some familiar types of Information may be categorized as: 1) Inventory Information; 2) Sales Data; 3) Sales Forecasting; 4) Order Information; 5) Product Ability Information; 6) Exploitation Information of New Products; and 7) Other Information. Partners like to share Inventory Information the most. Sharing this avoids going out of stock and stock repetition. It also reduces the total stock level and stock cost allowing more accurate forecasts and decisions to be made. Sales data sharing can eliminate order blow-ups, represent true customer demand, and decrease the loss caused by shortage or excess of innovative products. Members in a supply chain make forecasts independently. By sharing sales forecasts better predictions are made which may enhance the competitive advantages of the supply chain. Sharing order information would lead to a quick determination of the bottleneck in a supply chain, enhancing the quality of customer services. The flow of product ability information may assist the deceleration of the possible shortage gaming behavior and avoid potential causes of the bullwhip effect. Information about new products can be shared to allow receiving a timely supply of goods from suppliers when the manufacturers obtain the real demand from retailers. There also exist other types of

information such as, , quality information, status messages on freightage technique progress information, function parameters of supply chain, plan, etc. [28].

3.2. Benefits of information sharing

Many researches have been conducted to determine the advantages of information sharing in firms and organizational units. This Study investigates some of these benefits. The sources of these benefits are summarized in Table1.

Table 1: Benefits of information sharing

No.	Benefits	Sources
1.	*Inventory reduction and efficient inventory management*	*[25, 37-39]*
2.	*Cost reduction*	*[25, 37, 39, 40]*
3.	*Increasing visibility (significant reduction of uncertainties)*	*[3, 6, 36, 39, 40]*
4.	*Significant reduction or complete elimination of bullwhip effect*	*[36, 39, 41, 42]*
5.	*Improved resource utilization*	*[25, 39]*
6.	*Increased productivity, Organizational efficiency and improved services*	*[25, 33, 39, 40]*
7.	*Building and strengthening social bonds*	*[39, 40, 43]*
8.	*Early problem detection*	*[39, 42, 44]*
9.	*Quick response*	*[39, 42]*
10.	*Reduced cycle time from order to delivery*	*[40]*
11.	*Better tracing and tracking*	*[40]*
12.	*Earlier time to market*	*[39]*
13.	*Expanded network*	*[39]*
14.	*Optimized capacity utilization*	*[39]*

Sharing Information among supply chain members may bring a number of benefits to industries. Among these benefits, Lee et al. [37] demonstrates the potential advantages of information sharing for the manufacturers in two ways, either expected cost reduction or inventory reduction. According to Zhao et al.[45], if information sharing is used efficiently, the manufacturers are able to reduce the inventory costs by 5 to 35 presents when the service level may be maintained or increased to the retailers.

When additional information becomes available within a supply chain, partners may benefit from this improved visibility to alter existing plans or formulate future operations. For instance, sharing demand information enables each of the supply chain members to make accurate predictions based on real demand [3, 6, 36, 39, 40, 46].

In a supply chain, members may attain perfect information about themselves, but might not have such perfect information about the other members. Uncertainties may arise as a result of this lack of information about other members. If the members have the ability and willingness to share information with other members, uncertainties can be significantly reduced. The bullwhip effect may be caused by the lack of information symmetry in decentralized systems. The flow of information within supply chain members leading to a centralized system with much less uncertainties may significantly reduce or even eliminate the negative impact of the bullwhip effect [3, 36, 39, 41, 42].

Mourtzis [25] determined the advantages of the manufacturing network for SMEs in four important items: 1) Efficient inventory management through improved communication, 2) Cost reduction in orders management through efficient communication, 3) Increased productivity and profit through more efficient completion of orders , and, 4) Improved resource utilization through better management of the work allocation.

By information sharing between distinct parties within the logistics network, or supply chain management business partnerships can be created. Information sharing within a supply chain causes a great improvement in the business connections, for example cross-docking and quick response (QR), vendor managed inventory (VMI) [25, 36-39, 42].

According to Marshall and Bly [43], the shared information builds and strengthens relationships and social ties among the information receivers and givers. Organizational efficiency and performance are a couple of other advantages of information sharing. [33].

3.3. Barriers to information sharing

Sharing Information within a supply chain may encounter certain challenges. Among these barriers are confidentiality of the information shared, incentive issues, reliability and cost of information technology, anti-trust regulations, the timeless and accuracy of the shared information, and finally the development of capabilities that allow companies to utilize the shared information in an effective way [45, 47-49].

One of the main barriers of interpersonal information sharing may be concerns about information privacy. A trusted network should be created for individuals to share information [50]. Organization members may lack trust in each other which may impede information sharing [51, 52].

Learning to use IT systems for individuals in a supply chain is proven to take both time and energy. [53]. Making use of user-friendly IT applications may improve information sharing [54]. An inefficient and non-user-friendly system would have a negative impact on information sharing causing less information and knowledge to be shared [33].

