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INTEGRATION AND COLLABORATION IN SUPPLY CHAIN OPERATIONS

Mrs. J. Nithya, MBA

Assistant Professor in Department of Management Studies,

Dr. Sivanthi Aditanar College of Engineering

Abstract: Integrating and coordinating supply chain operations are considered a prerequisite for achieving high efficiency and competitiveness. An industry is used to illustrate the challenges of supply chain operations, and how control based on real-time information can be applied to improve performance, and reduce inventory and resource consumption in the supply chain. The results also indicate that the intensity of the collaboration, i.e. frequency of information sharing, degree of joint operative planning of involved supply chain activities, and process approach, are positively related to the effects experienced of the Integrating and coordination of supply chain operation. Furthermore, engagement from top management is recognized as an important driver for successful collaboration. The study shows that the traditional way of managing supply chain relations still dominates. The most crucial of the above mentioned solutions to the manufacturing industry for effective supply chain management is the embracement of new technologies, specifically e-manufacturing and instilling a risk management culture with senior management acting as catalysts. In this paper we surveyed and discussed the state-of-the-art studies related to the supply chain integration challenges, we have integrated the supply chain integration challenges research findings. A set of principle for the development of real-time, integrated supply chain operations is developed and described based on the methodology for a successful management.

I. INTRODUCTION

SC management constitutes the series of interdependent upstream, manufacturing and downstream processes targeted at transforming raw materials into products to meet customer demand. In the backdrop of global markets, increased competition and extended SCs manufacturing firms are now confronting new challenges. The need to eliminate waste, embrace new technologies, improve on supplier/ customer relations, better manage inventory, comply with regulation, and be more cost efficient is becoming more apparent in the quest to achieve operational excellence.

II. MANUFACTURING ENTERPRISE COLLABORATION AND INTEGRATION

Sometimes it makes sense to share information, and this, too, is collaboration. As our information systems applications have matured, we have developed large silos of increased amounts of information that, in most cases, provide better resulting data. Unfortunately, we have constructed walls around and between business processes. In spite of the best intentions, these walls exist between departments within companies and between supply chain network partners. In manufacturing enterprise collaboration the idea is to share information because it better supports the common everyday business processes that people work with as a matter of course. Historical efforts to tie systems together through tight integration have been very expensive, unreliable, time consuming to develop, and difficult to change once in place. Collaborative manufacturing methods use these systems as network nodes that are linked to retrieve or exchange information that can be interpreted and passed to interested parties and/or other systems. An additional step might be to provide that information to the planning and scheduling system for an automatic response to the actual yield quantity, and to revise the schedule accordingly. To further extend this, we might inform downstream partners of the quality assurance data, the resulting yield, the revised schedule, and current shipment information as developed in the logistics management system. One more step might be to advise the supply chain event management system of the new priority enhanced schedule by using a logic requiring notification by the MES if the revised schedule for the order does not begin on the date specified.

III. THE CHANGING STRUCTURE OF INDUSTRIAL ORGANISATIONS

Over recent years, the phenomenon of the supply chain has generated enormous academic and popular interest. The roots of this preoccupation may be traced to the early 1980s. Suddenly the inefficiencies of the very corporations that had both spearheaded and epitomized post-war capitalist development were exposed: corporations such as Ford, General Motors and IBM were found seriously wanting as they were comprehensively out-manoeuvred by an emerging group of Asian rivals. However what was particularly alarming for corporations and governments alike was that the ground rules of industrial organization appeared to be shifting. Specifically, the underlying premise that vertically integrated corporations constituted the elemental unit of dynamic and prosperous economies was shown to be erroneous. Changes in the Social Division of Labour The first concerns the link between the production system and the social division of labour which may be defined as the allocation of people to different firms or units of production. From the industrial revolution

until the 1960s, there was an apparently inexorable growth in the size of lead firms. This trend was seen across many parameters: market share, levels of employment, physical assets, and so on. For this reason, lead firms were increasingly equated with the production system. In practical terms, this was largely correct. However it was conceptually flawed. Considerable importance was therefore focused on large firms. Changes in the Technical Division of Labour But herein lay the second misconception. Firms - whether large or small - are effectively only vessels for different elements of the technical division of labour and it is these, rather than firms, that define the production process; firms are merely organising units. In fact, tasks can potentially be distributed across the social division of labour in many different permutations. Products became ever more complex and, for the most part, they came to depend upon an increasing range of technologies and competencies. This rapid increase in the number of tasks is mirrored across the majority of product lines and it amounts to a significant elaboration of the technical division of labour. The Changing Nature of Demand However, to this must be added a further set of processes relating to the changing nature of demand.

