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Study of Select Issues related to Supply Chain Coordination: Using SAP-LAP Analysis Framework

Rajendra Kumar Shukla
J.S.S.Academy of Technical Education
Noida, India
rkshukla135@yahoo.com

Dixit Garg
Department of Mechanical Engineering
NIT Kurukshetra Haryana, India
dixitgarg@yahoo.co.in

Ashish Agarwal
Mechanical Engineering Department
Indira Gandhi National Open University,
New Delhi, India
ashish_ka@yahoo.com

ABSTRACT

Supply chain coordination is concerned with managing dependencies between various supply chain members. It is the joint effort of all supply chain members to achieve mutually defined goals. The paper presented here is a case study of a leading automotive components manufacturer in India. The case analyzes the status of coordination in its supply chain with the help of SAP-LAP model.

A situation-actor-process (SAP)-learning-action-performance (LAP) model has been used to analyze the issues related to the coordination of supply chain for the case company. Based on SAP analysis, various learning issues have been identified which lead to suitable action followed by impact of SAP on the performance of the supply chain of the organization.

KEYWORDS

	Supply chain Management		coordination
	Flexibility		Situation analysis
	Case study		SAP-LAP

PREAMBLE

A firm needs to develop effective coordination within and beyond its boundaries in order to maximise the potential for converting competitive advantage into profitability (Dyer and Singh, 1998). Coordination is defined as managing dependencies or joint efforts of members towards common goals (Malone and Crowston, 1994).These members are dependent on each other to effectively transfer goods and information among each other. Self-interest of a member may hurt the performance of the other supply chain members and may result in degraded overall performance of the supply chain (Horvath, 2001).

In this paper, a case study of a leading automotive components manufacturer in India, ABC, has been undertaken to analyze various issues related to upstream and downstream coordination.

The organization of this paper is as follows. The main issues based on the background to the case organization are highlighted in Section 3 after literature review in section 2. In Section 4, the SAP-LAP framework is presented. Learning issues from the study have been analyzed using SAP-LAP analysis in section 5. Paper is concluded with concluding remarks in section 6.

LITERATURE REVIEW

Literature review has been reported under three subheads of supply chain coordination, flexibility and SAP-LAP model.

1. Supply chain coordination

Supply chain coordination is an effective approach to streamline operations/processes between the dependent supply chain members (Chopra and Meindl, 2003). The dependencies between the supply chain members can be managed with the help of coordination mechanisms such as supply chain contracts, information sharing, information technology, collaborative decision-making, meetings with supply chain members, and technical support (Tsay, 1999; Cachon and Fisher, 2000; Disney and Towill, 2003).

A large number of quantitative models have been reported in the literature for supply chain coordination. For example, joint ordering, replenishment and forecasting (Aviv, 2001), inventory data sharing (Moinzadeh, 2002), procurement process (Arshinder et al., 2004), multi-plant coordination (Bhatnagar et al., 1993), coordinated distribution (Lee and Kim, 2002), and initiatives like vendor managed inventory (VMI) (Disney and Towill, 2003). Also Efforts have also been made to consider important coordination mechanisms (supply chain contracts, information sharing, information technology, and joint decision-making) to quantify coordination capability of an organization (Kaur et al., 2006).

2. Flexibility

The issue of flexibility is gaining significant importance in management. Chandra and Grabis (2009) note the potential opportunities offered by flexibility of a system in enhancing its functionalities and capabilities. After defining the nature of flexibility, paper describes flexibility in a supply chain, pertinent issues, and potential tools and techniques utilized for designing and modeling flexibility in it.

Some of the future challenges and issues in designing and operating flexible supply chains are evolution of global supply chains, concurrence of product, process and supply chain design processes and valuation of flexibility enablers. Hamblin (2002) discusses the concept of flexibility as a managed performance measure through case research in the aerospace Defence industry in the UK and the USA.

3. SAP-LAP

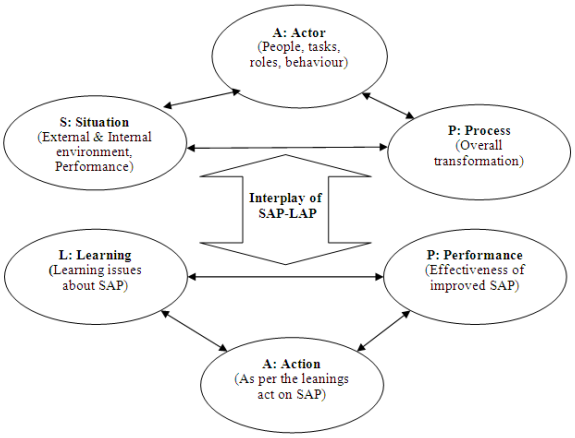
A situation-actor-process (SAP) learning-action-performance (LAP) model of a flexible system is proposed by Sushil (2000). For the systemic inquiry of coordination issues in supply chain and the adoption of coordination mechanisms by supply chain members the same framework can be used. The respective terms in SAP-LAP are explained below.

