



Responsive Supply Chain and an Analysis on Manufacturing Industry

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Abstract

Supply chains can be considered one of the most popular operations strategies for improving organisational competitiveness. Since the 1990's, rapid development of supply chains has played a significant role in the manufacturing sector. Supply chains are all about effectively integrating the information and material flows within the demand and supply process. Supply Chain Management (SCM) sets up a relationship between the suppliers and the customers through the supply chain participants, using information flow and logistics activities to gain competitive advantage and customer satisfaction.

This study presents a brief outline of different approaches to SCM before discussing Agile Manufacturing (AM) and its relationship with Responsive Supply Chain (RSC). Considering the significance of both AM and SCM for organisations to improve their performance, an attempt has been made in this paper to analyse both AM and SCM with the objective of developing a framework for RSC. Finally an assessment model has been proposed to evaluate an organization's RCS competency. The proposed model has four dimensions: logistics, knowledge, strategy and customer.

Keywords: Supply Chain, Responsive Supply Chain, Agile Manufacturing, Supply Chain Management

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Introduction

Due to the increase in competition these days, companies are constantly working to decrease their costs and increase their market share. Therefore they need to get products in demand to customers at the right time in the right way whilst at the same time working with suppliers effectively to get raw materials or stock as fast as possible at the lowest possible cost. This collective effort is called the Supply Chain and is the basis for the carrying out of a series of related processes in a compatible manner. These processes are concentrated mainly on the supplier, manufacturer, and customers. When considered from the view of business processes, supply chains cover many areas including sales processes, manufacture, stock management, material procurement, distribution, supply, sales forecasts, and customer services.

Supply chains, which have a seemingly increasing importance, are the subject of much research and have been defined by many researchers. For example, Simchi and Kaminsky [13] defined supply chain management as “a set of approaches utilised to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements.” Furthermore, a supply chain also encapsulates all the facilities of the supplier, manufacturing equipment, storage, retailers, stores and distribution centres considering all units that have an impact on costs and play a role in the manufacture of products that meet customers’ wants and needs.

Similarly, Lee and Billington [9] defined a supply chain as “a network of manufacturers and distributors who procure raw materials, turn them into intermediate goods, and distribute the final goods to customers”. Similarly according to Kopczak [8], a supply chain is “the set of elements including suppliers, logistics providers, manufacturers, distributors, and retailers through which materials, products, and information flow”.

The developments in information and communications technology and new management methods nowadays have increased the importance of the management of supply chain processes. The main aim of supply chain management is the provision of the effectiveness of output and costs in all businesses. For this reason, it is necessary to adopt supply chain management with a system approach rather than just simply minimising transport costs or reducing stock costs. Supply chain management aims to run the system in the best possible manner by coordinating all the functions of the supply chain from the planning of the product to product forecasts, from logistics costs to the procurement of raw materials, from sales marketing to customer satisfaction, taking into account the whole system. Responsive Supply Chain (RSC) is one important strategy of many developed to this purpose.

The aim of RSC is to enable a business to stay on its feet in the face of changes in critical factors in the market such as quality, price, response time, and service. Furthermore, it connects supply and manufacturing operations to the market and market distribution channels in order to provide competitive advantage. In this way, better levels of service and higher profits can be obtained with the benefits achieved from lower costs and sales [3].

This study introduces supply chain management in particular and evaluates strategies in use. In this scope, responsive supply chain strategy is evaluated as a new SCM strategy and a conceptual model is proposed to measure it. The relationship between SCM and Agile Manufacturing is explained and it is proposed that it needs to be used as a new strategy for the supply chain.

Supply Chain Management

Supply chain management sees the supply chain and organisation as one entity. It is a system approach for the management and understanding of different activities needed for the coordination of the flow of products and services to serve the final customer in the best possible way. This system approach creates a framework that will respond to business needs in the best way, otherwise the components will stay in discrepancy of each other. An effective supply chain requires instant developments in both customer service levels and the productivity of a business’s internal operations within the supply chain. Put simply, customer service is a high rate of fulfilling orders, delivering right on time, and whatever the reason may be, a low rate of customer product returns. Productivity of an organisation’s internal operations in a supply chain means to have an attractive rate of investment returns from stock and assets, and to find ways to reduce sales spending.



