

STUDY OF SELECT ISSUES OF SUPPLY CHAIN MANAGEMENT: A CASE STUDY

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Certificate

This is to certify that the thesis entitled “**STUDY OF SELECT ISSUES OF SUPPLY CHAIN MANAGEMENT: A CASE STUDY**” which is being submitted by Mr. Mahesh Chand to the Mechanical Engineering Department of the Delhi College of Engineering, Delhi for the award of the degree of Master of Engineering (Production) is a record of bonafide research work carried out by him. He has worked under my guidance and supervision.

The results contained in this thesis, have not been submitted in part or full to any other university for the award of any degree.

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Abstract

Supply chain is concerned with managing dependencies between various supply chain members and the joint efforts of all supply chain members to achieve mutually defined goals. There are different mechanisms reported in the literature that have been discussed like information sharing, customer service and satisfaction, Supplier development, Inventory management and Strategies which help in coordinating the supply chain members. There is a need to consider a holistic perspective of effectiveness in the entire supply chain. So various effectiveness factors of the supply chain such as Top management commitment, Mutual understanding, Flow of information, Relationship and decision making, organization factors and Performance are considered in this study. These issues are illustrated with the help of case study: For doing case study SAP-LAP framework has been used. Findings of the study will be highly useful for industry and academic.

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Abbreviations

Symbols/Notations used throughout the text of this thesis are explained as given below in alphabetical order

ATO	Assemble-To-Order
BSC	Balanced Scorecard
CAGR	Compound Annual Growth Rate
CODP	Customer Order Decoupling Point
DSD	Direct Store Delivery
EDI	Electronic Data Interepreter
FTL	Full Truckload
FY	Financial year
FMS	Flexible Manufacturing Systems
GT	Group Technology
LAP	Learning - Action Performance
MTS	Make-to-stock
NPI	New Product Introduction
OEM	Original Equipment Manufacturers
PQ	Production Qualification
PPAP	Parts Approval Process Validation
Ppm	Parts Per Million
SD	Supplier development
SMED	Single Minute Exchange of Die
SCM	Supply Chain Management
SAP	Situation, Actor, and Process
SIAM	Society of Indian Automobile Manufacturers
SCEM	Supply Chain Event Management
TOFC	Trailer on Flatcar
VMI	Vendor Managed Inventory

CHAPTER 1: INTRODUCTION

1.1 Introduction

During the last decade, many upcoming trends in logistics managements have emerged, with each broadening and improving the focus of the previous. The notion of cost-cost tradeoffs was introduced. That is, the lowest total cost might not be achieved by pursuing the lowest achievable cost in each individual part of logistic process. This introduction has bought the concept of logistics integration.

Later, many companies began to realize that on the way of optimizing logistics cost, it was not sufficient to focus on the originations itself, rather it was compulsory to include the member standing outside the origination but in relationship in the term of physical and information flow such as suppliers, subtiers and distribution network. The challenge for logistic manager becomes to integrate logistical performance across all operating facts of a business. This holistic concept has become known as Supply Chain Management (SCM). The Council of logistics managements define SCM as follows

“Supply Chain Management is the systematic, strategic coordination of the traditional business functions and the tacties across these functions within a particular company and across business with the supply chain for the purpose of improving the long term performance of the individual company and the supply chain as a whole.”

The scope of SCM is clearly more than the physical movements of goods from one location to another location. It is also information, money movement, and creation and deployment of intellectual capital. Or some call it knowledge work. The supply chain encompass every effort involve in producing and delivering a final product or service, from the subtiers to end customers SCM include managing supply and demand, sourcing raw material and part, manufacturing, warehousing and inventory tracking, order management, distributions across all channels and delivery to the effect an extended enterprise that reaches far behind the factory doors. Today material and service supplier channel supply partners and customer them self, as well as SCM consultants. Supply chain applications software suppliers and system developer is the key player in SCM (The company logistic project team report, 2002)

While companies have transformed their supply chain to integrated supply chain, they have in need of a tool which will show the combined performance of supply chain. The final outcome of the effort of all integrated members, new improvement area through supply chain, and weather the supply chain is improved or not. This needed tool is a supply chain performance measurement system.

However, the importance of supply chain measurement system has been neglected during the SCM transformation efforts. According to research and case experience in Asia many companies are flying blind when it comes to performance measurement capabilities.

Today, in the context of SCM had been realized that successful supply chain transformation efforts via effective supply chain. In today complex supply chain system timely and accurate assessment of overall system and individual system component performance is of paramount important in much aspect. Statement such as “you can t manage what you do not measure” “Anything measured improved”. “What you measure what you get” and anything measured get done; stress the importance of measurement system. In addition by using appropriate performance measurements system. Companies should be able to support and monitor continuous improvement. Which is one of the best methodologies for supply chain transformation?

An effective measurement system provides companies with a broad assortment of both culture and technical benefits, which are not commonly recognized. It provide basis to understand the system. Influences the behaviour throughout the system, provide information regarding the result of system effort to supply chain members and stakeholders and play a major role in monitoring the implementation of strategy. In addition, measuring supply chain performance in and of itself lead to improvement in overall performance (Handfield and Nichols, 1999). While coordination is defined as managing dependencies or joint efforts of members towards common goals (Malone and Crowston, 1994). Supply chain management is the management of flow of inventory, information, and money between the different members of supply chain (Mentzer et al., 2001). These members are dependent on each other to effectively transfer goods and information among each other. The member’s self-interest and myopic view of supply chain may lead the supply chain member to focus exclusively on its own goal. This 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). The rising competition

triggered by globalization and outsourcing has forced the supply chain members to work coherently with each other. Typically, an organization is identified by the suppliers for the supply of good quality products and the customers to whom services are provided. The competition is not between the organizations but it is between the supply chains. To face this competition, supply chain members are coming together as a part of a unified system to improve of the whole Supply chain system. 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 invoking 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). The supply chain members are expected to be more flexible to change their perspective and the organization design to incorporate the theory of coordination. Even though coordination improves the performance of the supply chain it may not always be beneficial to coordinate the supply chain members. The high adoption costs of joining inter-organizational information systems and information sharing under different operational conditions of organizations may hurt some supply chain members. Therefore this study is aimed to

- **To develop a case study with SAP-LAP framework on SCM.**
- **To evaluate the supply chain effectiveness index of an automotive sector.**

1.2 Background for research

In this section, the literature is used in describing the general context within which measurement of supply chain is undertaken. The works of various authors are used in establishing the need for supply chain effectiveness index and to describe in general terms how it should be addressed-emphasis is on this systems and approaches as opposed to specific measures.

Many firms look to continuous improvement as a tool to enhance their core competitiveness using SCM. Many companies have not succeeded in maximizing their supply chain's potential because they have often failed to develop the performance measures and metrics needed to fully integrate their supply chain to maximize effectiveness and efficiency. [Lee and Billington (1992)] observed that the discrete sites in a supply chain do not maximize efficiency if each pursues goals independently. They point to incomplete performance measures existing among industries for assessment of the entire supply chain. Measurements should be understandable by all supply chain members and should offer minimum opportunity for manipulation (Schroeder et al (1986)). Performance studies and models should be created so that organizational goals and achievement of those goals can be measured, thus allowing the effectiveness of the strategy or techniques employed to be accessed.

Most companies realise the importance of financial and non-financial performance measures, however they have failed to represent them in a balanced framework. According to [Kaplan and Norton (1992)], while some companies and researchers have concentrated on financial performance measures, others have concentrated on operational measures. Such an inequality does not lead to metrics that can present a clear picture of organizational performance. For a balanced approach, companies should understand that, while financial performance measurements are important for strategic decisions and external reporting, day to day control of manufacturing and distribution operations is often handled better with non-financial measures. Another area where inequality persists is deciding upon the number of metrics to be used. Quite often companies have a large number of performance measures to which they continue to add based on suggestions from employees and consultants. They fail to realize that performance

assessment can be better addressed using a trivial few-they are not really trivial, but instead are those few areas most critical to success.

The effectiveness index that is used in performance measurement and improvement should be those that truly capture the essence of organizational performance. A measurement system should facilitate the assignment of metrics to where they would be most appropriate. For effective performance measurement and improvement, measurement goals must represent organizational goals and metrics selected should reflect a balance between financial and non-financial measures.

1.3 Methodology

A research method is a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection. The choice of research method influences the way in which the researcher collects data. Specific research methods also imply different skills, assumptions and research practices. Klein and Myers (1999) define four research methods as method of inquiry, viz. action research, case study research, ethnography and grounded theory. Case study research is the most common qualitative method used in information systems. It is particularly well-suited to information system research, since the object of this discipline is to study the information systems in organizations, and "interest has shifted to organizational rather than technical issues".

The term case study has multiple meanings. It can be used to describe a unit of analysis (e.g. a case study of a particular organization) or to describe a research method. A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. It is a qualitative approach. The motivation for doing this comes from the observation that, if there is one thing that distinguishes humans from the natural world, it is our ability to talk! Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live. We have used the SAP-LAP methodology for critically examining the case study. Case studies developed are analyzed by selecting typicalness rather than uniqueness of the situation. Focus on typicalness leads to meaningful generalizations and scientific abstraction whereas uniqueness would preclude these. Case studies look simple, but

they require thorough familiarity with the existing theoretical knowledge of the field of inquiry by the researcher and also the skill to differentiate significant variables from insignificant ones. An unbiased approach is mandatory. Unsystematic approach to the analysis of a case study till recently prevalent was as thorough and as deep as the analytic capability of the researcher. Occasionally, bias would creep in, some significant factors may be lost sight of, some factors even though not significant may get more attention, faithful longitudinal approach would not be taken, etc. Sushil, (2000) has recommended a formal analysis methodology for critically examining a case study. This methodology consists of two phases as follows. In SAP analysis, it describes the case through three basic components that define the dynamic interplay of reality in flexible systems management paradigm. These are situation, actor, and process (SAP). They interact flexibly on multiple planes in the ambiguous reality and help us in understanding the reality.

The case studies have been prepared by collecting data from both from primary and secondary sources. The cases were then analyses applying flexible systems methodology, i.e. Situation - Actor - Process, Learning - Action Performance and flexibility tools to bring about the implicit issues of strategic deployment of Business technology under the given context. Sushi discusses SAP analysis and LAP synthesis as method of case analysis. In SAP analysis, the dynamic parameters of a case is highlighted through the three dynamic interfaces of any business system.

In real life, it is difficult to identify all the factors of a given situation in the first place. Processes can hardly be defined unless the situation and strategies are clear. No meaningful actions are possible without mapping of the situation and deciding the supporting processes would alter the situation. Actors cannot initiate any rational actions to alter the situation in favour of the company without knowing the cause and effect relationships. The cause and effect relationships can only be learnt by observing the performance of the past in conjunction with the analysis of the situation and processes. Ironically, no actor will possibly know all the factors of the environment that significantly influence the performance of company's actions. Actors control the internal processes and actions with their knowledge and understanding plus assumptions about the future. Positive assumptions earn rich dividends. Negative assumptions results losses. Therefore actors take calculated risks. The environmental factors are dynamic and changing as a result of cumulative effects of other players' actions. Conversely, created

processes that have defined inputs, throughputs and outputs, and is static in nature. However, these static processes become partially dynamic when the cycle time of static processes get reduced to a great extent. This implies that one can start with certain logical assumptions; observe the steps carefully, analyze the processes and performances and learn more about the system; and make necessary corrections in the processes and do it again. In this process the static processes also become dynamic. The key of this conversion is continuous observation and learning.

Therefore the next logical step of SAP analysis is LAP synthesis. LAP links three components, i.e. learning issues, actions and performance. Actors consistently evaluate situation, follow 'practice, take actions, learn from their performances and depending on the results of performances either the processes are modified or same process followed for repeat performance. Therefore live organizations, which are in the process of adaptation of new and complex technology, the SAP-LAP framework provides one of the most useful methodologies of analysis mid synthesis.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

For any business activity, such as supply chain management (SCM), which has strategic implications for any company, identifying the required measures on most of the criteria is essential and it should be an integral part of any business strategy. Many methods have been suggested over the years for SCM evaluation of any organization. However, a balanced approach to evaluate SCM is a source of increasing cost and concern to management as traditional methods focus only on well-known financial measures, which are best, suited to measure the value of simple SCM applications. Unfortunately, evaluation methods that rely on financial measures are not well suited for newer generation of SCM applications. These complex supply chains typically seek to provide a wide range of benefits, including many that are intangible in nature. As a result, it suggests that it may be appropriate to use a balanced approach to measure and evaluate supply chains.

In recent years, a number of firms realized the potentials of SCM in day-to-day operations management. However, they often lack the insight for the development of effective performance measures and metrics needed to achieve a fully integrated SCM due to lack of a balanced approach and lack of clear distinction between metrics at strategic, tactical, and operational levels (Gunasekaran et al., 2001 and Hudson et al., 2001). Therefore, it is clear that for effective SCM, measurement goals must consider the overall scenario and the metrics to be used. These should represent a balanced approach and should be classified as financial and non-financial measures. Balance scorecard helps as

- It points out the importance of key players in the performance measurement of SCM, and the nature of roles they need to play.
- A balanced performance evaluation of SCM such as, balanced scorecard not only helps organizations in faster and wider progress monitoring of their operations but can also help them in improving their internal and external functions of business such as engineering and design applications, production, quality improvement, materials management, quick response, gaining lost market shares, proper implementation of business strategies etc.

- In this literature review application of balanced SCM scorecard throwing light on the management of supply chain by conducting case studies. It focuses on critical factors that are likely to contribute for the successful performance measurement of SCM.

Organizations increasingly find that they must rely on effective supply chains, or networks, to successfully compete in the global market and networked economy. This concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies. Companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal management working of other individual players. Therefore, the choice of an internal management control structure is known to impact local firm performance. In the 21st century, changes in the business environment have contributed to the development of supply chain networks. First, as an outcome of globalization and the proliferation of multinational companies, joint ventures, strategic alliances and business partnerships, significant success factors were identified, complementing the earlier "Just-In-Time", "Lean Manufacturing" and "Agile Manufacturing" practices. Second, technological changes, particularly the dramatic fall in information communication costs, which are a significant component of transaction costs, have led to changes in coordination among the members of the supply chain network .

Supply chain management (SCM) delivering major economic benefits to businesses as diverse as manufacturers, retailers, and service providers. Benefits include such classic supply chain functions as inventory control, purchasing, and order fulfillment. But it is a mistake for businesses to think of SCM as limited to these functions alone. Enhanced SCM can create efficiencies and cost savings across a wide range of business processes. Properly implemented, SCM is a strategic activity that must be conducted across the entire enterprise, from marketing and product design groups all the way through to the accounts receivable department. Ultimately, SCM must be conducted between enterprises, since optimizing entire supply chains will require a level of information sharing and collaboration among enterprises previously unknown in most businesses.