The "situation" represents the present status, environment of an organization, and the driving forces for good performance of an organization. The "actors" are the individual participants, or group of members, which influence the situation and define an organization culture to evolve business processes.

The "process" is an overall transformation process that converts a set of inputs into outputs to recreate the situation (Sushil, 2001a). The interplay and synthesis of SAP leads to LAP in which various learning issues are brought out regarding SAP. Based on the learning's, action is to be taken on the front of SAP or the interface. The impact of the action on the performance can be analyzed for the improved performance of actors or processes and situational parameters.

SAP-LAP model has been used by a number of researchers (Kak, 2004; Sushil, 2001b; Husain et al., 2002) in a variety of situations through case studies in automobile and pharmaceutical industry. These case studies have analyzed the issues regarding financial health of companies, core competencies, strategy formulations, and role of flexibility in strategy formulation.

The SAP-LAP model in these case studies is used in a very holistic manner, which helps in the understanding various issues that make an organization different from its competitors. Table-I show the applications of SAP-LAP in various industries.



Source: (Sushil, 2001)

Figure 1: SAP LAP analysis framework

Table-I Applications of SAP-LAP in various Industries

S.No.	Researchers(year)	Applied to	Issues covered
1	Sushil (2001b)	Human resources	Hard and soft system paradigm
2	Majumdar and Gupta (2001)	Automobile	Internet and e-business technology
3	Sharma (2001)	Manufacturing	Adoption and operation of Flexible manufacturing Technology in Indian context
4	Kak (2004)	Pharmaceutical	Learning issues about strategic management, core competency and flexibility
5	Agarwal (2005)	Application softwares	Issues regarding cultural and environmental factors
6	Thakkar (2008a)	Manufacturing	Information technology (IT) adoption and implementation in Supply Chain
7	Garg (2009)	Maintenance	Engineering support issues

BACKGROUND TO THE CASE ORGANIZATION

The case organization under study is a multi-product, multi-location Group having turnover of $ 650 million per year and 36 plants in India, 3 in Germany, 1 in Czech Republic, 1 in Poland, 1 in Indonesia, 1 in Vietnam, 1 in Uzbekistan, Office in Europe & Japan Number of employees over 12000 and Cater to all OEMs and vehicles manufacturers in India and also supplying to OEMs in Europe and Asia.

Vision, Growth and Expansion:

"To be a dynamic, innovative and profitable global automotive organization for emerging as the preferred supplier and employer to create value for all stakeholders" The following are driving factors for ABC to become one of the largest in the world:

Research and Development:

ABC research and development activities involve designing and development of new products, manufacturing and testing of prototype samples, reliability testing, product quality improvements, rationalization and technical coordination with other manufacturing locations in respect of quality and warranty.

Quality initiatives:

All the manufacturing facilities are ISO/TS 16949 certified. Quality improvement is the foremost activity of this organization.

Sourcing:

The preference is always to form close and long-term partnerships with the suppliers. The team of competitive and motivated technical associates establishes suppliers of world-class quality at competitive prices and optimum delivery performance.

Performance:

The most important measure of performance is the quality. This is followed by innovation to ensure and sustain business and to keep customer satisfied for a

long-term growth.

According to ABC, coordination can be achieved: by understanding the customer requirements, by delivering the order on time with right quantity, and by sharing the information with the suppliers. The effectiveness of coordination can be assessed on the basis of quality, innovation, and customer satisfaction.

SAP-LAP FRAMEWORK

A case study is presented to understand the supply chain coordination issues and flexibility required in adopting the coordination mechanisms in automotive components manufacturer in India. The interviews were conducted with the senior managers in manufacturing units of ABC on the basis of SAP-LAP model of inquiry (Figure 1). A structured set of queries was prepared, as shown in Table II, to bring out the issues related to supply chain coordination.