4. Conclusion

In this study the significance of information integration in a supply chain has been elaborated. Information sharing may bring a significant amount of advantages to manufacturing sector such as inventory reduction and efficient inventory management, cost reduction, increasing visibility (significant reduction of uncertainties), significant reduction or complete elimination of bullwhip effect, improved resource utilization , increased productivity, organizational efficiency, improved services, building and strengthening social bonds, early problem detection, quick response , reduced cycle time from order to delivery, better tracing and tracking, earlier time to market, expanded network, and optimized capacity utilization. On the other hand, there are some barriers to sharing information as well. As discussed, manufacturing sector are required to make the best use of advanced information technologies to share information within their supply chains in order to increase their competitive advantages and hence survive in today's global economy.

References

[1] Nunes M.B., Annansingh F., Eaglestone B., Wakefield R., Knowledge management issues in knowledge-intensive SMEs, Journal of Documentation, 2006; 62: 101-119.
[2] Lotfi Z., Sahran S., Mukhtar M., A Product Quality - Supply Chain Integration Framework Jounal of Applied Sciences, 2013; 13: 36-48.
[3] Fiala P., Information sharing in supply chains, Omega, 2005; 33: 419-423.
[4] Flynn B.B., Huo B., Zhao X., The impact of supply chain integration on performance: A contingency and configuration approach, Journal of Operations Management, 2010; 28: 58-71.
[5] Zhao X., Huo B., Selen W., Yeung J.H.Y., The impact of internal integration and relationship commitment on external integration, Journal of Operations Management, 2011; 29: 17-32.
[6] Li J., Shaw M.J., Sikora R.T., Tan G.W., Yang R., The effects of information sharing strategies on supply chain performance, College of Commerce and Business Administration, University of Illinois at Urbana-Champaign, URL: http://citebm. cba. uiuc. edu/B2Bresearch/ieee_em. pdf (30.9. 2002), 2001; 34:
[7] Larson P.D., Rogers D.S., Supply chain management: definition, growth and approaches, Journal of Marketing Theory and Practice, 1998; 6: 1-5.
[8] Stock J., Boyer S., Harmon T., Research opportunities in supply chain management, Journal of the Academy of Marketing Science, 2010; 38: 32-41.
[9] Stadtler H., Supply chain management and advanced planning: concepts, models, software, and case studies, Springer Verlag, 2008.