Traditionally, the focus of companies has been on the flows within the organisation or flows over which the organisation has direct control. But, successful supply chain management requires the

recognition that the firm is simply one player in the long chain that starts with suppliers and includes transporters, distributors and customers. Close relationships between suppliers, manufacturers, transporters, distributors and customers are going to be the key to success in times to come. Organisations must interact co-operatively with their channel partners for the mutual benefit of the channel as well as the gain of each player. In order to adopt this external perspective, organisations should not only consider the impact of any business decision on their own performance but also on the bottom line of their suppliers, distributors and transporters. Companies are recognising that supply chain innovations can be not only a driver of cost reduction, but importantly, a catalyst for revenue growth by achieving greater levels of customer satisfaction. Lee and Anderson (1999) call the new generation of supply chain strategy a “synchronised supply chain”.

There is increasing interest in inter-firm relationships as more firms rely on resources outside their own firm to compete successfully (Harland, 1996). Companies look at their supply chains – the upstream part of the value-chain from the company’s perspective – as a means of focusing on their own core competencies, of leveraging those of vendors, of lowering their costs, and, thus, becoming more responsive to customers. Each link in the chain must add competitive advantage. However, this is not adequate enough. The basis of competition between organizations is shifting to how effectively these supply chains are managed.

As a supply chain perspective entails looking at the supply chain partners, it is important to have a trusting relationship between them, where each party has mutual confidence in the other members’ capabilities and actions (Handfield and Nichols, 1999). As organizations enter the era of network competition, the winners will be those organizations who can better structure, coordinate and manage the relationships with their partners in a network committed to better, faster and closer relationships with their final customers (Christopher, 1999). The relationship between the partners, instead of being restricted to coordination only, should transform to a more collaborative one. Failing to collaborate would result in the distortion of information (bullwhip effect) as it moves through the supply chain, which, in turn, can lead to costly inefficiencies, excess inventories, slow response, and lost profits (Lee *et al.*, 1997).

As organizations look beyond their own firms, it becomes important for them to involve their suppliers and customers in the various processes. Successful involvement yields major benefits: increased market share, inventory reductions, improved delivery service, improved quality, and shorter product development cycles (Corbett *et al.*, 1999). Proper management of customer-supplier involvement offers significant opportunities for firms to create strategic advantage and achieve extraordinary financial performance. In other words, a collaborative process of creating mutually beneficial strategic outcomes results in “pie expansion” (Jap, 1999).

It is important to use this alliance strategically. Earlier, large organizations experimented with customer-supplier alliances as a cost-cutting device. But recently, companies have been using partnerships, not as a money saver, but as a sales strategy also (Useem, 1997). Although it has numerous benefits, involving and maintaining involvement of supply chain partners is a tricky business (Fenn, 1997). The involvement of customers and suppliers is on the rise; however, failure rates also seem to remain high (Arino and Doz, 2000).

2.2 Inventory management in SCM

Inventory management is challenging because it directly impacts both cost and service. Uncertain demand and uncertain supply and/or production cycle times make it necessary to hold inventory at certain positions in the supply chain to provide adequate service to the customers. As a consequence, increasing supply chain process inventories will increase customer service and revenue, but it comes at higher cost. Therefore, the management of supply chain processes has to resolve this trade-off by identifying possibilities of decreasing inventories by simultaneously improving customer service. A well-known management lever in this respect is risk pooling by different types of centralization or standardization, e.g. central warehouses, product commonalities, postponement strategies (cf., e.g., Tallon, 1993). In this way, it is usually possible to reduce inventory costs to a large extent. However, this reduction of inventory costs often is related with an increase in other costs, like transportation costs or production costs. In multi-stage inventory literature capacity aspects are usually disregarded, or capacity (transportation and production) is assumed to be constant (Biller *et al.*, 2002; Dellaert and de Kok, 2004).

If activities in the supply chain are postponed downstream in the process by shifting the customer order decoupling point upstream in the process, the order cycle time is affected. For example, if no additional resources are allocated to the postponed activities, the order cycle time and thus the delivery time for a customer will be increased. Therefore, additional resources (labor and/or equipment) have to be taken into account for the evaluation of such process changes and the additional production costs have to be traded off with the reduction in inventory costs. Basically, the trade-off between inventory cost reduction and increased cost for resources depends on the positioning of the customer order decoupling point (CODP) in the supply chain process (push/pull boundary). In the case of make-to-stock (MTS) production, the decoupling point is at the finished goods inventory, whereas in the case of make-to-order (MTO) production, it is located at the raw material inventory. If only a part of the production is carried out after the arrival of a customer order we speak about assemble-to-order (ATO) production. In ATO production, the production steps upstream the decoupling point are performed in MTS mode (forecast driven), and the downstream steps are made to order (demand driven) . [Olhager \(2003\)](#) identified two major factors that affect the strategic positioning of the order decoupling point, the production to delivery lead time ratio and the relative demand volatility (standard deviation of demand relative to the average demand). Clearly, if the production lead time is larger than the delivery time of a customer order, then MTO production is not possible because of poor customer service. On the other hand, MTS production, in case of many finished goods, is not efficient because of high inventory cost. The high inventories are necessary to achieve the promised level of customer service, for MTS production mainly expressed by the fill rate.

For the purpose of our research work, it is necessary to be precise in the usage of the terms cycle time and lead time. Cycle time is defined as the time span, an individual flow unit takes to traverse a process from entering to leaving. One example is production cycle time, the actual cycle time between commencement and completion of a manufacturing process, as it applies to MTS products, order fulfillment cycle time, actual cycle time from customer order origination to customer order receipt, i.e. all activities from the decoupling point downstream to the customer. In contrast, lead time is specified by the management and it is used to indicate the maximum allowable cycle time for an entity. One example is production lead time, the time allowed on the manufacturing process (Hopp and Spearman, 2000). Delivery time is the negotiated or promised

time to fill a customer order from start to finish. The delivery time is composed of the average order fulfillment cycle time and the safety time, which mainly depends on the promised delivery performance for MTO and ATO production.

The supply chain manager negotiates with customers the delivery time and the level of customer service. For MTO and ATO production, delivery performance (percentage of orders fulfilled within the promised delivery time (or due date)) is used as measure of delivery reliability. Therefore, the manager has to decide about the most efficient type of production, i.e. MTS, MTO or ATO. In the case of MTO or ATO production, the trade-off between inventory cost and capacity cost has to be considered. The reduction of inventory cost can be increased by exploiting part commonalities by positioning the push/pull boundary such that several finished goods can be produced from standardized parts, the so-called product platforms in automobile industry (Desai et al., 2001).

In a supply chain, inventories range from raw materials, subassemblies and assemblies to finished products, as well as inventories held up in transit. What was traditionally perceived as a buffer in production to cope with uncertainties actually emerged to be one of the reasons for the increase in lead-time. As customer service requirements constantly increase, effective management of inventory in a supply chain becomes increasingly critical and important. Hence, it is essential that costs associated with inventory should be evaluated, and proper trade-offs, with suitable performance measures, should be implemented.

In a supply chain, the total costs associated with the inventory (Christopher, 1992, Lee and Billington, 1992, and Stewart, 1995) consists of the following:

- Opportunity cost consisting of warehousing, capital and storage,
- Cost associated with inventory as incoming stock level, work in progress,
- Service costs, consisting of costs associated with stock management and insurance,
- Cost held up as finished goods in transit,
- Risk costs, consisting of costs associated with pilferage, deterioration, damage.

- Cost associated with scrap and rework.
- Cost associated with shortage of inventory accounting for lost sales/lost production.

In dealing with these costs, consideration should also be given to part/material size. A low cost part may have large size, and consequently, a large space requirement. Also, in deciding which cost should be tackled first, Pareto analysis can be used to prioritize the options. In addition, proper trade-offs should be considered in dealing with inventory at various levels in a supply chain. An excellent discussion, based on pitfalls and opportunities, is provided by Lee and Billington (1992). In particular, they point out that the cost of reworking stored components due to engineering changes and the risk of obsolescence could inflate the inventory holding costs by 40%. Clearly, not considering such factors may lead to inappropriate choices.

In dealing with inventory in transit, a trade-off is needed because changing the mode of transportation can significantly affect inventory investment and service performance. A faster and more expensive shipping mode may save enough in inventory investment to justify increase in shipping cost, but if inventory costs rates are appropriately chosen. Care must also be taken for longer lead-time due to longer distance as it increases the “volatility” of inventories, resulting in either too high or too low inventory levels. This, in turn, can lead to higher administrative costs being incurred, and can be the cause of costs due to lost sales.

Another factor that needs to be measured and dealt with regarding inventory is the accuracy of forecasting techniques. Supply chain in many industries suffers from inventory, owing to their inability to predict demand. A new demand forecasting system that takes sales data from distributor’s computer and combines with on-hand inventory could serve as a technique to deal with this problem. It shows that using such techniques, Microsoft has been able to keep production schedules open until one week, and make what the market will accept. Therefore, measuring inventory at supply, production, distribution and scrap levels as well as accuracy of forecasting techniques, can provide an insight into the cost performance and reduce the lead-time in a supply chain.

2.3 Supplier development in SCM

Supplier development (SD) are defined as “long-term cooperative effort(s) between a buying firm and its suppliers to upgrade the suppliers’ technical, quality, delivery, and cost capabilities to foster ongoing improvements” (Watts and Hahn, 1993, p. 12). They are different to supplier evaluation/assurance that rate the performance of suppliers against certain with the aim to insure that they meet or exceed these criteria. The use of SD proved to be a successful strategy for several organisations in Japan, over the last 50 years (Helper and Sako, 1995; MacDuffie and Helper, 1997). The majority of the supply chains in the west however have different structural characteristics (they are less dedicated) and the cultural and economic environments are different to those in Japan. Krause and Ellram (1997) pinpoint that the lack of buying firm power in terms of the percentage of supplier’s output is a significant reason for lack of commitment on behalf of supplier and failure of these programmes. As a result, many suppliers either hesitate to participate in such programmes and if they do, their appreciation is limited to the achievement of certain performance indicators in the short term (Sako, 2004). In other words they are merely supplier assurance programmes. This does not facilitate substantial learning and knowledge diffusion between and amongst the trading partners and therefore an adapted model for SD is needed. In the SD literature there are in-depth studies on the practices and strategies that may lead to successful SD design and implementation. Krause (1995) for example, identifies the support of top management for both parties; development of cross functional teams; development of effective communication channels with the supplier and proactive measurement as necessary for the success of SD. It also discusses that a proactive SD approach is possible with supply chain structures that are based on buyer dominance or interdependence rather than those in which the supplier dominates. Along similar lines Handfield et al. (2000) describe a seven-step process for avoiding pitfalls of SD. These studies are very useful in understanding the general organisational structures and strategies which may lead to their success, but do not examine how learning and knowledge transfer may be facilitated between the trading partners. This aims to contribute to the SD literature by exploring the learning and knowledge transfer processes in SD. For this purpose salient concepts on learning and knowledge transfer presented in the literature are briefly reviewed in the next section to draw insights on these processes. Organisational learning and knowledge transfer. There is a voluminous literature in organisation and management studies on how learning takes place in organisations. Learning theories traditionally

focused on individuals' learning, but in recent years there has been a shift on whether organisations themselves can learn. Proponents of organisational learning advocate that although it is individuals that go through the learning process, this takes place within the context provided by the organisation (Argyris and Schon, 1978). The organisation as a whole continuously accumulates knowledge through the individuals who generate and transfer new solutions (Nonaka and Takeuchi, 1995). This accumulated knowledge can then survive the departure of individuals and absorb and nurture new employees and so on. It is reasonable then to argue that in order to study how organisations create and transfer knowledge it is important to consider the learning process that individuals go through. Cognitive scientists view knowledge as developing in a conscious and unconscious manner through the interpretation of a set of information acquired through experience and meditation on the experience itself and giving to its owner a mental and/or physical ability in an "art" (Polanyi, 1967).

The knowledge transfer between two or more actors (individuals or organisations) in an organisational setting can be defined then as the process by which the knowledge of one actor is acquired by another. It occurs when an actor is affected by and learns from experiences of other actor(s) through transmission of routines or capabilities (Berta and Baker, 2004) and in an organisation can take place by means of different ways, such as interaction of personnel, patent disclosures, publications, and so on. These definitions emphasise that knowledge is not simply an aggregation of information, but information that is associated to a meaning through an individual and/or an organisational interpretation process. It is developed and transferred with a specific purpose, to acquire a specific skill or competence.

This interpretation process is itself a learning process that is internalised by the received actor (individual or organisation) through four distinctive, consecutive stages (Gilbert and Cordey-Hayes, 1996): . Acquisition of information from an external actor and communication of this information to the rest in the organisation. These two stages refer to when and how various actors acquire and pass on information what makes them willing to do so, who do they share it with, and what aspects of information is shared. . Application and then adoption and retention of the information in the organisation (i.e. in the form of implementation of a good practice model). Finally, assimilation of this information. This stage is undoubtedly the most significant stage of knowledge transfer as it represents the process of cumulative learning that involves changes in individuals' skills and attitudes and organisational routines as a direct result of the use of

acquired knowledge. In this respect, it is posited that in order to deal with the ‘soft’ notions of learning and knowledge transfer through SD programmes, it is necessary to separate simple information transfer with information associated to a specific development of skills and study the interpretational process through which knowledge is transferred.

2.4 SCM Strategies

An effective strategy must take into account the distinctive competencies of a firm that will give it a competitive advantage over its competitors. In the present scenario of global competition, effective strategies for making investments, for developing competencies over time and strategies for reducing cost and improving quality are very important. These issues have been analysed for auto component sector in following sections.

Investments priorities. The image of the “factory of the future” is associated with advanced technologies enabling production of a variety of high quality products at low costs, delivered to the customers without delay. To achieve these goals, technological innovations are necessary. Technological innovations may involve several orientations such as: design-based, manufacturing-based and administration-based orientations. These are intended to improve product quality and process efficiency through a better design, better control, improved logistics, quicker and more effective communication. Other studies (Lal, 2004; Hodgkinson and McPhee, 2002) have found that users of advanced e-business technology perform better than non-users in export markets. According to Mosey (2005), SMEs can compete with their larger rivals by developing new products using novel and often simpler technologies. According to a study carried out by Fletcher and Hardill (1995), a stronger orientation of French firms towards human resource management (HRM) practices and investment in new technology was a key reason for their better sales growth as compared to their counterparts in the UK. It is also commonly reported that the quality and consistency of the manufacturing performance of SMEs can be improved as a consequence of the use of the most appropriate information technology (IT) tools without any major changes in business practices, manufacturing operations or production facilities. Information and communication technologies are indispensable to the operation of the core routines of organizations (Hicks et al., 2006). For making investment in information and communication technologies, enterprises should seek accredited advisors to ensure success (Morgan et al., 2006).