Table II: A template for queries about SAP of ABC with reference to supply chain coordination

SITUATION
• What is the current position of the case company in the market as compared to its competitors?
• What are the problems faced by the case company with regard to increasing its market share / sustaining its business?
• How this organization is different from the competitors and from the other players in the automotive industry?
• What are the driving forces of this organization's success?
• What are the core competencies of the organization?
• What are future plans of company?
• Are the employees aware of supply chain and supply chain coordination?
• What initiatives they have adopted to coordinate with the suppliers and buyers?
• What efforts are made for intra-organizational coordination?
• What sort of flexibility lies in adopting the coordination mechanisms?
• To what extent is the process flexible?
• What is the present level of coordination?

ACTOR
• What is the role of top management in tackling the business problems of case company?
• Whether the suppliers of case company are included in the decision making process?
• Are the customer are included in the decision making?
• Are suppliers giving training and demonstrations according to plant requirements?
• What types of data /information's are shared with suppliers?
• Are the functional departments are well coordinated by some coordination mechanisms?
• What factors inhibit effective coordination among the supply chain partners?
• How much importance is given for the long-term partnerships with suppliers and buyers?
• What behavioral factors are required to coordinate with the members of supply chain?
• Are members ready to do all operations collaboratively?
• What kind of flexibility is required to coordinate with each other?
• What are the barriers they observed while coordinating with each other?
• What are the enablers of supply chain coordination?
• What are the perceptions of coordination by supply chain members?

PROCESS
• What are the operations case companies is doing to sustain its current position in the market?
• How the processes related to sourcing are coordinated with the suppliers?
• How the employees of the case company are included in the problem solving /decision making?
• Which coordination mechanisms are undertaken to achieve coordination?
• How coordination is achieved with the buyers?
• What is the expected outcome of coordination on the performance?
• How intra-coordination is achieved?
• Is the information system able to coordinate inter-functional departments in intra-organizational system?
• What are the performance indicators for measuring coordination?
• What are the methods of transaction and communication?
• Are the designing process done in a coordinated way?
• What is the process of acceptance of quotations and suppliers selection with reference to coordination?
• How the contract design and order management improve the company performance?

APPLICATION OF SAP-LAP IN CASE STUDY OF ABC

SAP-LAP model is very effective tool to analyze the case study and to explore the present situation of coordination in ABC. This tool will also help in consolidating various perspectives and efforts required to coordinate by various actors of supply chain, and different processes, which enhances coordination, at intra-organizational and at inter-organizational level.

The SAP leads to various learning issues about the success factors, core competencies, coordination mechanisms, difficulties in achieving coordination, and flexibility required to adopt the concept of coordination. Based on these learning issues, corrective actions may be suggested to improve the supply chain coordination. The impact of these proposed actions on the performance is observed in the context of ABC.

1. Situation

The situation represents the present status of ABC in terms of market share; technology, R&D, flexibility, competitive advantage, and the performance measures. The competitiveness in the above-mentioned situational parameters help ABC coordinate with the suppliers and buyers. The executives of various plants of ABC were interviewed to gauge the following situational parameters about the status of coordination in ABC:

Situational parameters about the status of coordination in ABC:

- Functional areas of ABC are Designing, Tool Manufacturing, Manufacturing Engineering, Component Manufacturing, Assembly, Concept Design Cell, and Quality.
- Due to frequent change in product requirement and variety of product (batch size 150-200 as per order) company has good in-house R & D and manufacturing capabilities.
- Company have Fully integrated Design Cell for new Development & Reverse Engineering, Strong team of expert Designers /Engineers, High end CAD-CAM systems.
- ABC has a professional management set up, which emphasizes on continuously modernizing and upgrading the product range. ABC has developed an ever expansion strategy for the introduction of new products.

- Company Current position is first in supply to 2 wheelers, second in supply to 4 wheelers and overall position including two and four wheeler supply is first.
- The first priority of ABC is to deliver quality products and quality service. •Future plans are to become preferred Global supplies.
- Approximately 15 at unit level and total 25 members are involved in managing supply chain.
•Company involved in mid-term (3 yrs.) and short term planning. • In ABC, the members from various functional departments are well coordinated and share information regarding their respective functional area. The shared information helps in joint planning of forecasted demand and production schedule.
- The inter-organizational coordination can be better achieved by identifying and working on the gaps in coordination with the other members of supply chain.