According to Hugos [6], any company within a supply chain must make an individual or collective decision about activities in five foundational fields. As will be explained in more detail below, these five main areas are production, inventory, location, transportation, and information.

Production: Production covers the creation of the original production plan considering factory capacity, workload balance, quality control, and maintenance of equipment. Furthermore, it is the field that identifies what products the market needs, and how many and at what time these products need to be manufactured.

Inventory: The method of storage and amount of stock throughout the supply chain process is important. How much stock is needed to be held as raw materials, semi-finished products or finished products is decided here. The main purpose behind holding stock is to provide a buffer against uncertainty in the supply chain. It is important to identify the optimum level of stock and the point at which to reorder without increasing the costs of holding stock.

Location: Where the production and storage facilities will be located is important for keeping costs to a minimum. Answers to questions such as whether new facilities need to be built or whether existing facilities can be used, and the identification of the most appropriate route for the product flow will be provided.

Transportation: This is an important action for getting stock from one supply chain location to another. Although air and land transportation is generally faster and more trustworthy, it is also more expensive. Although sea and rail transportation is cheaper, it takes longer and carries more uncertainty. Considering this uncertainty, a logistics network must be formed to decide on the most appropriate form of shipping whilst keeping costs at a minimum.

Information: When used at the right time in the right place, information allows for more effective desired results to be obtained. Obtaining the right information and when necessary and sharing it in the right manner is important from the view of making better decisions and providing better coordination. In a supply chain, the gathering and use of information plays a big role in the fulfilment of other actions such as production, inventory, location, and transportation. Therefore, it is the most important process in the supply chain that affects the process from start to finish.

The decisions made in these five areas will define a company's supply chain capacity and effectiveness. A company's capacity and competitive strength in the market are linked to its supply chain. If a firm's strategy is to compete in a market where products are concentrated and costs are a main element, it needs the type of supply chain that will optimise low costs. If a firm's strategy is to serve in a more niche market where customer service is more important, it needs a supply chain based on responsive product optimisation.

Supply Chain Management Approaches

When it comes to supply chain management approaches, different companies and even managers within the same company have different points of view and paradigms. As there is no single approach to supply chain management, it cannot be said that any one is right or wrong. In reality, one company's view can be different from that of another. Just as there are many reasons for this, these views are not constant and as time goes on and as pressure from competitors' increases, these views can change. Ayers [1] considered these approaches generally, and summarised them as follows, stating with the connections between them. These approaches have been ordered below from the most narrow-scoped to the broadest approach.

Functional Approach: The functional approach is the most fundamental approach concept used in the majority of businesses today. In this perspective companies are made up of individual departments. An example of such an organization is supply, operation, engineering and distribution departments in a manufacturing business. Each department has its own agenda. Auditing of connections between the departments is weak. This sort of audit isn't even considered between companies in a supply chain. Performance evaluation for this kind of company is cost heavy.

Supply Approach: In general, differences from the functional approach start with working on reducing costs. From this perspective, the 'supply' of a supply chain is given predominance. These days, the cost of materials is the most important element for most manufacturing companies. When these kind of firms refer to supply chains, their first thoughts are of suppliers and supplying. They buy a lot of products and services from service organisations. Most of these organisations are connected to other suppliers. For example, car insurance companies have a wide network of vehicle repair stores and insurance experts. The healthcare sector on the other hand relies on a supply network made up of doctors, hospitals, and insurers. The cost of materials and services make the supply approach appealing in terms of reducing costs. At the same time, this understanding has brought various programmes such as supplier number reduction programmes and vendor-managed inventory to the table. In this approach supply is completely under the responsibility of the supply chain. This effort is reflected outside the company and affects the suppliers, too.