-Strategies for cost and quality. Markland et al. (1995) have observed that for European and US manufacturing executives, quality is the most important competitive priority. Lau (2002) has also found higher quality and lower cost as top ranking competitive factors among US electronics and computer industries. According to Fleury and Fleury (2003), for operational excellence, organisations should optimize the quality/price ratio. The intensity of strategies adopted by auto component sector for cost and quality. It is observed that in reducing cost, the auto component sector focuses on strategies for reducing rejection/rework followed by improvement of maintenance and process capability. For improving product quality, reduction of rejection/rework continues to be the top strategy along with improvement of process capability, product design and maintenance. It is observed that the intensity of some of the strategies addressing cost and quality such as automation of operation, improvements in product design and training of employees differ significantly.

2.5 Role of information-sharing in SCM

Much has been written about SCM in recent years. However, one tenet appears as a common thread tying the discussion together: success depends on managers' ability to identify changes in the competitive environment and then to structure SC resources to help the company compete more effectively. This contingent response determines how well the firm, and the entire chain, adapts to the dynamics of an evolving and intensely competitive market (Hofer, 1975). Of all the resources a company manages, information has perhaps received the greatest attention as critical to the implementation of the company's strategic SC response. To respond productively to rapid change, a company must "be aware of new information generated in its environment and adopt structures that enable fast decision making and practices that reduce information overload" (Mendelson, 2000, Tushman and Nadler, 1978). For this reason, companies are investing heavily in information technologies to enhance their ability to manage information and knowledge across the supply chain (Ofek and Sarvary, 2001).

Most of the managerial and theoretical focus has been the technological side of the information sharing capability. Yet, many organizations have been "disappointed with the returns from these investments" (Jap et al., 2002). One possible reason for the disappointment is that the technologies have not been supported by commensurate investments in organizational cultures that promote open sharing of information (Fawcett and Magnan, 2001). Common sense suggests

that the technological ability and the willingness to share information should work supportively together to enhance the quality and impact of SC decision making. Each of these two distinct dimensions – connectivity and willingness – of an information sharing capability.

2.6 Customer service and satisfaction

Customer specification in design, set the dimensions of quality and the feedback for the control process. They contain product/service flexibility, customer query time, and post-transaction service.

- Flexibility

A great deal of research into defining various types of flexibilities in manufacturing has occurred over the last two decades in SCM. Despite this, there is no general agreement on how to define flexibility. The early definitions of manufacturing flexibility are concerned with the ability to effectively adapt to changing circumstances (Mandelbaum, 1978). However, this rather popular definition of flexibility does not explain what “ability” means and is hard to operationalize. Other researchers have attempted to modify the early definition in order to consider the manufacturing system, process, product, or part, in an attempt to develop a definition of flexibility more applicable to manufacturing activities. Within this perspective, Buzacott (1982) defined manufacturing flexibility as the ability of the manufacturing system to produce a wide variety of parts or assemblies, without intervention from outside to change the system. However, Boyle (2001) states that most of the earlier definitions view flexibility as a reactive capability of the supply chain management to the uncertainty faced by an organization, ignoring the performance dimensions such as cost, time and quality. Subsequently this view was echoed by Upton (1994), who considered flexibility as being the result of various dimensions, each of which appears in different time intervals and with three distinct “elements” or ways of being flexible: range, mobility, and uniformity. On viewing these various elements proposed by Upton (1994), researchers have begun to include the performance dimensions in their definitions. Flexibility is the degree to which the firm is able to adjust the time in which it can ship or receive goods (Prater et al., 2001). Therefore, a more comprehensive definition might be “the ability of the manufacturing system to change or react with little penalty in time, effort, cost, or performance” (Upton, 1994). Some authors have provided definitions of manufacturing

flexibility that considers the issue of the strategic importance of flexibility (such as marketing aspect, customers' requirements etc.) in SCM . For example according to Zhang et al. (2002) flexibility is “the organization's ability to meet an increasing variety of customer expectations without excessive costs, time, organizational disruptions, or performance losses”. Hyun and Ahn (1992) state that strategic flexibility refers to the ability of firms “to reposition themselves in a market, change their game plans, or dismantle their current strategies when the customers they serve are no longer as attractive as they once were.”

The definitions of manufacturing flexibility play an important role in defining supply chain management (SCM) flexibility. However, as the supply chain extends beyond the enterprise, supply chain flexibility must also extend beyond one firm's internal flexibility (Vokurka et al., 2003). One of the key attributes of a successful player in today's highly competitive marketplace seems to be the ability to respond rapidly to end-customer demand (Stalk and Hout, 1990). The definition of supply chain flexibility for this research considers the definitions just described, the perspective of the entire value adding system, i.e. total system flexibility, and flexibilities that directly impact a firm's customers. The operational definition of supply chain flexibility for this research is “the ability of supply chain partners to restructure their operations, align their strategies, and share the responsibility to respond rapidly to customers' demand at each link of the chain, to produce a variety of products in the quantities, costs, and qualities that customers expect, while still maintaining high performance.”

Being flexible means having the capability to provide products/services that meet the individual demands of customers. Some flexibility measures include: (i) product development cycle time, (ii) machine/tool set up time, (iii) economies of scope (Christopher (1992)) refers to the production of small quantities of wider range.

Being flexible refers to making available the products/services to meet the individual demand of customers. This has become possible as a result of the development of such technologies as flexible manufacturing systems (FMS), group technology (GT), and computer-integrated manufacturing (CIM). In addition, other methods such as single minute exchange of die (SMED), as well as information technology (IT) and communication systems (CS), which provide online information, further facilitate quick response of the control system. The flexibility

that these systems impart has a high impact on winning customers. For example, Toyota is using FMS and logistic principles to provide a high level of responsiveness to customer needs

Hence, by defining flexibility as a metric and by evaluating it (Gunasekaran et al., 2001), companies can achieve what was previously impossible: rapid response to meet individual customer requirements.

- The customer query time

Customer query time relates to the time it takes for a firm to respond to a customer query with the required information. It is not unusual for a customer to enquire about the status of order, potential problems on stock availability, or delivery. A fast and accurate response to those requests is essential in keeping customers satisfied.

On several occasions, a customer enquires or needs to be informed about the status of an order, and the potential problems on stock availability or delivery. Providing such information genuinely helps the customers to schedule their activities, and helps the firm to retain them as customers. Thus, providing online information is an important element of customer service, and it can be evaluated for improving the same. To measure customer service, questions “what are the response times”, and “what procedures exist to inform customers” should be considered.

- Post transaction measures of customer service

The function of a supply chain does not end by providing goods to the customer. The post transaction activities play an important role both as part of customer service, and for valuable feedback for further improvements in the supply chain. For example, timely availability of spares helps companies to provide better customer service, and to trace the problems arising from warranty claims; then making improvements on them.

Service level compared to competitors: to be competitive, an organization must measure how well its service performance compares against the competitors’.

Measuring customer perception of service: this is done primarily through direct interviews with customers. What are their needs? What is the service level they receive versus what are their expectations?

2.7 Performance

Effective performance measurement system plays an important role in supporting managerial development in the organizations (Garengo et al., 2005). Performance measurement is defined as the process of quantifying the efficiency and effectiveness of manufacturing system. Performance of an enterprise is often measured as a ratio of output to input. The outputs constitute the products of the enterprise and the inputs are the resources used by the enterprise. It is highly essential that all the factors, both tangible and intangible, should be included in analysing organizations performance. Traditionally, organizational performance has been measured by using only financial indicators such as profit, market share, sales, and growth rate. Financial indicators measure only past performance. Garg et al. (2003) suggest that as most small firms are privately held, it is unlikely that their CEOs will be willing to provide detailed accounting data on the firms performance. Therefore, they suggest the use of “subjective and self-reporting measures of performance.” Performance of an organization relative to its industry standards is termed as its competitiveness. Vastag and Montabon (2001) have measured competitive advantage by using five point Likert scales, which compared the firm’s unit cost of manufacturing, delivery speed, etc. with its competitors.

- . Measurement of the own and the other partners’ performance level.
- . Comparison of performance levels, processes, practices, etc.
- . Learning from the other partners to introduce improvements.
- . Improvement

A implementation framework for automotive manufacturing but it has been validated with only six pilot case studies, not tested empirically. They have divided key performance measures in two categories, i.e. hard measures and soft measures. Hard or tangible measures include work-in-progress levels, lead-time, delivery-time, rejection (percent), rework (percent), product quality, product reliability, process cycle time, employees skill level, etc. The soft measures may include management commitment towards quality improvement, improvement in customer’s satisfaction for both internal and external customers, existence and practice of team working, employee’s

involvement, rewards and suggestion schemes, etc. Performance assessment model given by them involves broad areas of manufacturing, customer focus and business results. St-Pierre and Delisle (2006) have developed an expert diagnosis system for the performance. On the basis of data taken, they have observed that benchmarking improve their operational and financial performance. Tool to improve the Production Performance. It has integrated quantitative and qualitative information about the company. Hudson et al. (2001) have also recommended for taking steps to redesign the current performance measurement systems.

2.8 Problems in Supply chain management

Supply chain management must address the following problems:

- **Distribution Network Configuration:** number, location and network missions of suppliers, production facilities, distribution centers, warehouses, cross-docks and customers.
- **Distribution Strategy:** questions of operating control (centralized, decentralized or shared); delivery scheme, e.g., direct shipment, pool point shipping, cross docking, DSD (direct store delivery), closed loop shipping; mode of transportation, e.g., motor carrier, including truckload, LTL, parcel; railroad; intermodal transport, including TOFC (trailer on flatcar) and COFC (container on flatcar); ocean freight; airfreight; replenishment strategy (e.g., pull, push or hybrid); and transportation control (e.g., owner-operated, private carrier, common carrier, contract carrier).
- **Trade-Offs in Logistical Activities:** The above activities must be well coordinated in order to achieve the lowest total logistics cost. Trade-offs may increase the total cost if only one of the activities is optimized. For example, full truckload (FTL) rates are more economical on a cost per pallet basis than less than truckload (LTL) shipments. If, however, a full truckload of a product is ordered to reduce transportation costs, there will be an increase in inventory holding costs which may increase total logistics costs. It is therefore imperative to take a systems approach when planning logistical activities. These trade-offs are key to developing the most efficient and effective Logistics and SCM strategy.

- **Information:** Integration of processes through the supply chain to share valuable information, including demand signals, forecasts, inventory, transportation, potential collaboration, etc.

- **Inventory Management:** Quantity and location of inventory, including raw materials, work-in-progress (WIP) and finished goods.

- **Cash-Flow:** Arranging the payment terms and methodologies for exchanging funds across entities within the supply chain. Supply chain execution means managing and coordinating the movement of materials, information and funds across the supply chain.

2.9 Research methodology

2.9.1 SAP-LAP in Supply Chain Management

a) Situation: The environment constitutes the situation under which a business system operates and which significantly influences the outcome of the actions and processes of the business entities. Business entities have no direct control over the environmental Factors. They are entitled to decide their strategic action plans for doing business under the given situation and thereby alter their position. Business entities are constrained to make continuous efforts to assess their position versus present and most probable future situations

. How this organization is different from the competitors and from the other players in the

. What are the driving forces of this organization's success?

. What are the core competencies of the organization?

. Are the employees aware of supply chain and supply chain coordination?

. How many members are involved in the supply chain?

. What is the nature of suppliers and buyers?

. What initiatives they have adopted to coordinate with the suppliers and buyers?

. How is the basis for the relationship with suppliers and buyers?

. What kind of relationship prevails among manufacturing units?

. What efforts are made for intra-organizational coordination?

. What sort of flexibility lies in adopting the coordination mechanisms?

b) Actors: The decision-makers constitute the actors who assess the situation, use their specialized knowledge and judgment to produce and deliver products or services - that enables

- . How they define coordination?
- . Do supply chain members share information?
- . Are members ready to do all operations collaboratively?
- . What kind of flexibility is required to coordinate with each other?. How about the technical skills to implement new technologies?
- . What are the barriers they observed while coordinating with each other?

c) Process: The procedural steps taken by the actors to deploy technology, personnel and management attention to produce, deliver or tailor the products and services that offer unique value to their customers and shareholders constitute the process. Some processes may be explicitly identifiable while some others will be implicit. Any dynamic behaviour that alters the situation has the potential of being a process. . How the processes related to sourcing are coordinated with the suppliers?

- . What activities are coordinated?
- . Which coordination mechanisms are undertaken to achieve coordination?
- . How coordination is achieved with the buyers? What are the services provided to the buyers to remain competitive?
- . What is the expected outcome of coordination on the performance?
- . How intra-coordination is achieved?
- . How is the relationship between the employees inside the organization?
- . Is the information system able to coordinate inter-functional departments in intra organizational system?
- . What about the compatibility of information systems at each level of supply chain

In real life, it is difficult to identify all the factors of a given situation in the first place. Processes can hardly be defined unless the situation and strategies are clear. No meaningful actions are possible without mapping of the situation and deciding the supporting processes that would alter the situation. Actors cannot initiate any rational actions to alter the situation in favour of the company without knowing the cause and effect relationships. The cause and effect relationships

can only be learnt by observing the performance of the past in conjunction with the analysis of the situation and processes. Ironically, no actor will possibly know all the factors of the environment that significantly influence the performance of company's actions. Actors control the internal processes and actions with their knowledge and understanding plus assumptions about the future.

The flexibility model of SAP-LAP is used in this case study, as the supply chain coordination is an evolving area. This model will help in covering all the issues (soft and hard) of supply chain coordination between organizations and the gaps, which are to be filled flexibly by supply chain members in order to coordinate with each other nature, which deals only with the internal and external environment of an organization. On the other hand, the flexible model of SAP-LAP along with internal and external environment also considers the impact of dynamic environment on inter-organizational systems and intra-organizational systems. It seems that the traditional models are not able to capture the overall gamut of supply chain activities in a holistic manner. The traditional models are also weak in capturing the dynamics of changing environment and flexibility required to face dynamics. The proposed model not only discusses the issues of coordination only but also explains how to work on the issues, potential lie for some change, the impact of change, the extent of change, and the flexibility required to adapt the change. SAP-LAP 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 industry. These case studies have analyzed the issues regarding 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

When traditional performance measurement systems are analyzed two properties of this measurement system may be identified. First tracked performance matrix are usually based on financial accounting system. These performance measures allow companies to evaluate the past. Second these performance measures are insufficiency several performance measurement system have been developed during the last decade.

2.9.2 Best practices in SAP supply chain management

The supply chains at most organizations have become longer over time and contain more partners than ever before.

These longer supply chains are the result of vertical integration strategies yielding to first outsourcing and then off-shoring. In addition, organizations continue to add more products, more suppliers and more plants or distribution centers. They have also evolved their customer and product mixes, implemented new postponement or replenishment strategies, or simply scaled in volume, leading to a significant change in the structure of their supply chains.

As the assumptions used in the initial supply chain model change over time, its model and processes are not likely to keep pace with the changes. What was once a smooth and efficient supply chain can begin to show weak performance metrics. As organizations seek to improve their supply chain metrics, the key question is what best practices they should adopt. Based on the experience of Bristlecone with its customers, here is a list of 10 supply chain practices that an organization should implement as it seeks to improve its performance metrics.