2. Actors

There are more than 12,000 employees working in ABC. The employees are motivated and creative. The strategic decisions in all manufacturing plants are taken jointly. ABC believes in continuous improvement and encourages the active participation of suppliers and buyers. The following views about coordination were gathered based on the field visits and structured interviews with the executives/employees of ABC:

Actors of ABC
• ABC forms long-term partnership with their suppliers and buyers. To maintain long-term partnerships, ABC regularly organizes meetings with members of supply chain. • Meetings are considered to be very important. Because meetings give motivation to suppliers and buyers to coordinate with each other. • The concept of coordination is visible within ABC as cross-functional teams are developed. These teams work together to select the suppliers. • Employees from various departments jointly plan the operational activities. They use tools like fish bone diagrams for problem solving and analysis. • The employees are committed and zealous to do work and are flexible in adopting new ideas. The team spirit is very much evident at work. • Sales and production people meet very frequently to plan for future demands. • Use of Technical centre facilities and adoption of new technologies have motivated the employees to be more innovative. • There are about 300 technical experts, who are engaged in developing new products to understand the specific needs of the customers. • The concept of intra-organizational coordination is extended to achieve coordination in inter-organization system. • The actors of ABC from different functional units jointly take decisions regarding demand projections and production. • ABC coordinates with buyers to take joint decisions regarding replenishments to improve the ultimate customer service and supply chain performance. • The actors from different organizations work jointly towards mutually defined goals and serve ultimate customers. • For a better relationship and understanding, the suppliers are invited to training sessions /demonstrations so that the design requirements are better understood and met.

3. Processes

Supply chain coordination deals in managing dependencies between supply chain members. All the members of supply chain are dependent on each other to carry out different processes like procurement, production, and distribution. While procuring the raw material the suppliers and ABC are dependent on each other for certain activities like: design and acceptance of quotations, supplier selection, contract design, order management, and order acquisition along with activities like information sharing and joint decision-making regarding operational parameters. Similarly, ABC is dependent on the buyers to know their order information, due date's data and other product-related information. To manage these external dependencies, the employees within ABC work in close relationship. The efforts put in and required by ABC at different interfaces of supply chain are explained below.

A. Coordination effort at upstream end

Case company is involved in manufacturing a large number of components with their changing specification, so it has to deal with a large number of suppliers. It can be observed that to manage such a large number of suppliers is not an easy task. However, to sustain the leading position, ABC has to continuously improve the performance.

The following activities are carried out to coordinate at upstream and downstream end.

(i) Quotations from suppliers are handled manually involving considerable paperwork.

(ii) Suppliers are selected on the basis of traditional attributes. The subjective evaluation takes place in which supplier's company structure potential, quality potential, logistics potential; technical potential and cost potential are included.

(iii) Once the suppliers are selected, they are encouraged to form a formal contract with ABC. A

contract specifies parameters (like quantity, price, time, and quality).

(iv) The modes of communication used by ABC are phone and email for managing orders from customers.

(v) The supplier takes sole responsibility of inbound logistics.

(vi) Only capacity and order information is shared between ABC and the suppliers.

(vii) The major cost reduction can be done at the design stage, but there is no initiative by both the suppliers and ABC to collaborate at this stage.

(viii) In ABC, the level of information sharing with the supplier is very high regarding capacity, production schedule, lead time, order information, product specifications, and product promotions. They share moderate information regarding inventory, end customer data, sales data, and future plans. In general, very low level of information sharing seems to be there regarding cost-related data, price schemes, product design, and research and developments.

B. Coordination effort at downstream end

The following activities are coordinated by ABC with their buyers:

(i) ABC gets some inputs about the annual demand from their buyers; the order quantity varies with the period. The production system is flexible enough to absorb the variations in order quantities.

(ii) The quantity flexibility contracts are designed jointly with the buyer. The capacity information is also shared with the buyer.

(iii) The buyer commits certain minimum order quantity. This initiative helps to improve the profits and reduces uncertainty in order quantity.

(iv) ABC follows pull system of production to provide highly customized quality products.

(v) ABC entertains even a single piece of order. ABC is very flexible in producing small orders and the buyer gives the flexibility in delivery schedule.

(vi) ABC has proposed an initiative to coordinate the buyer's complaints. All complaints are entertained at one point. From this point, the information is transferred to the concerned maintenance department. This facility has helped in improving responsiveness of ABC.

(vii) The decisions regarding forecasting and replenishment are taken collaboratively with the buyers. It helps in reducing the forecasting error and hence, results in less demand variation.

There are different functional departments within an organization. The people from different functional domains may have conflicting views. Production department is highly dependent on purchasing department to receive raw material and also dependent on sales and marketing for forecast of sales which may be used to streamline the production schedule. The knowledge of coordination and willingness to coordinate with each other may help to cut across the functional boundaries of an organization.