Generally partnership meetings tend to be concentrated on price discounts, particularly in situations where there is pressure on sellers from buyers. Under such circumstances, without any improvement, the topic turns to profit within the supply chain, or a change in location.

Logistics and Shipping Approach: The physical movement of products in the supply chain is an important part of the national economy. Logistics is defined as a part of the supply chain comprising the productive and effective planning, implementation and control of the product, service flow, information from the point of origin to the consumer, and storage operations in order to meet the needs of the consumer [4]. With the logistics and shipping approach, companies that want to employ a supply chain manager usually hire someone with a career in distribution management. Within the scope of the term supply chain, these kind of businesses can turn it into an alternative demand chain. This turn is the reason for extra attention to be paid to the supply chain or externally rather than internally. At the same time this is a cost reducing effort that will increase profit. Here, typical cost reducing activities such as creating a storage model or a network of distribution centres and shipping are considered.

Information Approach: The information approach is an approach that focuses on the development of connections both within the company and in the supply chain. New approaches and implementations for the transfer of information have made this approach more active. Electronic Data Interchange (EDI) is one of the first applications of developing communication between businesses. One of the biggest hurdles here is the lack of integrated programs in businesses both internally and externally. Organisations such as the Supply Chain Council are still working to form a standard description for the data and processes they sponsor. These efforts will ease the sharing of information within supply chains. Using information can produce good results in improving the performance of the supply chain.

Business Process Reengineering Approach (BPR): This process is called process reengineering and here the main aim is to stop anything from going to waste and to improve quality. This can be achieved in a number of ways. For example, the Six Sigma concept is closely related to BPR. System and technology plans should follow the process plan, and this is the underlying principle of BPR. Therefore the driving force behind changes is not technology, but process requirements. Technology is just a tool. BPR efforts no longer stop at company boundaries, but have been spread among members of supply chains.

Strategic Approach: From one point of view, supply chain planning is integrated with competitive strategy. For those who defend this view, competition should not be concentrated on just the product but also on operations that realise the concept of the 'extended product'. These operations take the product to the consumers' hands. From these view supplier relations, logistics and information systems support customer satisfaction. The conversion of this is an increased market share and profit. Costs are a secondary factor in this approach.

Process Model Approach: In order for a supply chain to create value it must also be thought of as a process model. For the successful creation of an integrated value system, a process model represents a series of actions and strategies necessary for its implementation. The first step enables optimum coordination among a business's functions. Sales, operations and distribution business strategies, performance matrix, and understanding of where the organisation is heading must be brought into order. The main processes (ordering, source strategies, logistics flows) need to be analysed and developed. All business should be documented with an established goods strategy taking into account all the important sales places in line with global units. In addition, a foundational supplier and consumer network must be implemented (in many cases this supplier/consumer base needs to be reduced). This requires managers to closely monitor who they work with, and in some cases know the supply chain from the very beginning.

Agile Manufacturing and Responsive Supply Chain

One of the most important problems that businesses come across today is the changes, uncertainties and unexpected developments that occur in the environment they operate in. In order to be successful among these changes and uncertainties businesses must look for new methods and approaches. Global competition, developing technology, changing and developing business and industry environments, and the difficulty of keeping consumers satisfied put companies under more pressure. Current production practices increase a business's productivity and effectiveness, but they don't help a business adapt to changing market circumstances. The concept of agile manufacturing is defined as the process that needs to be followed for a company to be successful in an ever changing and uncertain competitive environment.



Goldman et al [2] state that responsive manufacturing gains competitive advantage in operations realised in an environment where the competition is ever changing and in unexpected ways, and argue that agile manufacturing has four fundamental components. They make the value of the product apparent to the customer. Every department and every employee must be ready for change at any moment. Employees are a company's most important resource and employees' skills must be fully utilized.