- **Create a consensus demand plan:** An organization can get consensus on market requirements and business assumptions by incorporating new product introductions, product retirement, upcoming promotions, financial projections, investor commitments and sales forecasts into the demand planning process, and creating a consensus plan around it. Without building consensus, everyone has a different perspective of customer demand and it becomes difficult to synchronize demand and supply.

- **Ensure supply demand synchronization:** By using techniques such as Sales & Operations Planning (S&OP), as well as creating a supply plan that maps to demand while also incorporating key constraints, a company can ensure that it will be able to meet its delivery commitments without incurring expediting costs or higher inventory. Such capability not only reduces costs, but increases customer loyalty.

- **Streamline supplier interactions:** By providing suppliers ongoing visibility into their forecast and consumption plans, as well as current inventory status and planned receipts, manufacturers can get their suppliers to improve replenishment lead time and become more responsive to their

changing needs. It also allows them to implement programs such as Vendor-Managed Inventory (VMI), cut costs through reduction in inventory and safety stock, reduction in overtimes or expediting costs.

- **Get visibility into supply chain events:** Traditional supply chains are evolving into a worldwide network of suppliers and manufacturing or distribution facilities. Such an environment requires stakeholders to share any shipment or material information such as plans, current status or exceptions with each other in a timely manner in order to improve overall supply chain performance. Without the ability to provide such levels of visibility to each other, each stakeholder ends up continuously reacting to unplanned surprises with limited time to act, not to mention carrying extra inventory to compensate for such surprises. Visibility into shipments and material-related information promotes faster decision-making within the supply chain and enables each stakeholder to proactively respond to issues. Supply Chain Event Management (SCEM) addresses these requirements.

- **Automate trade compliance:** As organizations grow in scale through new products and expanded geographical markets, or setting up plants in other countries, or turning to offshore suppliers, manual methods of managing the export and import compliance process become exponentially more complex and time-consuming. Even significant increases in headcount may not resolve the issues. Streamlining the export and import management process brings benefits such as significant cost savings, improved productivity, fewer shipment delays and reduced risk of penalties and fines due to non-compliance.

- **Rationalize the supply base:** By reducing the number of suppliers, procurement managers can take spending on a category that is currently scattered among multiple suppliers and award that volume of spending to a smaller number of suppliers to gain volume discounts. Rationalizing the supply base also reduces complexity associated with new part introduction and simplifies supply collaboration.

- **Integrate engineering and sourcing into supply chain management:** New product introduction (NPI) and sourcing are key elements of effective supply chain management (SCM). Without expertly incorporating NPI into the supply chain planning process, a manufacturer runs

the risk of inventory write-offs or shortages of critical components. Similarly, the sourcing process should incorporate requirements such as ability to deliver in the right replenishment model, responsiveness and flexibility to react to sudden changes in business needs.

- **Continuously measure key performance metrics:** One best practice is getting visibility into key supply chain performance metrics on an ongoing basis and using that information to continuously improve the supply chain. SAP's upcoming supply chain performance management solution will help close the loop for its customers.

- **Focus on time and inventory:** While one can focus on improving multiple aspects of the supply chain, the greatest impact can be had by focusing on continuously improving on two fronts: increasing the velocity of process and information flow and focusing on activities and actions that can reduce inventory within the system.

- **Deploy an integrated solution:** When the supply chain capabilities of ERP systems were not as mature as they are today, best-of-breed solutions were the preferred approach. However using such systems created information integration issues.

These 10 best practices can allow manufacturers to increase the efficiency and effectiveness of their supply chains.

2.9.3 Balanced Scorecard Approach in performance measurement system

Kaplan and Norton (1996) developed the Balanced Scorecard (BSC) at the end of a sponsored one year multicompany study. The study was motivated by a belief that existing performance Measurements approach, primarily relying on financial accounting measure was becoming obsolete. The BSC complements financial measure of past performance with measure of driver of future performance. According to Kaplan and Norton (1996) financial and non-financial measure must be a part of the information system for employee at all levels of the organization. The pressure for short term financial can causes companies reduce spending on new product development, process improvements, human resource developments, information technology , database and system as well customer and market development. In the short run ,the financial accounting model report these spending as increase in report income, even when the reduction have cannibalized company stock of assets and its capabilities for creating future value.

A balanced SCM scorecard has been proposed and developed discuss the several measures and metrics of SCM.

- It points out the importance of key players in the performance measurement of SCM, and the nature of roles they need to play.
- A balanced performance evaluation of SCM such as, balanced scorecard not only helps organizations in faster and wider progress monitoring of their operations but can also help them in improving their internal and external functions of business such as engineering and design applications, production, quality improvement, materials management, quick response, gaining lost market shares, proper implementation of business strategies etc.
- This articulates the experiences of application of balanced SCM scorecard specific to automobile company in India, throwing light on the management of supply chain by conducting case studies. It focuses on critical factors that are likely to contribute for the successful performance measurement of SCM.

The BSC provide executive with a comparative framework that translate company vision and strategy into a coherent set of performance measure organised into four different perspectives: Financial perspective, customer perspective, internal business process perspective, and learning and growth perspectives. In what follows is the description of those four perspectives.

a) Financial perspective

Since financial measures are valuable in summarizing the readily measurable economic consequences of action already taken, the BSC retains the financial perspective. Financial measures indicate whether a company's strategy, implementation, and execution are contributing to a bottom line improvement. During the development phase of the BSC of financial perspectives, executives should determine appropriate financial matrix for their strategy. Every selected measure should be a part of link of cause and effect relationship that culminate in improving financial performance.

Kaplan and Norton (1996) identify three stage of business strategy: Growth, Sustain, and Harvest. They also state that the financial objectives for business in each of these stages are quite different, thus selected performance measure should also be different.

b) Customer Perspective

In the customer perspective of the BSC manager identify the customer and market segments in which business unit will complete. They also identify the measure of the business unit’s performance in these targeted segments. The core measures include customer satisfaction, customer retention, new customer acquisition, customer profitability, and market and account share in targeted segments. The customer perspective enables business unit managers to articulate the customer and market based strategy then deliver superior future financial return. The case studies given in Kaplan and Norton (1996) show that all value propositions typically incorporate measure related to the response time, quality and price of customer based process. They also give a brief discussion of representative measure that can capture the time, quality and price dimension. These representative performance measure are given in table 2.1

TIME	QUALITY
Respond Rapidly	Defect free delivery
Reliability of lead time	Customer perceived quality
Short order to delivery lead time	Returns to customer
On time delivery	Warranty claim
Time to market	Field service request
	Performance of promised delivery time

Table 2.1 Representative performance measure

c) Internal Business Process Perspective

In the internal business process perspective, executives identify the critical internal process in which the organization must be excel. These processes enable the business unit to deliver the value propositions that will attract and retain customer in the targeted market segment, and

satisfy shareholders expectations of excellent financial returns. The internal business process measure focus on the internal process that will have the greatest impact on customer satisfaction and on achieving origination financial objectives.

The difference between traditional performance measurement and the BSC is that, while traditional approaches attempt to monitor and improve existing business process, the BSC approach will usually identify entirely new process at which organization must excel to meet customer and financial objectives.

Kaplan and Norton (1996) provide a value chain model template that can be used by companies to customize their internal business process perspective. This model encompasses three internal business processes: innovation, operation, post sale service.

d) Learning and Growth Perspectives

The fourth perspectives of the BSC identify the infrastructure that the organization must build to create long term growth and improvement. Organization learning and growth come from three principal sources: people, system and organization procedures. These perspectives provide the infrastructure to enable ambitious objectives in the other perspectives to be achieved. Kaplan and Norton (1996) identify three principal categories for learning and growth perspectives based on their experience in building BSC across a wide variety of service and manufacturing organization. These categories are: Employment capabilities, information system capabilities, motivation.

CHAPTER: 3

CASE STUDY OF LEADING AUTOMOBILE COMPANY

3.1 Introduction

The supply chain management helps to provide a baseline of success for the business. The automotive companies widely in growth trends, economic distinctiveness, competitors, and technological issues. The assessment of these two key areas will affect how the position of company within the supply chain, for the customers, and development of basic competitive strategies. Supply chain analysis of a automotive company uses basic factors and sub factors like culture & people, measurement and feedback, customer focus and orientation, continuous improvement and learning, Innovation management, empowerment & team work, system& techniques , strategic management, transportation and logistics, marketing, relationship and partnership, best practices, Organizational behavior, Organizing techniques, marketing, transportation and logistics and strategic management. This analysis assists the company to think strategically about industry's overall performance in complete supply chain and draw conclusion regarding the potential for growth & profitability and effectiveness.

3.2 Company profile

ABC Ltd. is family run company, which started its operation in 1966 with vision of becoming a supplier of Quality Machined Parts for the Original Equipment manufacturers. In 1977 with the coming of Majestic Auto Ltd., a unit of Hero Group, there was a strong need of good Quality Parts Suppliers. The Company becomes an Automatic choice for this company due to its commitment towards quality and on time delivery. Since then the company is supplying to this two wheeler company.

Today, the company is a leading Vendor of components for two and four-wheeler OEMS in India like Hero-Honda, Honda, Maruti, TVS, Bajaj, LML, Kirloskar, with the turnover of Rs. 450 million (2007-08) with market share 40% and current year growth in all respect is targeted to be 25% higher than the previous year. The company's products include parts of electricals, Nuts, Washers and Bolts apart from two and four wheeler components & Bright Bars of various

sizes & shapes. The company has got ISO 9001:2000 Certification from BVQI, which shows the company's commitment towards quality.

One of the biggest advantages that the company enjoys the wide variety of machines. As a result, the customer can get a wide variety of products from this company. It supply pipe assemblies, hose assemblies, tubings, multi layer hoses, stainer assemblies, moulded components, pipes, and so on for all kinds of worldwide automotives. They are enlarging their products line and more products are available upon inquiry. This is the one-stop auto parts supplier, focussing on high quality and customer satisfaction.

MAIN PRODUCTS

- Fuel Injection Pipe Assemblies
- Brake Tubes
- Teflon Hose Assembly
- Rigid & Fabricated Pipes
- Low Pressure Flexible Hoses
- High Pressure Hoses
- Nylon Tubings
- Multi Layer Hoses
- Stainer Assemblies
- Fuel & vaccume Hoses
- Radiator Hoses
- Moulded Components
- Piston Cooling Nozzle
- Leak Off Pipe
- Silicon Hoses
- Power Steering Hoses
- Hydraulic Brake Hoses

- **Machine shop**

The machine shop at the company has variety of precision machines required for the high quality components. The machines include hydraulic copy turning, automatic troubles, Semi automatic drilling/boring, center less grinder, broach machine, milling machine, thread rolling, tapping, power & hydraulic presses, turning, draw bench up to 100MM and other related machines.

- **Quality systems**

ABC Pvt. Ltd. is an ISO 9001: 2000 Certified Company. It got the certification in 2002 from BVQI. Quality systems at the company are well established and implemented to ensure that only customer specified products are supplied to the customer and thus to achieve customer satisfaction. Quality improvement is the foremost activity of this organization. Quality management in ABC Ltd is a method for ensuring that all the activities necessary to design, develop and implement a product or service are effective and efficient with respect to the system and its performance and Coordinating activities to direct and control an organization with regard to quality. Establishing and maintaining a strategically viable quality system in ABC Ltd, senior management defines the roles played by groups, departments, or functions within the ABC Ltd using risk/benefit analysis to determine the best fit in terms of logistics, costs, and capabilities. While there are many skills and responsibilities needed to continuously improve a quality system, the main which ABC Ltd apply to people in four roles: executive management, functional/departmental management, management representative, and quality assurance/quality control functions. ABC Ltd does open communication and genuine commitment for the good of the organization. In addition to establishing priorities and providing resources to accomplish required activities, management usually led by example. TQM is a system approach to quality management. It refers to complete commitment to quality in all spheres of the organization. ABC Ltd decided to focus on policy deployment and Daily Routine Management (DRM) to achieve their TQM implementation. As a result, ABC Ltd redefined its management of processes for new product development system, manufacturing quality, supplier quality and customer quality. In the new system, each manager is required to define his role, his metrics, his measurement of performance to date and steps being taken to improve performance.

Consistent Quality Requires Consistent upgrading Processes.

ABC Ltd takes care of the quality of the product at every stage of production.

- Product Quality Planning
- Pre Production Feasibility & Commitment
- Quality Planning Processes
- Flow Diagram

- Failure Mode & Effect Analysis (FMEA)-Process
- Process Control Plan
- Process Capability Analysis
- Gauge calibration and gauge R&R study tool & fixture control
- Supplier selection and approval
- Production part level control plan process
- Production Parts Approval Process (PPAP) Validation
- Production Qualification (PQ)

Incoming Inspection: Initial sample evaluation, Regular Supply Inspection, Supplier quality monitoring.

In process Inspection: Initial setup approval stage inspection, online testing line rejection analysis.

SPC: Critical process control charting process capability study.

Final Inspection: Fitment / Functional dimensional visual packing

-Work force

The work force of the company is its biggest asset. The efficient and dedicated work force has been the main reason behind the growth of the company. This work force over the years has been open to changes and improvements to face and overcome the ever-growing competition in the market. Regular training is given to the staff and workers by both outside experts and in-house faculty. The training topics range from latest technology to good human Behavior. All aspects of production and quality are covered. No worker is allowed to work in the factory without getting proper instructions and job training. The employees of the company always welcome new methods to improve productivity and quality.

- Ethical and fair dealing:

The biggest benefit our customers can get is ethical and fair dealing of the company. The Company believes that ethics come first and the basic need of a strong supplier customer relationship.

- Wide range of Products:

The company has a wide range of machines and capability to make many more with the vast range of infrastructure and dedicated suppliers. Different types of products can be sourced from our company hence saving precious time of the customers in dealing with separate suppliers.

- Good Technical Manpower:

The company having a strong technical people in both staff and work force, which help in making good quality products as, they understand the importance of quality. Any requirement of customers are hence easily understood and implemented.

- 100% Commitment:

We are fully committed to achieve and exceed our customer's expectations in all the fields be it quality, delivery. Cost and other stated and implied needs of our esteemed customers. Table: 3.1 shows the Plant wise product detail of ABC Ltd.

Table: 3.1 Plant wise product detail

S.NO.	Plant	Product manufacture
1	Faridabad	Fuel Injection Pipe Assemblies ,Brake Tubes ,Teflon Hose Assembly ,Rigid & Fabricated Pipes ,Low Pressure Flexible Hoses ,High Pressure Hoses ,Nylon Tubings ,Multi Layer Hoses ,Stainer Assemblies ,Fuel & vaccume Hoses ,Radiator Hoses ,Moulded Components
2	Pune	100cc and 125cc motorcycle component production.
3	Chennai	The company's products include parts of electricals, Nuts, Washers and Bolts apart from two and four wheeler components & Bright Bars of various sizes & shapes.
4	Lucknow	The company's products include parts of Scooter & 125cc motorcycle premium components.