4. Interplay of SAP

To implement the concept of coordination, the knowledge and understanding of the present coordination situation, and processes are required by the actors. The ABC actors may demand more freedom of choice to change the present concept of coordination in a more flexible way. The ABC actors may share values, knowledge, and willingness with other actors at intra-organizational (between various business processes of ABC) and inter-organizational (amongst different members of the chain) level. These organizations have different culture and different organization structure. The actors need to be flexible to adopt the concept of coordination of different organizations and are able to understand and implement the coordination mechanisms.

The climate and culture beyond organizational boundaries of ABC force the organization to change the situation so that coordination can be achieved with suppliers and buyers. The changing dynamic situation demands changes in the processes of ABC. The processes of designing, procuring components, manufacturing and distributing, may change when actors adopt different coordination mechanisms (like information sharing, joint decision-making, meetings, information technologies, and supply chain contracts). Flexibility is required to change the mind set of actors towards common vision and goals, so that a flexible situation is created to face uncertainty in supply and demand. Accordingly supply chain processes can be reviewed and revised.

5. Learning

There are various situational parameters like good R&D facility, know-how, and innovation in developing new products using advanced technology, expertise in delivering good quality products. Learning issues about situational parameters of ABC are:

- Global standards in quality, delivery & service, Collaboration with global industry majors to provide global standards, Develop internal competencies of global standards.
- Export is presently 20% of Group turnover, and growing at 100% per annum.
- Meet global standards and customer requirement.
- Fully integrated Design Cell, Strong team of expert Designers /Engineers and In-house tool design and manufacturing. Split micron accuracy.
- In house Product Reliability Testing and Calibration Facility.
- Deep understanding and appreciation of cross cultural diversity, Open environment with strong business ethics.
- Practice of Kaizen movements, 5S and cross-functional teams ensures improved competencies and dynamism of the employees.
- Understanding & integrating end customer needs .Enhancing value for customer.
- Technology coordination with other plants. Work as cross functional team.
- Employees having flexibility in sharing knowledge and views, Ability to change according to the needs of new generation vehicle.
- Vast range of products and believe in continuous improvement as well as understanding the latest needs of customers.
- Joint efforts on value engineering and value analysis with suppliers and buyers to reduce the cost of product.

The learning's related to various processes of ABC **are as follows:**

- Manual handling of quotations takes more time and there are chances of more errors because of huge paperwork.
- The suppliers are selected based on the traditional attributes like cost, quality, and delivery, which are not sufficient in today's competitive scenario. For quick information transfer and to avoid ambiguity, attributes related to information technology, and coordination capability can also be incorporated.
- At present, the transactions are done online only with few suppliers. All the suppliers need to be encouraged to send the orders online. Since suppliers are located at very far places; online order management may reduce the transactions cost. They may also share other information regarding operations planning along with the orders.
- Only capacity and order information sharing are not sufficient to reduce the uncertainties in supply lead times.
- Limited training and assistance is provided to the suppliers.
- There is a need to develop more trust between the members of supply chain, so that the initiatives like VMI can be successfully implemented.
- Some flexibility should be provided to the suppliers while designing contracts.
- Members should always be motivated and encouraged to share the production information that will improve the performance of all the members as well as the performance of whole supply chain.

The main performance measures used by ABC are quality, continuous innovation, and customer satisfaction. These performance measures are expected to be improved after implementing successful coordination with the suppliers and buyers. By incorporating coordination mechanisms in supply chain processes, ABC may form strong partnership with upstream and downstream supply chain members.

The information system used within ABC is not so efficient. There are some problems associated to this system as follows:

- Mismatch in information system at supplier's end and at the buyer's end is quite common.
- There is mismatch in inventory shown by computerized system and the actual inventory present at the shop floor. This is because the production people do not continuously update the information. It affects the ordering cycle.

6. Action

Based on the situation, actors, and processes, the following improvement actions are suggested.

A. Coordination at upstream end

A better procurement system can be proposed by achieving coordination between suppliers and ABC. The procurement processes in the existing system can be improved in the following ways:

(i) A set of web-based technologies can be used to reduce the documentation cost.

(ii) Along with the traditional attributes some other attributes like type of information systems, information sharing capability, willingness to work collaboratively, etc. are to be included in supplier selection and evaluation.