IV. PROBLEMS & OBJECTIVES

SC disruption poses technical or behavioural problems for manufacturers. Technical problems include equipment malfunctions, system failures, and financial distress; while labour strike and human fraud are behavioural problems. In addition, disruption may occur from other uncontrollable events such as natural disasters and terrorism. This paper primarily identifies the supply chain (SC) problems commonly faced by manufacturing firms and their impacts on the entire SC. A range of solutions are suggested to address these problems, furthermore the applicability of each of these solutions significantly depends on their social ramifications that are systematically evaluated.

V. METHODS AND DATA SOURCES

A series of research studies were conducted and the information presented in the entire paper is abstracted from a variety of authoritative data sources, namely, scientific and practitioner literature, and survey-based reports.

The sample

To fulfill the purpose of this paper, suitable respondents had to be found. The main reason for choosing this population is that this type of companies (together with retailers) is the one most considered in SCM. Furthermore, this population also represents different industries which all have specific characteristics and constraints, but which have many similar logistics challenges in common. 55 randomly chosen names of logistics managers in 66 manufacturing companies.

Table shows mean values of experienced effects in the supply chain integration, and collaboration

Human related barriers	Triadic collaboration	Supplier collaboration	Customer collaboration	Total mean
Technology related problems	3.02 (1.24)	2.45 (1.17)	3.02 (1.14)	2.80 (1.21)
Personal chemistry and different cultures	2.51 (1.12)	2.29 (1.11)	2.44 (1.26)	2.40 (1.17)
Trust between the participating companies	2.40 (1.09)	2.32 (0.96)	2.72 (1.22)	2.48 (1.10)
Different logistics competence	3.07 (1.07)	3.03 (1.22)	2.78 (1.05)	2.96 (1.12)
Involved companies have different goals	2.64 (1.06)	2.42 (1.18)	2.60 (1.05)	2.54 (1.10)
Different opinions of how costs and savings shall be shared	2.77 (1.22)	2.31 (1.21)	2.83 (1.30)	2.61 (1.26)
Different opinions about responsibility areas	2.26 (1.06)	2.31 (1.15)	2.33 (0.98)	2.30 (1.06)
Understanding from the own company	2.24 (1.14)	1.98 (1.15)	2.33 (1.03)	2.18 (1.11)

Concerning human related barriers no differences in mean values between the respondents with triadic collaborations and dyadic collaborations can be found. When only taking into account the dyadic collaborations in ANOVA analysis, differences occur on the variable "Different opinions of how costs and savings shall be shared", where respondents with customer collaboration experience more problems than their colleagues with supplier collaborations. This study shows that the type of information that is shared within supply chain integration and Collaboration .

Table shows mean values (in days) of sharing frequency of a certain type of information.

Information type	Number of respondents	sharing once in a month or more often	Mean (in days)	Standard Deviation
Production planning	111	71%	9.09	7.3.7
Inventory levels	118	76%	8.79	7.52
Forecasts	149	94%	12.23	7.49
Sales information (point of sales data)	68	43%	13.37	8.09
Error messages etc	126	81%	8.67	7.16
Product campaigns	58	37%	16.76	6.09
Price levels and pricing	35	22%	18.17	4.91
Future deliveries etc	124	79%	11.84	7.75
Confirmations, track and trace, etc	104	66%	6.85	6.20

The mean values in days are only based on those respondents that share the certain type of information at least once a month (e.g. 111 respondents, or 71%, share information about production planning at least once a month and the average number of days between sharing for these respondents is 9.09 days). 58.8% (104 respondents) of the respondents share at least two types of information at least once a week with their

partner/partners. In coming analyses this group of respondents is considered to be respondents with a high frequency of information sharing. The degree of processed data, i.e. the degree of adjustment for the specific receiver, of the shared information was investigated with a five point Likert scale, ranging from “the information is not adjusted/processed” to “the information is very adjusted/processed”. The mean value (standard deviation in parenthesis) for the answers was 3.66 (1.12). This indicates a high degree of adjustment of the information that is shared, which in turn speaks for good possibilities for the receiver to use the information properly.