Following are the major milestone of ABC Ltd shown in table 3.2

Table: 3.2 ABC Ltd mile Stones

1969	Established as a partnership firm and started assembling full hoses in a small area (30 sq. mtr).
1978	Rubber processing facilities for manufacture of rubber hoses.& Supplies to Telco as O.E. Supplies to Escorts as O.E
1982	Manufacturing of F.I. pipes started in bulk.
1989	Collaboration with Meiji Rubber for brake hoses Supply of fuel injection tubes for Railway Traction Locomotives.
1992	Commenced manufacture of high pressure hose assemblies at new unit at plot 94,sector-25, faridabad. ISI certification obtained for brake hoses.
1997	ISO 9002 accreditation. Self certification for auto Malt Telco, Pune Technical collaboration with Gates, USA.
2000	QS-9000 accreditation for all plants (Plant-I,II,III,IV).Global supplier to JCB, John-Deree & Cummins
2004	Certification TS-16949

As per company policy, the company is committed to meet customer perception, stakeholder expectations and applicable regulatory requirements through: -

- Orientation towards continual improvement in quality, cost and delivery
- Innovation in process, product and service.
- Development of people for improved effectiveness and efficiency.
- Promotion of work culture that encourage team work and mutual respect.
- Optimization of supply chain management.

3.3 Future outlook of ABC Ltd.

Current trends indicate a smooth run for the auto component industry. In fact, since 2000, this is one sector which has made a global mark and has been identified as a sunrise industry. The industry is transforming from being highly domestic-centric, to a force ready to face global competition.

The factors that will drive growth for the auto component industry are:

- The growth expected in the domestic automobile industry will give a fillip to the auto component sector. The Indian automobile industry offers great potential considering the low penetration along with rising income levels and a rapidly growing middle class. These factors will see a boost in demand for vehicles, especially passenger cars and two wheelers. These two segments are estimated to grow at between 10-12% for at least the next five years.
- The entry of global OEMs, making India as their manufacturing base, has given a big boost to the industry. For instance, Skoda plans to source parts for its European operations from its Indian base and raise indigenization level for Indian models to 70%. This trend has also enabled Indian companies to gain a competitive edge in the global market. Further, the model of cluster-based development prominent in this sector will provide economies of scale.
- Export of automobiles has also emerged as a key component of growth. Rising exports of Indian-made vehicles like M&M's Scorpio model, Bajaj Auto's Bikes, Tata Motors' City Rover are indirectly increasing the demand for Indian auto components. Also, the export of India-made models of global OEMs.
- De-regulation and the Government's policy initiatives have facilitated growth and focus has now shifted towards attracting foreign direct investments. Also, the Government's initiative towards road development will give a boost to demand for vehicles and indirectly auto components.
- The Government's initiatives towards opening up channels of finance.
- Investments coming in for research and development will keep the industry abreast of the latest technology.

These factors portend a robust auto ancillary industry in India and the overall expected good growth will provide several opportunities for the emergence of new enterprises. Extending their reach to global markets is the pre-dominant outlook among the top auto component manufacturers in the country. The vision to compete globally comes from the inherent strengths the Indian auto component industry possesses. Some features are:

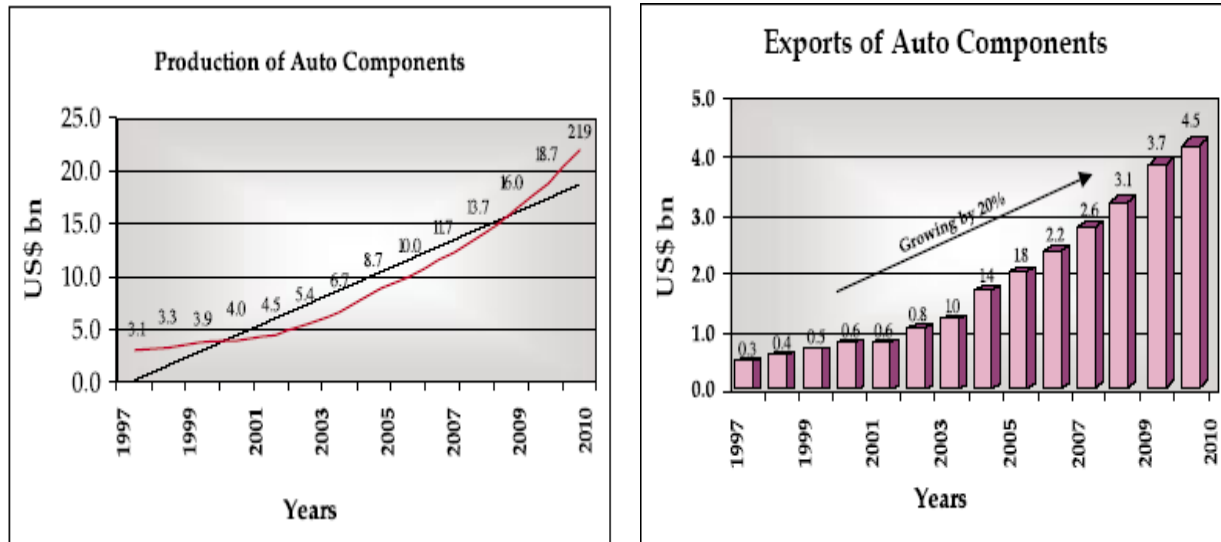
- Cost reduction of 25-30% in production in the domestic market compared to overseas
- Low labour costs
- Designing, engineering and technical skills
- Established quality systems
- Availability of raw materials
- Adaptability to new technology
- Investments in research and development, coming in from global OEMs. This stands out positively in favour of India. Key players are not only willing to invest in R&D but also in mechanical and engineering operations. These investments are expected to increase in the near future

Though India rides on these inherent strengths, a few risks exist that the auto component manufacturers may have to confront.

- A global slowdown can derail the prospects of the industry.
- Volatility in the prices of metals and other inputs could erode the industry's cost competitiveness. Further, global OEMs expect a commitment of 5-10% reduction in prices every year.
- Manufacturers taking up Greenfield projects overseas.
- Intense competition from counterparts in other emerging economies may add pressure on margins of manufacturers.

The Indian auto component industry is poised for robust growth till 2010. There is a perceptible exuberance in the industry and growth estimates indicate a booming industry. Going by current trends in production and exports of auto components, indicate a doubling of the domestic auto component industry by 2010. The production of auto components could grow to US\$22 bn by 2010. Similarly, India's exports of auto components could grow to US\$4.5 bn as compared to US\$1.8 bn in 2005. Expected growth in production and exports of auto components is shown in the figure 3.1

Figure - 3.1 Expected growth in production and exports of auto components



The overall trend is encouraging, but remaining competitive in this changing scenario will be the toughest challenge. The combination of low manufacturing costs along with quality systems would give an edge to companies in terms of pricing and quality. Expansion and diversification will help break into new markets. It would be imperative for these companies, which are largely based on traditional management practices, to imbibe technology in a big way. The auto company can exploit these opportunities through joint ventures, collaboration and technical tie ups. Knowledge, specialization, innovation and networking will determine the success of the company in this globally competitive environment.

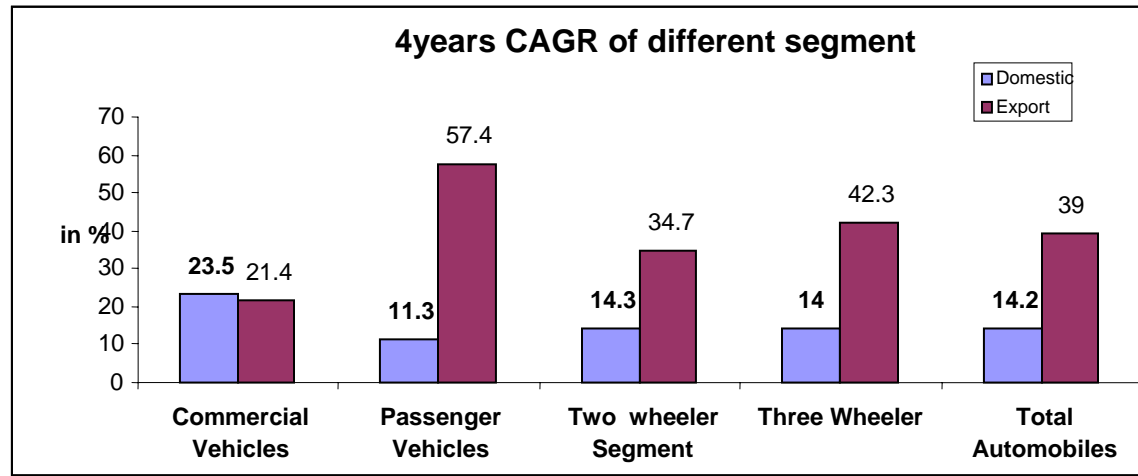
3.4 Demand Conditions of ABC Ltd:

The India automotive sector has a presence across all vehicle segments and key components. In terms of volume, two wheelers dominate the sector, followed by passenger vehicles with 13 per cent. The industry had few players and was protected from global competition till the 1990s. After government lifted licensing in 1993, 17 new ventures have come up. At present, there are 22 suppliers of passenger cars, 15 suppliers of multi utility vehicles (MUVs), 19 suppliers of commercial vehicles, 21 of two wheelers and 14 of three wheelers, besides 15 suppliers of engines more than SMEs. With the arrival of global players, the sector has become highly competitive.

The production and domestic sales of the automobiles in India have been growing strongly. While production increased from 4.8 million units in 2002-3 to 8.5 million units in 2007-8. That

is a **Compound Annual Growth Rate (CAGR)** of over 15 percent, domestic sales during the same period have gone up from 4.6 million to 7.9 million units (CAGR 14.2 per cent) as shown in figure 3.2

Figure: 3.2 CAGR of different segments in last four years

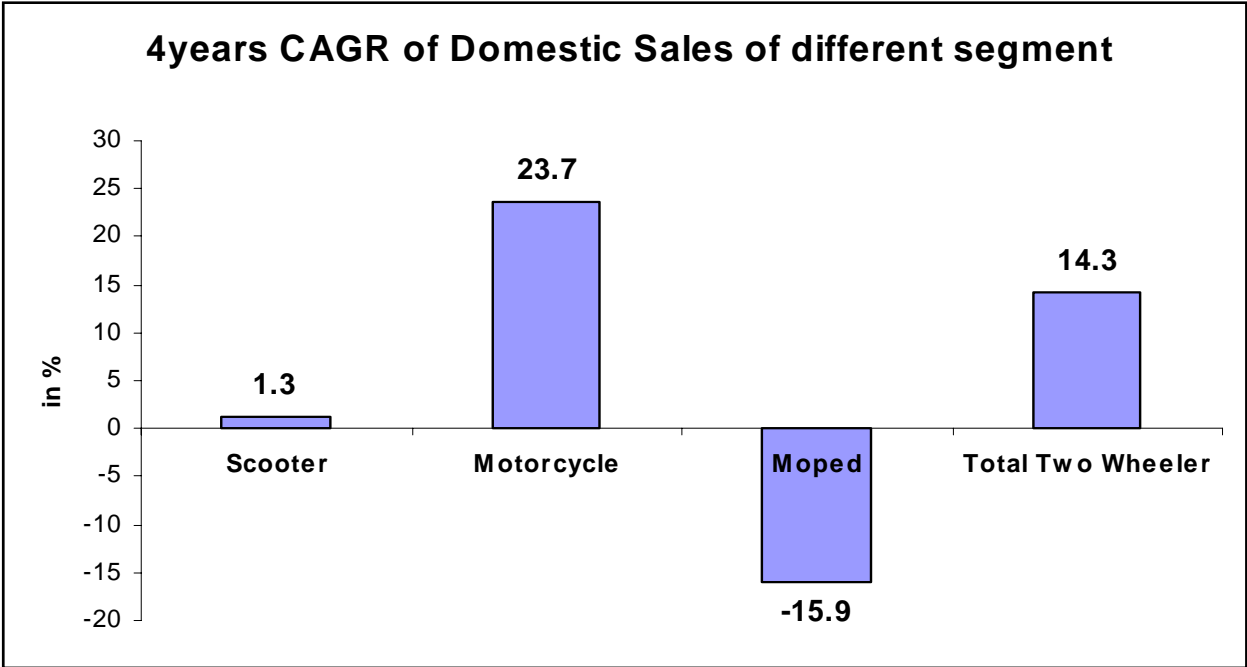


Source: Society of Indian Automobile Manufacturers (SIAM)

A positive trend in the domestic market is that the growth has not been driven by one or two segments, but is consistent across all key segments. Two wheelers components, which constitute the majority of the industry volume, have been growing at a rate of 14.3 per cent, the production of two wheelers in India increased from 3.76 million vehicles in 2001 to 6.53 million vehicles in 2005. Figure: 3.3 while the domestic sales of automobiles components have been increasing at a significant rate, exports have taken a quantum leap in recent years. The exports of automobile components from India have been growing at a CAGR of 39 per cent for the past four years.

It is shown in figure: 3.3 that domestic sales have been increasing at a CAGR of 14.3 per cent for the past 4 years. Motorcycles component constituted 79.5 per cent of the domestic sales of two wheelers in India and have been growing at nearly 24 per cent CAGR. In the scooter segment, overall domestic sales grew by 1.3 per cent CAGR, driven primarily by un-gearred scooters and scooters with automatic gears. The sales of mopeds have declined at a CAGR of 15.9 per cent for the past four years.

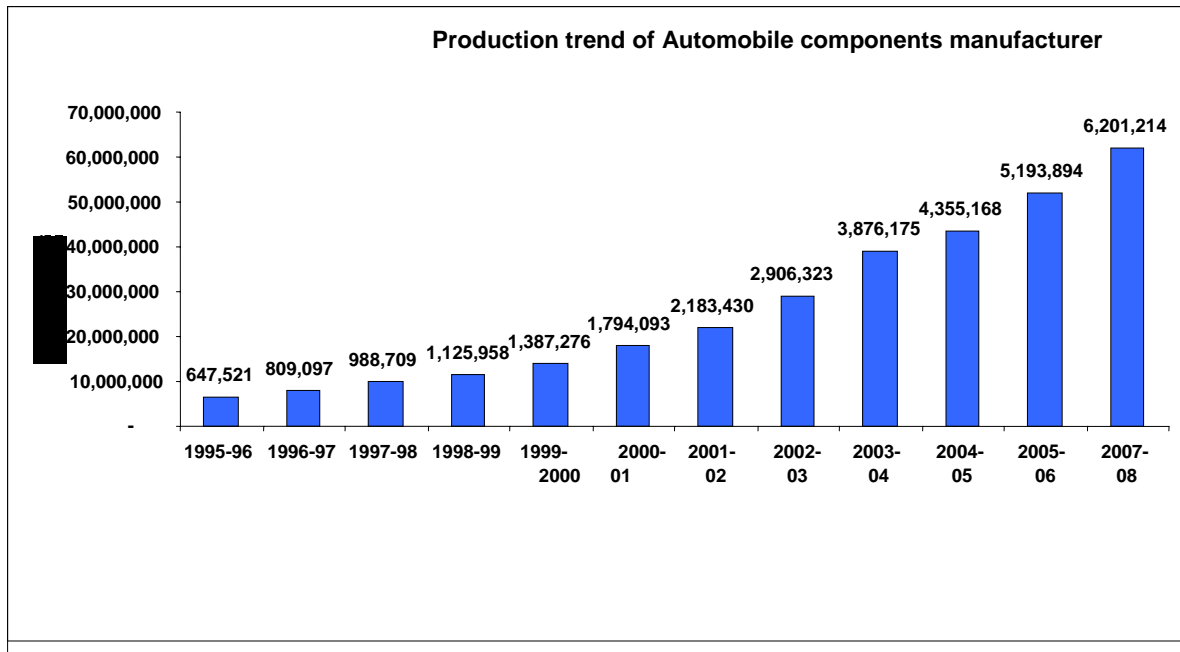
Figure: 3.3 CAGR of domestic sales of different segments in four years



Source: Society of Indian Automobile Manufacturers (SIAM)

The motorcycle segment clearly drives the growth of the two wheeler segment in India. The two wheeler segment is being shaped by changing demographics and lifestyles. An increasing number of working women and greater affluence among college goers have led to an increase in demand for without geared /auto geared scooters. As with the case of passenger vehicles, there is a rising demand for higher-end models that combine style and performance in this segment as well. In motorcycles, for example, models with higher engine capacities are proving very popular. Figure: 3.4 shows Production trends of automobile components manufacturer.