(iii) At present, ABC cannot communicate well in time because of inadequate information systems at suppliers' end. Good information systems will reduce the transactional time. Some standard analytical models are available to evaluate the suppliers (for example, Analytic Hierarchy Process (Saaty, 1980), and Fuzzy logic (Ross, 1997)). Use of these models will help in making the evaluation process more objective.

(iv) The use of formal and written contracts by ABC and the supplier should encourage the supplier to provide a streamlined supply. This would result in improved profits for both supplier and ABC.

(v) The new modes of transferring data like EDI, XML are giving remarkable results. They help in reducing the data transmission errors, clerical paperwork, and inventory investment. Also it helps in increasing the flexibility of response to rapidly changing customer demands. ABC should invest more in these technologies.

(vi) Information sharing is one of the most accepted ways to achieve effective coordination Cachon and Fisher, 2000). ABC and supplier can plan their operations if they are aware of certain information in advance. Supplier can improve his customer service and reduce the lead time if he knows in advance about the production plan of manufacturer.

(vii) The supplier and ABC can collaboratively take decisions regarding design of product. Collaborative decision-making will reduce the cost of product as well as time taken for inspecting the material supplied. The suppliers should be given proper training and their involvement should be encouraged while designing and setting quality norms. It will result in long-term and reliable relationship.

(viii) Some support and assistance should be given to the suppliers to install good information systems. Compatible information systems will help in sharing quick and comprehensible information between the supply chain members.

B. Coordination at downstream end

The main problem, ABC is facing is that of sudden increase in demand. The main challenge now is how to fulfill this demand. This sudden rise in demand may be handled by: Encouraging joint forecasting decisions with buyers, sharing capacity information with customers and implementing a good forecasting tool. Following is the proposed information system for better coordination among the supply chain members.

- **A very good ERP package is required to automate various processes of ABC.**
- **The information system must have flexibility of linking with suppliers and buyers.**
- **Suppliers can coordinate with manufacturer by installing compatible information system. The manufacturer should assist suppliers in installing and providing training in information system.**
- **All transactions may be done online.**

7. Performance

The performance of ABC is measured on the basis of following three performance measures Quality, Continuous innovation, and Customer satisfaction. ABC provides quality products to their customers. The combination of quality products and highly customized products has made them different from their competitors.

- Product customization is highly dependent on the extent of communication with the customer. They understand the customer's needs very well and also serve them with quick after sales service. ABC has also started improving their information systems. An effort has been started to do all the transactions online with all suppliers and all buyers. Initially the online communication was with limited number of suppliers. This may help in reducing uncertainty in supply and demand.

- ABC has the potential and flexibility to adopt the coordination theory.

- To measure coordination and hence to improve, the supply chain performance, ABC emphasizes on: understanding customer requirements, on time/quality delivery, and sharing information with supply chain partners.

Based on the learning's and actions suggested for incorporating flexibility, ABC may coordinate with their suppliers and buyers to improve performance. The willingness to share information, provision of transfer of clear and quick information, knowledge to understand the information and information system, and zeal to work jointly by developing more trust between the organizations will result in a smooth and uninterrupted communication. These coordination mechanisms will help in placing all supply chain members under one system. More the flexibility to adopt these mechanisms, more will be the improvement in the performance of the members.

7. CONCLUSION

Supply chain coordination is an effective approach to improve the performance of the supply chain. A case study presented here is an attempt to identify the various issues regarding coordination in ABC. A systemic model is presented to capture the whole scenario of coordination to improve the performance level of supply chain by adopting appropriate coordination mechanisms.

The utility of SAP-LAP model can be appreciated from studying the present situation of coordination, which may motivate the actors who may initiate coordination and the allied processes. The framework helps in identifying different coordination issues based on the relative importance of coordination in supply chain.

The employees of ABC are well trained, motivated, and form good relationship with other members of supply chain. They conduct frequent meetings with buyers to understand their needs, give training to suppliers, and all transactions are done online. The information sharing with the members is moderate that means lead time and order information sharing is there. They have good information system within organization, but not linked with other members.

They are trying to implement various coordination enablers like VMI, QR, ERP and ECR. There is good scope in ABC to adopt coordination issues because they are flexible to adopt new generation requirements. SAP-LAP model used in the analysis is found to be very useful in understanding various issues of coordination. The different issues discussed are coordination with supplier, coordination with buyer, information sharing,

information system, coordination initiatives, and flexibility required to coordinate with members. SAP-LAP framework has helped in understanding various coordination issues related to the downstream and upstream of the supply chain of ABC.

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