Table shows mean values of policies and procedures in the supply chain integration, and collaboration

policies and procedures	Triadic collaboration	Supplier collaboration	Customer collaboration	Total mean
Maintaining standardised operations	3.65 (1.17)	3.64 (1.06)	3.37 (1.19)	3.55 (1.14)
Sharing processes	3.78 (1.04)	3.40 (1.14)	3.61 (1.00)	3.59 (1.07)
More efficient technology implementation and management	4.23 (0.83)	3.82 (0.98)	4.31 (0.80)	4.11 (0.90)
More efficient sales forecast	3.98 (0.86)	3.98 (0.76)	3.69 (0.97)	3.88 (0.87)
Effective materials management for production	3.93 (0.85)	3.68 (1.10)	3.59 (1.16)	3.72 (1.06)
Efficient inventory management	4.02 (0.95)	3.84 (1.27)	3.81 (0.89)	3.88 (1.06)
Better performance measurement	3.98 (0.78)	3.51 (0.97)	4.00 (0.85)	3.82 (0.90)
Cost and service delivery efficiency	3.70 (0.94)	3.48 (0.82)	3.40 (1.00)	3.52 (0.92)
Effective coordination of logistics activities	3.73 (1.11)	3.09 (1.10)	3.49 (1.20)	3.41 (1.16)

Comparing the mean values, a significant difference between collaborations can be found for the variable “More efficient technology implementation and management”; respondents with customer collaborations claim that they have improved this type of service more. The respondents with Integration as well as those with triadic collaborations also experience that their competitiveness has been improved significantly. Finally, the respondents with triadic collaborations also experience significantly more positive effects for the variable “Effective coordination of logistics activities”.

Key findings

It was identified that the major problems commonly faced by manufacturing firms were:

- Supply disruption risk acts as a logistical impediment;
- Inaccuracy and inconsistency of information breed inefficiency between SC entities;
- Uncertainty in supply and demand jeopardizes the decision making capabilities of manufacturing firms; and
- Regulatory compliance stagnates the dynamism of the SC.

VI. Discussion

The findings in this study show that there was collaboration in firms in the supply chain. The managers gave examples and explanations of how their firms integrated with suppliers and customers. They were able to set procedures in their dealings with partners, shared knowledge and processes, and subsequently joint-planned and invested with them for better operations, systems and processes in the supply chain. Further analyses were also conducted showing how the various initiatives and strategies in collaboration enhanced continuous innovation in the case studies. The various outcomes in the firms as a result of collaboration with partners in the supply chain, were both incremental innovations (such as enhanced processes, more efficient operations, better quality, lower costs, etc.) and radical innovations (such as new technology implementation and a change in strategy). However the majority of the improvements are incremental as a result of better, more efficient processes. These firms were able to develop and improve their capabilities for continuous innovation as a result. The capabilities and initiatives for collaboration discussed in the paper provide management with an increased capacity for future decisions and to establish and develop relationships that engage with different suppliers and customers. They may work on the basis of contractual agreements (e.g. in Firm F), cooperative partnerships (sharing inventory, processes or information), entering into alliances (e.g. joint strategic planning and joint investing) or through virtual, horizontal or vertical integration. Innovative outcomes furthermore add value to products and processes in the supply chain network and in the marketplace. It is acknowledged that there are limitations to the study. The responses from managers were difficult to quantify or gauge the extent of these factors. They tended to give an optimistic and possibly biased view most of the time, portraying their firms to be successful and innovative. It was also difficult to compare across organisations in some aspects because the scope of a particular collaboration was not well known and it was difficult to assess which firms were more innovative or successful as a result. The challenge facing distribution centers is strategically integrating their operations such that they are able to meet the demands of this dynamic industry. Management was conscious of the need to determine and prioritise efforts to save costs and satisfy customers and at the same time collaborate for efficient allocation of resources throughout the supply chain. This study nevertheless provides additional information for both academics and practitioners in industry. The case studies also serve as examples for managers in logistics organisation who are contemplating strategies and issues on collaborative relationships. The study demonstrates how such relationships can positively impact on the operation of firms and their capability to innovate.

VII. Conclusion

In examining developments within the supply chain, there are then whole gamuts of considerations that must be taken into account. Elements within it variously address structural issues, the implications of power relations, the nature of the innovation process, the critical but highly differentiated character of management along the supply chain, the implications of fragmented production systems for regulatory processes, and so on. Several solutions are suggested to address these problems. Firstly, supplier disruption risk can be remedied by utilising various suppliers and global outsourcing. Secondly, information integrity can be enhanced by standardisation and embracement of new technology. Thirdly, planning of supply and demand can be improved by organisational leadership, SC and value re-engineering and multi-enterprise collaboration. Finally, regulatory compliance can be addressed by establishing a total risk management culture for total quality management.

This paper proceeds by considering the supply chain issues pertaining to a number of industries. These industries vary across many criteria: levels of technological sophistication, the extent to which production is continuous or project-based, levels of market concentration, and degrees of internationalization.

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