Figure: 3.4 Production trends of automobile components manufacturer

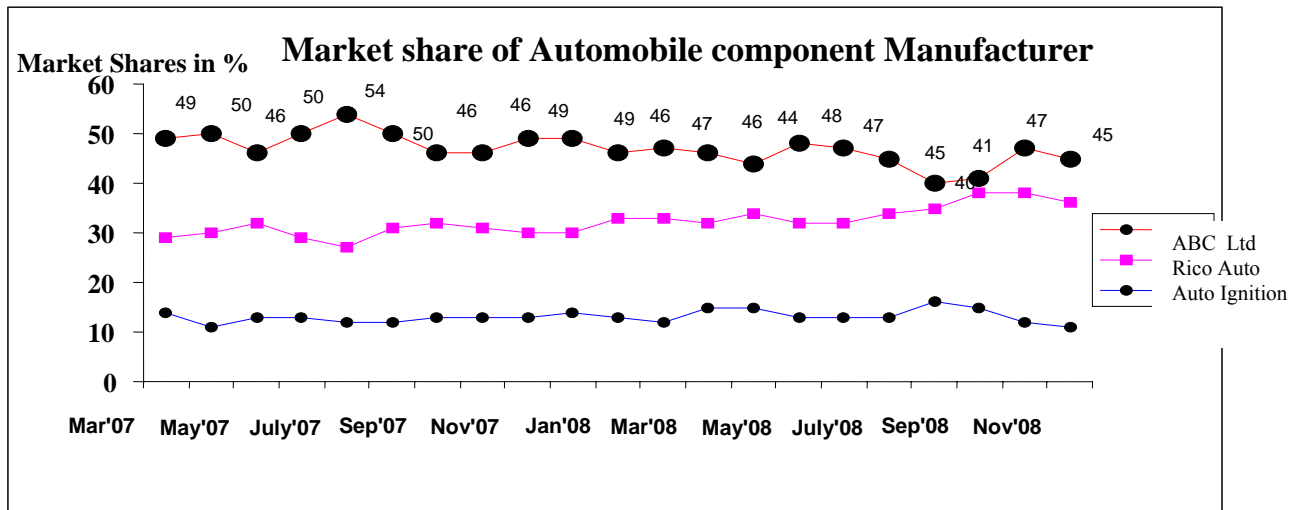


Source: Society of Indian Automobile Manufacturers (SIAM)

Two wheeler penetration levels in the country are still low and there exists tremendous potential for the two wheelers sold, ABC Ltd expect the two wheeler component industry will grow in the range of 12-15% p.a. with motorcycle segment growing at a slightly higher rate.

ABC Ltd crossed the unit sales threshold of 5 million units in the FY(financial year) 2005-06, which is a worldwide first. This helped the company achieve the distinction of having a 15 million strong customer base since its inception. The company maintained its market share position with a healthy 40% share in automobile components industry. During FY 2007-08, the company plans to achieve double digit growth rate in sales for the year. Data given in figure 3.5 shows ABC Ltd is competitive as compare to its competitors in market shares.

Figure: 3.5 Market share of two wheelers manufacturer



Source: Society of Indian Automobile Manufacturers (SIAM)

3.5 SAP-LAP analysis for the case study

This analysis refers to the current situation of a supplier network of the company. This industry is also characterized by outsourcing of manufacturing and R&D to suppliers, short product life cycles, compressed time-to-market and increased demand for on-time deliveries and generally short lead times. The ABC Ltd. industry shows a similar tendency, but R&D and final assembly are mostly conducted by the original equipment manufacturers (OEM). But in the not-so-distinct future also, in the automotive industry a power shift from OEMs to suppliers will be expected. The company under consideration is faced with keen competition and, consequently, it is forced to keep its costs low (company strategy). In addition, this supplier has to operate in a supply chain that can be characterized as agile (supply chain strategy), i.e. supply has to react quickly and flexibly (service level is the market winner) to the changing demand.

3.5.1. Process description

To remain competitive in today's dynamic market the organization has to deliver good quality products in short time and in right quantity. The quality of product is highly dependent on the

quality of raw material and the components of product. An organization may spend about 60-70 per cent of its overall value on procurement coordination issues process. The manufacturer put great effort on supplier selection, supplier development, supplier evaluation, and optimization of supplier base. There are approximately 250 components required to manufacture one pump in one of the four manufacturing plants of ABC Ltd. These components are supplied by 19 local suppliers. Some of the components are also imported from its parent European company. ABC Ltd. offers around 300 types of pumps. The total purchase value is Rs. 6 cores that is about 30-40 per cent of total budget allocated. It can be observed that to manage such a large number of suppliers is not an easy task. ABC Ltd. is among the leaders in automotive parts industry. However, to sustain the leading position, ABC Ltd. has to continuously improve the performance. The implementation of various supply chain coordination mechanisms can further cut down the costs and result in more profits for both the suppliers and the manufacturer process flow.

The internal supply chain process includes three stages. Originally, the whole supply chain process (Fig. 3.6) is forecast driven because the average cycle time from the raw material storage and component storage manufacturer II to departure of the finished products to the customer is longer than the requested delivery time ($T_d=5$ days). The customer provides rolling forecasts every week for the next 6 weeks on a weekly basis. The frozen horizon is one week.

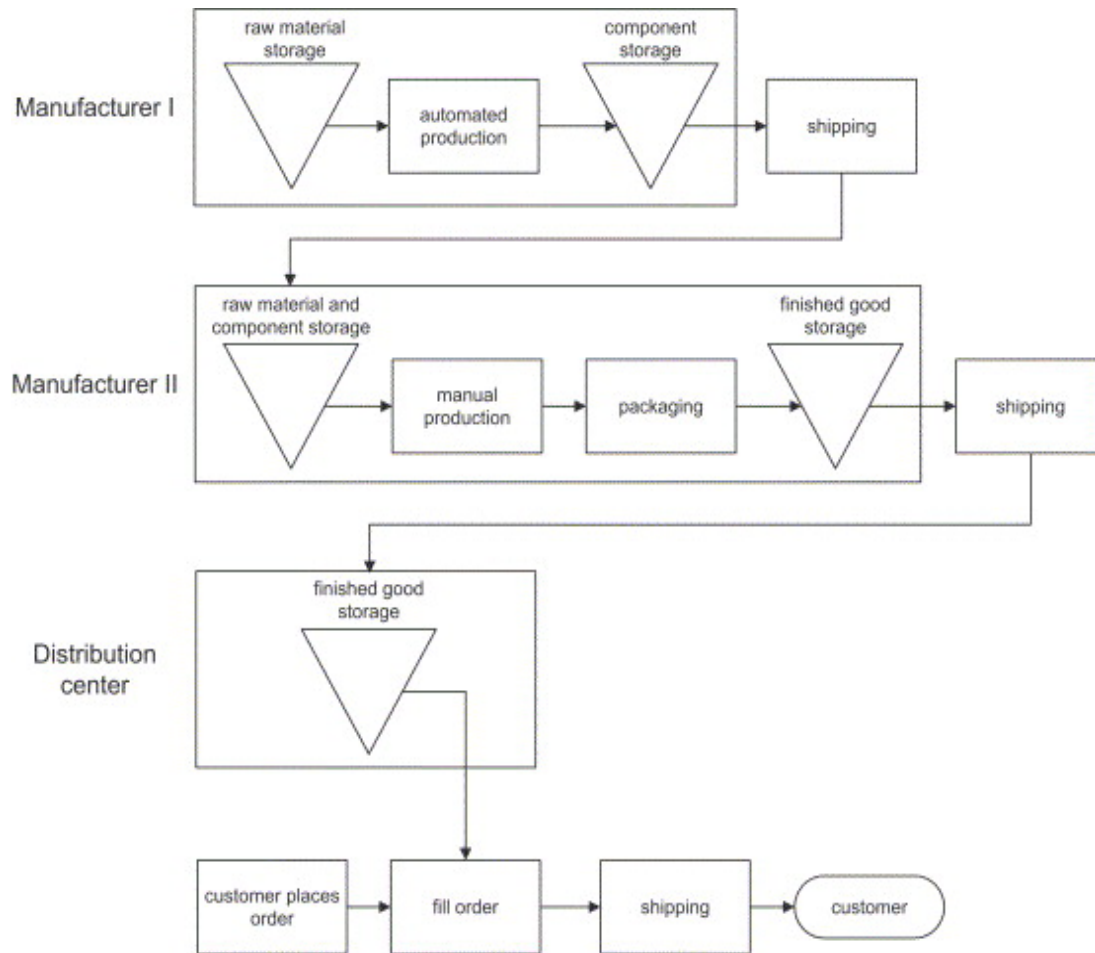


Figure: 3.6 Original supply chain of ABC Ltd

3.5.2 Development of frame-work for study in ABC Ltd:

Supply chain coordination can be achieved by joint efforts of dependent members of supply chain. It requires efforts at individual level, organizational level, and at inter- Organizational level. SAP-LAP model is very effective tool to analyze the case study to explore the present situation in ABC Ltd. 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. Based on these learning issues, corrective actions may be suggested to improve the supply chain coordination as well as the flexibility required to implement different coordination mechanisms. The impact of these proposed actions on the performance is visualized in the context of ABC Ltd. shown in figure 3.7

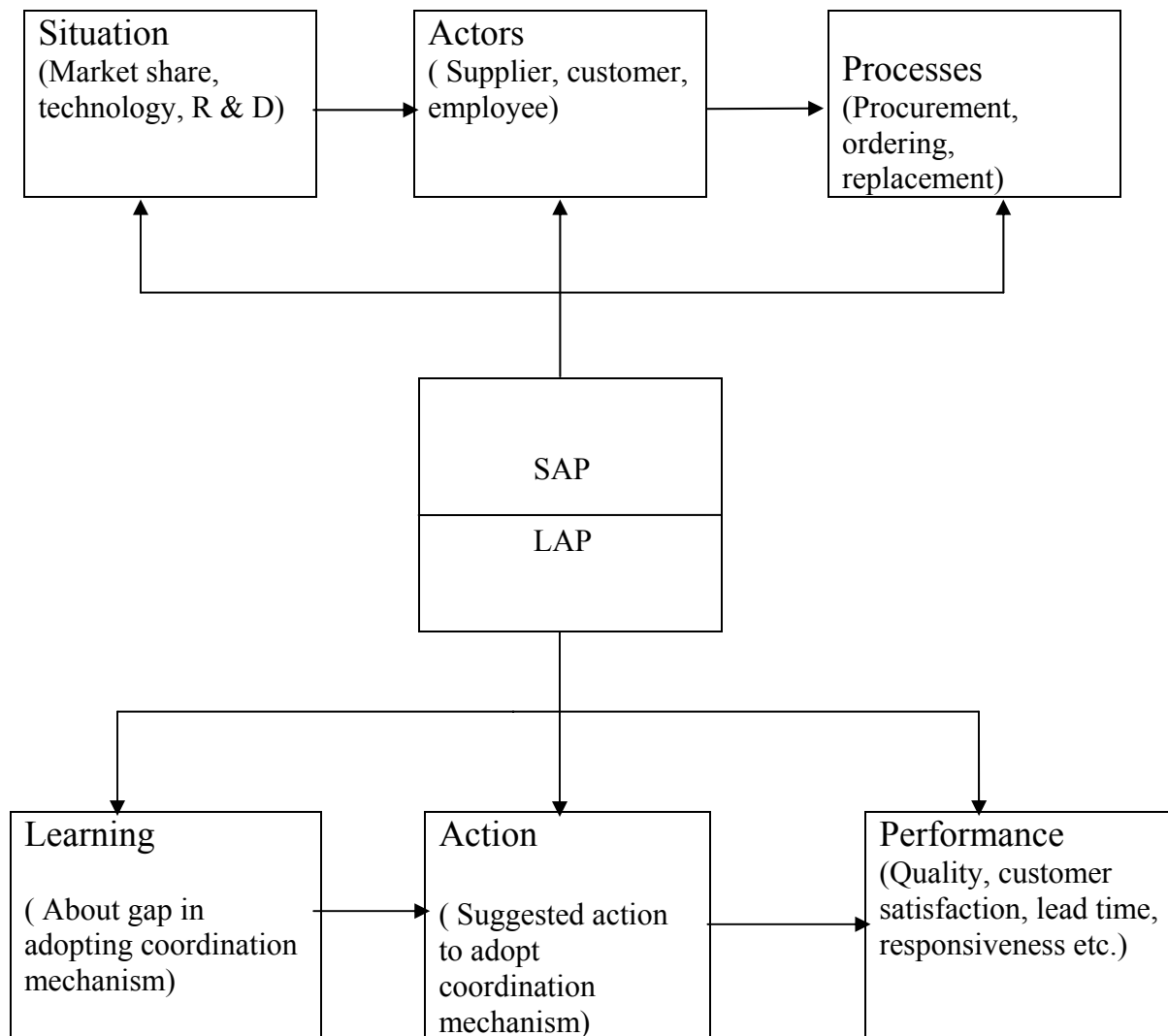


Figure: 3.7 Development of SAP-LAP framework

a) Situation

The situation represents the present status of ABC Ltd. in terms of market share, technology, R&D, flexibility, competitive advantage, and the performance measures. The competitiveness in the situational parameters help ABC Ltd. to coordinate with the suppliers and buyers. The executives of ABC Ltd. were interviewed to gauge the following situational parameters about the status of coordination in ABC Ltd. ABC Ltd well-known auto ancillary companies in India and connected with European company.