A virtual cooperation must be set up between businesses. By sharing information with key customers and key suppliers, agile manufacturers should create a virtual network, and through the effective sharing of information due to this network supported online they will be able to identify both changes and customers' needs more quickly and accurately [12]. Of the components above, the first three are found in lean production, and the importance given to them is less than that given to the prevention of waste.

Hormozi [5] defines an agile business as one that can adapt quickly and easily to changes. Agility means being successful in an ever changing environment whilst at the same time reordering inter-company relations, operations and processes in an effective way in response to change. This new approach comes from long-term strategic plans and covers the business from top to bottom [5]. Nagel and Bhargave argue that product variety, awareness of customer desires, and product development duration are determinants of competitive strength and that their success will lead to a more agile organisation structure. Responsive production is defined as the manufacturing structure that is can answer to demands and problems at the highest degree and create virtual cooperation's. According to researchers, future leading businesses will have structures that are continuously developing and able to incorporate agile manufacturing without overlooking the importance of quality. Therefore, being able to respond to changes in both production and supply chain processes will be a critical point for companies. Fluctuations caused by a country's economic or political changes make it harder for companies to make long term plans. High and changing inflation rates, changing exchange rates, government policies that can change in an instant, increasing interest rates, political chaos that can erupt in some countries from time to time, globalisation, barriers to trade, technological advances and the behaviour of online businesses, and business relationships with customers and other businesses can be shown as some of the reasons for these kinds of fluctuations [10].

A Model Proposal for a Responsive Supply Chain

Nowadays, constant change and uncertainty dominates many industries. For businesses change has become a necessity, not an exception. As consumer demands change, consumers expect personalised products of high quality at a reasonable price. In order to gain a competitive advantage it is necessary to meet the demand of high quality and personalised products immediately. As in manufacturing, acquiring the characteristic of responsiveness in the supply chain too requires being ready for the causes of change, and integrating motivated and reinforced quality personal with flexible technology. In this way companies will attain the fundamental characteristics for the Responsive Supply Chain (RSC) approach.

Kidd [7] argues that the three core components of people, organisation and technology need to be integrated in order to achieve agility that will deliver a business to success in a new competitive environment.

RSC address new ways of running companies to meet challenges such as consumer demand or logistics. In a changing and competitive environment there is a need to develop cost effective solutions for organisations and facilities that are highly flexible and responsive to the changing market and customer requirements. Youssef et. al. [14] describes the RSC as necessary for manufacturers to be flexible and compatible to changing market conditions. According to their research, the manufacturing approach most similar to supply chain manufacturing is agile manufacturing. A strategic responsive supply chain requires a strong partnership between suppliers and customers, and information systems for effective supply chain management. It also requires the ability to survive and prosper in a competitive environment of continuous and unpredictable changes by reacting quickly and effectively to changing market, driven by customers [3].

Measuring how well supply chain strategies are carried out is just as important as managing them in an effective manner. There is a need for evaluation approaches that get feedback by analysing results, and then uses this feedback with the aim of improving supply chain processes. With the view that it is difficult to manage a process that can't be measured, great importance is given to the development of an evaluation model for RSC. The biggest problem encountered in this kind of RSC evaluation approach is the acquisition of numerical data from RSC processes. However, these days it is possible to analyse a firm's position by



measuring intangible assets other than financial data such as intellectual capital. Özel and Öztemel [11] carried out a study into the measurement of intangible assets in businesses, looked at the evaluation systems already used in literature, and proposed an evaluation model. According to this model proposal a framework model has been created and an evaluation proposed that covers fields such as strategic competency, intellectual competency, and R&D and innovation competency where it is hard to obtain numerical data together with areas where it is easy to collect numerical data such as financial values.

Considering the approaches explained in detail in earlier sections, four important dimensions in the evaluation of RSC processes have been determined. The four dimensions of importance for RSC are:

- logistics dimension
- knowledge dimension
- strategy and business process dimension
- customer dimension

In the figure below a schematic diagram of the proposed RSC evaluation model has been given.