[10] Cooper M.C., Lambert D.M., Pagh J.D., Supply chain management: more than a new name for logistics, International Journal of Logistics Management, The, 1997; 8: 1-14.
[11] Günday G., Ulusoy G., Kılıç K., Alpkan L., Effects of innovation types on firm performance, International Journal of Production Economics, 2011; 133: 662-676.
[12] Tian Y., Automotive Supply Chain Evaluation with Conventional Model and Integrated Model, in, University of Duisburg-Essen, 2011.
[13] Anuar A., Yusuff R.M., Manufacturing best practices in Malaysian small and medium enterprises (SMEs), Benchmarking: An International Journal, 2011; 18: 324-341.
[14] Mosavi S.A., Ghaedi M., A survey on the relationships between customer satisfaction, image, trust and customer advocacy behavior, African Journal of Business Management, 2012; 6: 2897-2910.
[15] Giunipero L.C., Brand R.R., Purchasing's role in supply chain management, International Journal of Logistics Management, The, 1996; 7: 29-38.
[16] Pandey V., Garg S., Shankar R., Impact of information sharing on competitive strength of Indian manufacturing enterprises: An empirical study, Business Process Management Journal, 2010; 16: 226-243.
[17] Weber M., Hiete M., Lauer L., Rentz O., Low cost country sourcing and its effects on the total cost of ownership structure for a medical devices manufacturer, Journal of Purchasing and Supply Management, 2010; 16: 4-16.
[18] Cooper M.C., Ellram L.M., Characteristics of supply chain management and the implications for purchasing and logistics strategy, International Journal of Logistics Management, The, 1993; 4: 13-24.
[19] Kristianto Y., Gunasekaran A., Helo P., Sandhu M., A decision support system for integrating manufacturing and product design into the reconfiguration of the supply chain networks, Decision Support Systems, 2011;
[20] Ding H., Guo B., Liu Z., Information sharing and profit allotment based on supply chain cooperation, International Journal of Production Economics, 2011; 133: 70-79.
[21] Droge C., Jayaram J., Vickery S.K., The effects of internal versus external integration practices on time-based performance and overall firm performance, Journal of Operations Management, 2004; 22: 557-573.
[22] Christopher M., Jüttner U., Developing strategic partnerships in the supply chain: a practitioner perspective, European Journal of Purchasing & Supply Management, 2000; 6: 117-127.
[23] Droge C., Vickery S.K., Jacobs M.A., Does supply chain integration mediate the relationships between product/process strategy and service performance? An empirical study, International Journal of Production Economics, 2012;
[24] Rosen B., Furst S., Blackburn R., Overcoming barriers to knowledge sharing in virtual teams, Organizational Dynamics, 2007; 36: 259-273.
[25] Mourtzis D., Internet based collaboration in the manufacturing supply chain, CIRP Journal of Manufacturing Science and Technology, 2011;
[26] Sun S., Yen J., Information supply chain: A unified framework for information-sharing, Intelligence and Security Informatics, 2005; 422-428.
[27] Tsung F., Impact of information sharing on statistical quality control, Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on, 2000; 30: 211-216.
[28] Zha X., Ding N., Study on information sharing in supply chain, in, ACM, 2005, p. 787-789.
[29] Polanyi M., Sen A., The tacit dimension, Peter Smith Gloucester, MA, 1983.
[30] Cress U., Kimmerle J., Hesse F.W., Information Exchange With Shared Databases as a Social Dilemma The Effect of Metaknowledge, Bonus Systems, and Costs, Communication Research, 2006; 33: 370-390.
[31] Klischewski R., Scholl H.J., Information quality as capstone in negotiating e-government integration, interoperation and information sharing, Electronic Government, an International Journal, 2008; 5: 203-225.
[32] Scholl J., Knowledge management and the vital organization, Management Strategien 2000, 1999; 133-158.
[33] Yang T.-M., Maxwell T.A., Information-sharing in public organizations: A literature review of interpersonal, intra-organizational and inter-organizational success factors, Government Information Quarterly, 2011; 28: 164-175.
[34] Nonaka I., Takeuchi H., The knowledge-creating company, Harvard Business Review, 2007; 85: 162.
[35] Min S., Roath A.S., Daugherty P.J., Genchev S.E., Chen H., Arndt A.D., Richey R.G., Supply chain collaboration: what's happening?, International Journal of Logistics Management, The, 2005; 16: 237-256.
[36] Yu Z., Yan H., Cheng T.C.E., Benefits of information sharing with supply chain partnerships, Industrial Management & Data Systems, 2001; 101: 114-121.
[37] Lee H.L., So K.C., Tang C.S., The value of information sharing in a two-level supply chain, Management science, 2000; 626-643.
[38] Lau J.S.K., Huang G.Q., Mak K., Web-based simulation portal for investigating impacts of sharing production information on supply chain dynamics from the perspective of inventory allocation, Integrated Manufacturing Systems, 2002; 13: 345-358.
[39] Lee H.L., Whang S., E-business and supply chain integration, The Practice of Supply Chain Management: Where Theory and Application Converge, 2004; 123-138.
[40] Bagchi P.K., Skjøtt-Larsen T., Supply Chain Integration in Nordic Firms, in: 2nd World Conference on POM, Cancun, Mexico, 2004, p. 1-23.
[41] Li Z., Gao Y., Information sharing pattern of agricultural products supply chain based on E-commerce, in: E -Business and E -Government (ICEE), 2011 International Conference on, 2011, p. 1-5.
[42] Jauhari V., Institutional Context for IT Use in the Automotive Industry: A Case Study on the Market Leader in India's Passenger Vehicle Sector, Technological Innovation Across Nations: Applied Studies of Coevolutionary Development, 2009; 65.
[43] Marshall C.C., Bly S., Sharing encountered information: digital libraries get a social life, in: The 4th ACM/IEEE-CS joint conference on Digital Libraries, IEEE, Tuscon, AZ., 2004, p. 218-227.

[44] Grabot B., Marsina S., Mayere A., Riedel R., Williams P., Planning information processing along the supply-chain: a socio-technical view, Behavioral Operations in Planning and Scheduling, 2011; 123-158.
[45] Zhao Y., The Impact of Information Sharing on Supply Chain Performance, in: Industrial Engineering and Management Sciences, Northwestern University, Evanston, Illinois, 2002.
[46] Lee G.L., Oakes I.K., Templates for change with supply chain rationalization, International Journal of Operations & Production Management, 1996; 16: 197-209.
[47] Lee H.L., Whang S., Information sharing in a supply chain, International Journal of Manufacturing Technology and Management, 2000; 1: 79-93.
[48] Khurana M., Mishra P., Singh A., Barriers to information sharing in supply chain of manufacturing industries, Int. J. Manufact. Syst, 2011; 1: 9-29.
[49] Fawcett S.E., Magnan G.M., McCarter M.W., Supply chain alliances and social dilemmas: Bridging the barriers that impede collaboration, International Journal of Procurement Management, 2008; 1: 318-341.
[50] Razavi M.N., Iverson L., A grounded theory of information sharing behavior in a personal learning space, in, ACM, 2006, p. 459-468.
[51] Ardichvili A., Page V., Wentling T., Motivation and barriers to participation in virtual knowledge-sharing communities of practice, Journal of knowledge management, 2003; 7: 64-77.
[52] Cetindamar D., Çatay B., Basmaci O.S., Competition through collaboration: insights from an initiative in the Turkish textile supply chain, Supply Chain Management: an international journal, 2005; 10: 238-240.
[53] Goodman P.S., Darr E.D., Computer-aided systems and communities: Mechanisms for organizational learning in distributed environments, Mis Quarterly, 1998; 417-440.
[54] Kim S., Lee H., The Impact of Organizational Context and Information Technology on Employee Knowledge‐Sharing Capabilities, Public Administration Review, 2006; 66: 370-385.