The ABC Ltd. has an overall market share of 30 per cent in fuel injection pumps (FIPs) and 35 per cent in spark plugs. Fuel injection equipment spares and components contribute to about 34 per cent and spark plugs to about 5 per cent to the turnover. The other products include auto electricals, special purpose machines, hydraulic and pneumatic equipment. Research and development efforts meet the European emission norms for FIPs. The R&D center of ABC Ltd. has been designated as a global development center for single cylinder and multi-cylinder diesel FIPs. FIPs typically form 3-4 per cent of the vehicle cost, making it a critical component. ABC Ltd. also manufactures a range of hydraulic products and power tools.

ABC Ltd. has a professional management set up, which emphasizes on continuously modernizing and upgrading the product range. ABC Ltd. has developed an ever expansion strategy for the introduction of new products and accordingly their coordination issues have set up four plants in India to meet the expected growing demand.

The parent European company has opened one global development center, which is dedicated to provide world-class technological solution for the auto industry. It has over 193 qualified and experienced engineers and technicians. Its main aim is to develop the products in tandem with the specific needs and the need of new generation vehicles to cover broad customer segment. The first priority of ABC Ltd. is to deliver quality products and quality service.

In ABC Ltd., 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 same concept of coordination between different functional departments is extended to inter-organizational systems to improve the performance of supply chain of ABC Ltd. The inter-organizational coordination can be better achieved by identifying and working on the gaps in coordination with the other members of supply chain. These gaps can be filled by understanding the needs of members, objectives, technology, schedules, expectations, flexibility, and align these attributes of other members with the attributes of intra-organizational system.

- PRESENT PRODUCTION IN NUMBER

Product Group	Quantity Unit pcs per year
Brake Hose Assemblies	1020000
Brake Tube	1500000
Export	2400000
Fabricated Hose Assemblies	3780000
Fuel Hose	840000
Fuel Injection Pipes	2760000
Hydraulic Hose Assemblies	1800000
Low Pressure Flexible Hose Assemblies	5160000
Nylon Tube	260000
Rubber Hose	12000000
Teflon Hose	832000

Table 3.3 showing Production in numbers

b) Actors

There are more than 900 employees working in ABC Ltd. The employees are motivated and creative. The strategic decisions in all four manufacturing plants are taken jointly. ABC Ltd. 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 Ltd. ABC Ltd forms long-term partnership with their suppliers and buyers. To maintain long-term partnerships, ABC Ltd. regularly organizes meetings with members of supply chain. These meetings are considered to be very important. These meetings give motivation to suppliers and buyers to coordinate with each other. The vision of long-term relationship makes all the members of supply chain more aligned while dealing with commercial transactions. It is believed that the good relationship may result from the trust and commitment between the members developed with time. The commitment is visible from the fact that the supplier always sends the committed quantity to ABC Ltd. in time, which in turn has streamlined the flow of material in the supply chain. The concept of coordination is visible within ABC Ltd. as cross-functional teams are developed. These teams work together to select the suppliers. The team members are from different departments like

purchasing, production, and quality assurance. 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. Use of Technical center facilities and adoption of new technologies have motivated the employees to be more innovative. There are about 193 technical experts, who are engaged in developing new products to understand the specific needs of the customers. An impressive increase in the demand (almost double) compared to the last year' demand is an evidence of good quality of service provided to the customers. Sales and production people meet very frequently to plan for future demands.

The concept of intra-organizational is extended to achieve coordination in inter-organization system. The actors of ABC Ltd. from different functional units jointly take decisions regarding demand projections and production. The same concept is also extended to inter-organization system, where ABC Ltd. 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.

With a workforce of 900 people ABC Ltd, achieved sales of Rs. 40 million for Year 2004. ABC Ltd. has warehouse in Detroit, London Jamshedpur, Lucknow & Pune with the total area of 55,205 SQ. MTS. land and 17,870 SQ. MTS. Building.

Employers

Managers	48
Engineers	107
C.Staff	86
Workers	659
Total	900

Table 3.4 showing employer's classification

c) Processes

Supply chain deals in managing dependencies between supply chain members. These dependencies can be seen at the interfaces of supply chain: between supplier-manufacturer, manufacturer–distributor, distributor–retailer, and retailer– customer. All the members of supply

chain are dependent on each other to carry out different processes like procurement, production, and distribution. The procurement process and distribution process requires coordination across the boundary of an organization whereas internal coordination is required to carry out the production process. While procuring the raw material the suppliers and ABC Ltd 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 Ltd. 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 Ltd. work in close relationship. The efforts put in and required by ABC Ltd. at different interfaces of supply chain are explained below.

- Supplier Management:

The quality of what goes into a product or service determines the quality of what comes out. Here's how to keep costs low and quality high. Performance means taking inputs (such as employee work, marketplace requirements, operating funds, raw materials and supplies) and effectively and efficiently converting them to outputs deemed valuable by customers. The manufacturing industry is in a special situation: Much of what manufacturers purchase is then incorporated into their products. This means there is a higher inherent risk, or potential impact, in the manufacturing customer-supplier relationship. For this reason, manufacturers often develop detailed supplier-management processes. While marketing focuses downstream in the supply chain, sourcing and supplier management looks upstream to suppliers. Make/buy decisions fall into this category, as does global sourcing. The location category addresses the location of ABC Ltd own facilities, while this category pertains to the location of the ABC Ltd's suppliers. Supplier relationship management falls into this category as well. ABC Ltd and its suppliers are putting part specifications on the web so that dozens of suppliers can bid on jobs. ABC Ltd, for instance, is planning to develop a trading process network that allows many more suppliers to bid than was possible before. The suppliers have developed a similar capability; and much of them make use of game theory to understand supplier relationships, contracts, and performance metrics. The information and electronic mediated environments category addresses long-standing applications of information technology to reduce inventory and the rapidly expanding area of

electronic commerce. Often this subject may take a more systems orientation, examining the role of systems science and information within a supply chain of ABC Ltd.

- Inventory Management:

A good inventory management system has always been important in the workings of an effective supply chain. New technologies and collaborative methods of working with trading partners will revolutionize this practice. Those who embrace, implement, lead and master these new technologies and inventory management system methods will develop a significant competitive edge over rival firms in the marketplace.

At ABC Ltd, for the purpose of having the optimal inventory, SAP software is used. Inventory analysis is done at all levels i.e. component, raw material, consumables and finished goods. Schedule of procurement for new material and flow of goods within the company, is made on the basis of inventory analysis with SAP. This also helps in rationalizing the vendors. A significant issue at ABC Ltd. is that some of vendors are too away and some of are the single source. ABC Ltd. plans with a continuous production without any production losses the minimum requirement of the stock at different stages. It also helps to reduce the inventory at shop floor. To make the system more effective there is separate production planning and control (PPC) department. PPC department uses SAP to release the daily, weekly and monthly plan and purchase and Production engineering decides the inventory norms as per production plan. A physical inventory of WIP and finished goods is done on daily basis and report released on daily basis by PPC department. All the analyses on inventory are carried with the help of SAP in comparison to pre decided inventory norms.

- Order management

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.

- Operations planning

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. At present, there is no product design collaboration between suppliers and ABC Ltd. 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. The contracts may offer some discounts on ordered quantity, risk sharing or reward sharing schemes, and long-term relationship contracts. 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. 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.

There is neither any quantifiable measure of coordination used by ABC Ltd. nor any performance measure to know the extent of coordination between the members. There is a need to measure coordination to know how well the members form relationship, whether there is smooth flow of information and what is the impact of coordination on the performance of supply chain. The main performance measures used by ABC Ltd. 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 Ltd. may form strong partnership with upstream and downstream supply chain members. The strong partnership may result in the following benefits:

- improved clarity and accuracy of information;
- improved responsiveness;
- reduced inventory costs;
- reduced lead-time; and
- reduced stock outs.

The demand for products is continuously increasing. ABC Ltd. should have enough flexibility enough to accommodate the increase in demand. This increase in demand can be met either by increasing the capacity and/or by effectively sharing capacity information with the buyer. In such cases sharing of advance demand information by buyer will also help in reducing the demand uncertainties. Similarly, information sharing regarding capacity, inventory, and production schedules with suppliers will help in reduction of supply uncertainties.

There are some problems associated to this system as follows:

- 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.
- It cannot be updated instantaneously.
- There is an absence of some good forecasting tool.

Mismatch in information system at supplier's end and at the buyer's end is quite common. The supplier's systems are old and insecure for data transfer and at the customer's end; there are very good web-based information systems.

3.5.3 Interplay of SAP

SAP are the three basic components that define the dynamic interplay of reality in the flexible system management paradigm. Supply chain coordination is a new concept evolving in industries to cope up environmental uncertainties. The coordination situation can be managed if the actors have the vision to adapt to flexible process and adopt different coordination mechanisms. The adoption of coordination mechanisms help in recreating the situational parameters of ABC Ltd.

To deploy the concept of coordination, the knowledge and understanding of the present coordination situation, and processes are required by the actors. The ABC Ltd actors may demand more freedom of choice to change the present concept of coordination in a more flexible way. The ABC Ltd. actors may share values, knowledge, and willingness with other actors at intra-organizational 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. For example, ABC Ltd. actors may share information on various data types with suppliers and buyers. In turn, it is expected from ABC that the suppliers and buyers must share their operational information. Here, all the actors may show their willingness and discuss about the data, which has to be shared and when it has to be shared. To implement this coordination mechanism, the supply chain processes have to be flexible, which might change the situation and create flexibility in situational parameters. The second example can be of information systems installed by ABC Ltd. actors. The suppliers and buyers of ABC Ltd. may coordinate by having common information systems and common training to operate information system. It is desirable that the information system should be compatible throughout the supply chain. To face the changing requirements of other supply chain members, ABC Ltd. has installed a flexible information system. The climate and culture beyond organizational boundaries of ABC Ltd. 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 Ltd. 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.

a) 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. The employees of ABC Ltd. are self-motivated. They are open minded and skilled enough to work on recent technologies. ABC Ltd. has a priority goal of delivering good quality product to the customer. To satisfy customer, there is a good degree of coordination across various functional departments. The same concept of coordination is extended at upstream end and downstream end of ABC Ltd.

The learnings related to various processes of ABC Ltd. are as follows:

- Supplier selection

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.

-R&D

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

-Flexibility

It can bear the change in demand technology coordination with other plants Highly customized products are manufactured for specific needs Ever expansion strategy Work as cross functional team Employees having flexibility in sharing knowledge and views Ability to change according to the needs of new generation vehicle.

Following flexibility dimensions as follows:

- Customer service flexibility. The ability to accommodate special customer service requests.
- Order flexibility. The ability to modify order size, volume or composition during logistics operation.
- Location flexibility. The ability to service customers from alternative warehouse locations.
- Delivery time flexibility. The ability to accommodate delivery times for specific customers.

b) Action

Based on the situation, actors, and processes, the following improvement actions are suggested. A better procurement system can be proposed by achieving coordination between suppliers. The procurement processes in the existing system can be improved in the following ways:

- Supplier selection

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. At present, ABC Ltd. 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.

- Contracts

The use of formal and written contracts by ABC Ltd. and the supplier should encourage the supplier to provide a streamlined supply. This would result in improved profits for both supplier and ABC Ltd. (based on quantity discounts, quantity flexibility contracts).

- Order management

The new modes of transferring data like EDI 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 Ltd. should invest more in these technologies.

- Operations planning

The following actions are suggested regarding the operations planning done at ABC Ltd.

- Information sharing is one of the most accepted ways to achieve effective coordination. ABC Ltd. and supplier can plan their operations if they are aware of certain information in advance. ABC Ltd. can order supplier without any hassles if supplier share his capacity information. Also, supplier can improve his customer service and reduce the lead time if he knows in advance about the production plan of manufacturer. At present, ABC Ltd. is facing a problem of excess inventory of components. Implementing VMI system can reduce this excess inventory. It will also help in reducing the communication cost as well as the problem of information distortion. Coordination by information sharing may result in improved performance for all supply chain members.
- The supplier and ABC Ltd. 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 his

involvement should be encouraged while designing and setting quality norms. It will result in long-term and reliable relationship.

c) Performance

The performance of ABC Ltd. is measured on the basis of following measures.

- Quality
- Cost
- Delivery

ABC Ltd. 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 Ltd. 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 Ltd. has the potential and flexibility to adopt the coordination theory, as the people are very skilled and trained. ABC Ltd. is equipped with latest technology. To promote effective coordination, the following four factors may be given importance: productivity, quality, continuous improvement and customer satisfaction. To measure coordination and hence to improve, the supply chain performance, ABC Ltd. emphasizes on understanding customer requirements, on time/quality delivery, and sharing information with supply chain partners.

Based on the learning and actions suggested for incorporating flexibility, ABC Ltd. 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. A systemic model based on SAP-LAP is proposed to capture the essence of coordination and flexibility required to adopt the most appropriate coordination mechanisms. The SAP-LAP methodology applied in a case study of ABC Ltd. helps to identify important effectiveness issues. The flexibility model of SAP- LAP in conjunction with its present situation and capabilities of ABC Ltd. like

collaboration with parent company in Europe, good R&D facilities, innovation in technology, skilled employees, and technology leadership, has also incorporated effectiveness issues from adopted methodology and flexibility in adopting coordination mechanisms. These factors are expected to improve the supply chain performance of ABC Ltd are shown in figure 3.8.

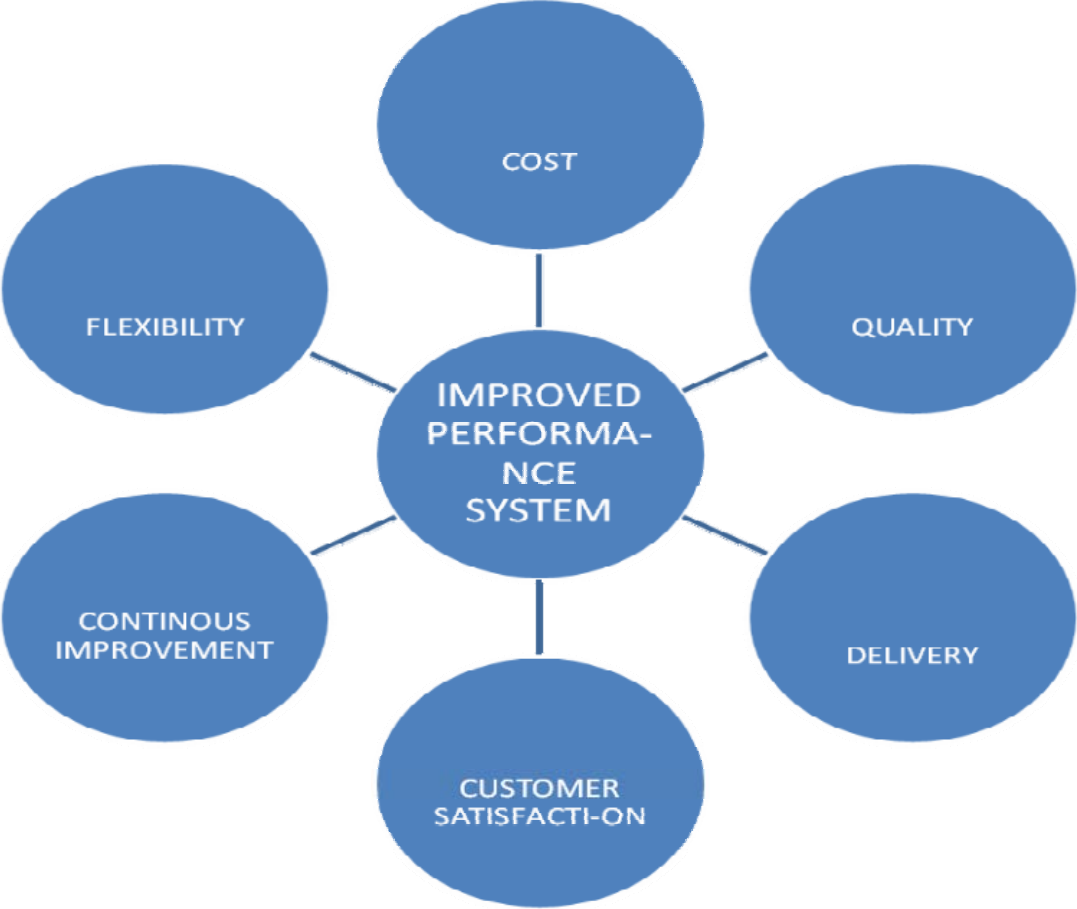


Figure: 3.8. Proposed model of supply chain coordination and its impact on the performance of ABC Ltd.