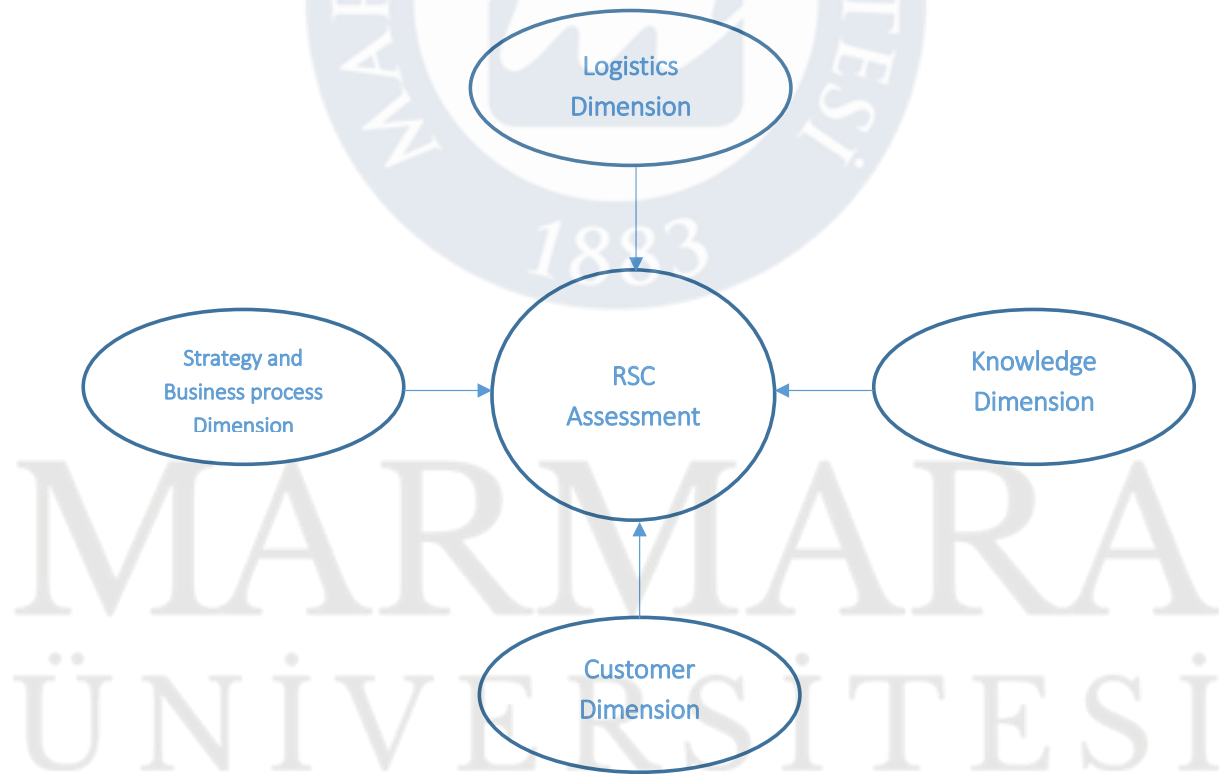


Figure 1. Responsive Supply Chain Assessment



Consequences

Nowadays, instead of businesses having individual competitors, there is a competitive environment created from the whole supply chain that the business is a part of. In this environment, enterprises need to forward their cooperation's with the suppliers and customers they work with in order to stay ahead of their competitors and ensure sustainability of the company. It is important for business to work according to collective principles, create a trustful environment and share working processes with each other.

The increasing competition between businesses makes the subject of supply chains even more important. In particular, by using new approaches and strategies in this field, it is possible to both cut costs and corporately reach new successes in the race for market leadership. With this goal in mind, responsive supply chains are an important driving power for companies in this race as an addition to classic SCM strategies. Furthermore, it is possible to take the continuation of the success provided by using RSC even further with the assessment approach proposed under the scope of this work. It is considered that developing the proposed model will make a contribution to business and researchers studying in this field.

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