3.6 Business measures of ABC Ltd:

Business measurement is the process of quantifying the efficiency and effectiveness of manufacturing system. Performance of an enterprise is often measured as a ratio of output to input. The outputs constitute the products of the enterprise and the inputs are the resources used by the enterprise. Performance Analysis confidence and trust are the two enduring values associated with ABC Ltd. These values define the bond that ABC Ltd establishes with customers cutting across geographic locations, income levels, and market segments. The reliability and durability of this relationship has resulted in positive word-of-mouth from satisfied customers, working to the brand's advantage. Business measures of a firm can be assessed on multiple parameters: Financial Results, Comparisons with competitors, Product Results, Process Results, Customer Results, etc. Hence, detailed analyses of business measures of ABC Ltd's are given below.

- a) Productivity
- b) Process Results
- c) Product Results
- d) Financial Results

a) Productivity:

ABC Ltd increases its productivity in a variety of ways. The most obvious methods involve automation and computerization which minimize the tasks that must be performed by employees. Recently, less obvious techniques are being employed that involve ergonomic design and worker comfort. A comfortable employee, the theory maintains, can produce more than a counterpart who struggles through the day. In fact, some studies claim that measures such as raising workplace temperature can have a drastic effect on shop floor productivity. Experiments done by the Japanese Shiseido Corporation also suggested that productivity could be increased by means of perfuming or deodorizing the air conditioning system of workplaces. As per Table: 3.5 the productivity of individual shops is increased in respect to last financial year by taking the countermeasures like auto loader installed in press shop. U cell lay out in Weld shop etc.

Table: 3.5 Shop wise productivity

Shop Description	Productivity (05-06)	Productivity (06-07)	Productivity (07-08)	Action taken
Weld Shop	15 FuelTanks/Man	17Fuel Tanks/Man	19Fuel Tanks/Man	U Cell Lay out for Robot Mig
Paint Shop	18 Vehicles/Man	20Vehicles/Man	22Vehicles/Man	No.of Components increased
Frame Assembly	300 vehicles/Man	350vehicles/Man	425 vehicles/Man	Dynameters installed.
Press Shop	250 Strokes/ Man	320Strokes/ Man	475Strokes/ Man	Auto loader installed

b) Process Results:

ABC Ltd has been highly successful in lowering Manufacturing costs, the fuel Consumption, In-House Rejections, and improving Profitability and Inventory turnover Ratios. As per Table:3.6 ABC Ltd achieved overall rejection rate 1440 ppm against targeted 1566 ppm in 2005-06 , 1335 ppm against 1400 ppm in 2006-07 and1190 ppm against 1280 ppm in 2007-08. That was the big benchmark among its competitors. The Rework and delivery time also achieved within the target by doing kizens and poka-yoke in process and system.

Table: 3.6 Process results of ABC Ltd

Description	Unit	2005-06		2006-07		2007-08	
		Target	Action	Target	Action	Target	Action
Rejection	PPM	1566	1440	1400	1335	1280	1190
Rework	Percentage	5	4	3	2	2	2.2

Delivery	percentage	100	100	100	100	100	100
Production Rate	Component /day	8200	8220	8500	8520	9100	9120

c) Product Results:

Table: 3.7 shows the product results of ABC Ltd in 2005-06, 07, 08 in different product groups. The company maintained its grip in the motorcycle segment with market shares 40% in 2007-08. In the previous year, ABC Ltd sold one million more components than its nearest competitors. The lead was maintained in 2007-08.

Table 3.7 Product Results of ABC Ltd.

Product Group	Quantity Unit pcs per year		
Year	2005-06	2006-07	2007-08
Brake Hose Assemblies	8370000	9050000	1020000
Brake Tube	1240000	1450000	1500000
Export	2050000	2220000	2400000
Fabricated Hose Assemblies	2350000	2580000	3780000
Fuel Hose	750000	810000	840000
Fuel Injection Pipes	2430000	2550000	2760000
Hydraulic Hose Assemblies	120000	1600000	1800000
Low Pressure Flexible Hose Assemblies	5070000	5110000	5160000
Nylon Tube	170000	230000	260000
Rubber Hose	10200000	10900000	12000000
Teflon Hose	803000	827000	832000

At present there are so many players of supplying components in the two-four wheeler industry in India, namely ABC Ltd, Auto-ignition Ltd, Rico Auto etc. ABC Ltd is the market leader with a market share in excess of volumes. Today, there are over 15 million motorcycles on Indian roads. With each of its models, addressing different customer needs and Combined with technical excellence is a large dealer network, reliable & quality after sales and the provision of genuine spare parts.

d) Financial Results:

Sales: Annual sales crossed 6 million units during 2007-08 and in value terms total sale increased 14.5% as compared to 2005-06.

Cash surpluses: The Company generated cash of Rs 23 cores from operating activities, compared to Rs 19crores during 2005-06.

Capital Expenditure: This was pegged at Rs. 23 cores during the year, primarily on account of capacity expansion in the existing manufacturing facilities at Pune and Lucknow and acquisition of land for the company’s new production facilities. Due to this, the depreciation increased by 28.2% to Rs 8 cores from Rs 5.7 cores during year the 2005-06.

Raw material cost: Cost of raw material as a percentage of total sales decreased from 70.1% in 2005-06 to 69.5% in 2007-08 costs came down mostly because of favorable change in the sale mix and a continued focus on cost rationalization. This table 3.8 shows performance of ABC Ltd. in last three years.

Table-3.8 ABC Ltd Performance tracking

ABC Ltd			
Particulars	2005-06	2006-07	2007-08
Market share (%) (November)	41	45	40
Growth in Sales (%)	17.70	26.20	26.60
Growth in Total Income (%)	14.40	19.50	20.40

Profit before Tax (million)Rupee	250	290	300
Profit after Tax (million)Rupee	160	190	200

Source: Company annual report

Profitability: Earning before interest, depreciation and taxes during the year 2007-08 is 30 cores and in 2005-06 it was 29 cores, and after tax it is 20 cores in year 2007-08 and 16 cores in year 2005-06.

CHAPTER: 4

EVALUATION OF SUPPLY CHAIN EFFECTIVENESS INDEX

4.1 Evaluation of Supply Chain effectiveness factors

The Company is supplier to the Automotive Industries. Those who care for quality, service and just in time delivery are the regular customers of ABC Ltd. Main Customers of the organization are Hero-Honda, Honda, Maruti, TVS, Bajaj, LML, Kirloskar. Primary objective of the organization is to produce plastic components of global excellence, precision, durability and elegance conforming to end product requirements. This company is member of automotive component manufacturers association of India (ACMA), Plastic export promotion council, Indo-German chamber of commerce, PHD chamber of commerce and industry. India trade promotion organization. The element of flexibility, coupled with fast responses, innovation, quality consciousness and responsibility towards the customers, have enabled the company to always keep its business partners happy and satisfied all over the World. This organization gives top priority for quality along with cost and delivery time.

For analyzing level of effectiveness in the supply chain of this company, response of the management was taken on different attributes of effectiveness issues in Likert scale of 1 to 5 (1- Very low, 5- Very high). Score of different attributes for ABC Ltd. are given in Table 4.1. For computing effectiveness index, first of all mean for a particular issue (Component) of framework is calculated after taking average of scores for all its key items. After this rank, inverse rank and weight for each issue is decided.

For assigning weight to different issues of effectiveness index, the highest and lowest values of five point Likert scale i.e. 5 and 1 are mapped 100% and 0% respectively. For each of the issues of effectiveness a weight is assigned. The criteria for weight (W_i) is as under:

$W_i = +1$ (Strength), when percentage score $> 60\%$ (Mean value > 3).

$= 0$ (Neutral), when percentage score is between 40-60%
(Mean value between 2 and 3).

$= -1$ (Weakness), when percentage score $< 40\%$ (Mean value < 2)

Sum of entries of last column (Wi Log Ki), will give effectiveness index of ABC Ltd. i.e. 2.08. Theoretically, effectiveness index value may range between -2.86 to 2.86. Computation of effectiveness index of ABC Ltd. is illustrated with the help of a worksheet as shown in Table 4.2.

Sr. No.	Effectiveness Factor		Five Point Likert Scale					Mean
			1	2	3	4	5	
1.	Top management Commitment	Investment of time and money for resource development						3.00
		Focused communication system						
		Long term investment motive						
		Commitment to promises						
		Ready to adopt new technology						
		Employees training and empowerment						
2.	Mutual Understanding	Agreed vision and goals of members of supply chain						2.25
		Trust development in SC members						
		Effective implementation of joint replenishment forecasting decisions						
		Supply chain risk/ reward sharing						
3.	Flow of Information	Use of Information Technology (IT) tools & techniques						2.67
		Information sharing/ exchange						
		Inventory tracking at SC linkage						
		Sharing of data related to purchasing & supplies						
		Knowledge sharing						
		Design data sharing						

4.	Relationship & decision making	Long term relationship with suppliers						3.16	
		Long term relationship with customers							
		Collaborative decision making/ planning with SC members							
		Logistics synchronization							
		Supply chain integration							
		Rationalization of suppliers							
5.	Organization Factors	Lean organization structure						3.33	
		JIT and lean practices							
		Organization behavior for SC implementation							
		Organization culture for SC implementation							
		Role of SC with respect to other members							
		Integration of departments within the organization							
6.	Performance	Customer service & satisfaction parameters							3.00
		Application of ethical standards							
		Ability to customize the product							
		Ability to reduce customer response time							
		Ability to deliver product on time							
		Improvement of order fill rate							
		Ability to reduce cost continuously							
		Ability to resolve customer complaints							
		Ability to determine future expectations of customer							
		Ability to reduce shipping error							

	Ability to follow up customer inquiries							
	Finance parameters							3.33
	Market share							
	Sales turn over							
	Return on investment							
	Net Profit							
	Export share							
	Reduction of Inventory cost							
	Revenue growth							
	Reduction of order processing cost							
	Reduction of Transportation cost							
	Innovation & growth parameters							
	Ability to implement new technology							
	Ability to compete based on Quality							
	Ability to respond well to customer demand for new features							
	Ability to offer reliable product							
	Ability to reduce product design & development cycle time							
	Ability to offer less price than competitors							
	Ability to identify new customer							
	Ability to introduce new facility							
	Internal Business Parameters							3.37
	Use of modern quality control techniques							
	Ability to reduce the product cycle time							

	Ability to reduce the wastage						
	Ability to reduce the inventory						
	Improvement in labour productivity						
	Development of cross functional team						
	Level of teamwork & coordination among internal departments						
	Reduction in breakdown of machines						

Table 4.1: Score of SC effectiveness for ABC Ltd.

4.2 Effectiveness Index of ABC Ltd:

Sr. No.	Factors of SC	Mean	Rank	Inverse Rank (Ki)	Log Ki	Weight (Wi)	Wi. LogKi
1.	Top management commitment	3.00	4	3	0.48	0	0
2.	Mutual understanding	2.25	6	1	0.00	0	0.00
3.	Flow of information	2.67	5	2	0.30	0	0
4.	Relationship and decision making	3.16	3	4	0.60	+1	0.60
5.	Organizational factors	3.33	1	6	0.78	+1	0.78
6.	Performance	3.23	2	5	0.70	+1	0.70
Effectiveness Index = $C_j = \sum \{W_i \text{ Log } K_i\} = 2.08$							

Table 4.2: Illustration for Effectiveness Index of ABC Ltd.

4.3 Results

In this study it found the effectiveness index of ABC Ltd., based on response from management. Effectiveness index have been calculated to be 2.08. Effectiveness index of ABC Ltd. shows that presently it is very high as maximum value can reach up to 2.83. On the basis of this analysis, it is observed that most of sub attributes of effectiveness in SC have good score except mutual understanding and flow of information. Therefore this organization should focus on factors, mutual understanding factors and also flow of information factors. This approach can be utilized by the organization to benchmark its performance with national and international standards. It can also help in BSC analysis of the organization. On the basis of BSC analysis, organizations can develop their supply chain strategies to improve the effectiveness among different members of supply chain thereby improving the competitiveness in global market.

CHAPTER: 5

5.1 Conclusion

These days competition is between integrated supply chains rather than individual organizations. To be more competitive a supply chain should be well coordinated. It will help in making it responsive to customer demands. In this study sixty three attributes for effectiveness supply chain has been identified. These are grouped in six categories such as top management commitment, organizational factors, mutual understanding, flow of information, relationship and decision making and performance. This model will be useful for making strategies of effective supply chain. We have proposed application of the balanced SCM scorecard to organizations with the objective to evaluate their day-to-day business performance. In this case study BSC framework is used to measure and evaluate SCM. A concept initially proposed as a decision-making tool for senior managers was examined in the day-to-day operations management domain by proposing and detailing four SCM evaluation perspectives. We have also considered specific metrics for each of the perspectives. While applying the BSC in SCM, it is interesting to observe that some of the metrics in one category contradict other metrics in another category. Even within a category one SCM metric compromises others. For example, efforts to minimize metric 'variations against budget' often result in problems related to other measures such as on-time delivery, inventory, lead-time, cash flow and forecasting from other categories. By reducing flexibility of change in finance metric 'variations against budget', sudden high market demands could be compromised. Measure such as 'supplier rejection rate' contradicts buyer-supplier partnership level in the finance perspective. Similarly, 'range of products and services' compromise metrics such as flexibility to meet particular customer needs, order lead time, responsiveness to urgent deliveries and effectiveness to distribution planning schedule in the same category of customer perspective.

This study has also illustrated an approach for evaluating effectiveness index in a supply chain of the company. This approach will help to benchmark their performance in terms of various attributes of supply chains.

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