CONCEPT

The Supply Chain can be defined as the integral management—within the company and through other companies—of the company's various logistical stages such as materials procurement, production, storage, distribution, and customer service. The Supply Chain concept should be seen as a whole, that is, the entire system from the mine to the final consumption of a good or service.

As its name indicates, the Supply Chain concept should be understood as a concatenation of the company's different logistical stages.

In this network we must include all the organizations involved in the production of a certain good or service (from the mine to final consumption), and each of the logistical stages within these organizations. Thus, the Supply Chain is a network linking and interweaving the different supply chains of all the companies involved in a production process. A diagram depicting the Supply Chain is shown below:

The Supply Chain is therefore a complex object, as it involves decision-makers from many different companies, who sometimes have no direct relationship and are in very different geographical locations; yet the decisions they make are mutually dependent upon each other. Clearly, there has to be an information system capable of linking together the different members of the chain so that there is open communication between them.

The Supply Chain's process is made up of different aspects or parts. They are:
• “Supply Chain Planning”: this is responsible for the physical structure of the Supply Chain and addresses logistical problems at different operational levels.

• “Supply Chain Execution”: this part's primary function is to control the Supply Chain's day-to-day functioning and deals with shipments, seeking to optimize customer service by coordinating finished product storage and delivery, which in turn improves inventory handling, storage, order processing and transportation.

• “Demand Management”: as a result of new uses of technology and the implementation of the Supply Chain, companies' demand forecasts are in a process of continual change. Demand management's function is to administer companies' demand, taking into account the changes that have occurred—which generates special product demands among the companies comprising a Supply Chain—with the aim of optimizing existing resources.

• “Manufacturing Planning”: this is responsible for controlling and planning raw materials, and the activities performed by Supply Chain Execution.
CRITICAL ASPECTS

The fact that the organizations involved in the Supply Chain are closely interrelated—though in practice not always as closely as they should be—is the most common cause of disruption in the Supply Chain. The members of the Supply Chain are subject to "shock waves" due to unforeseen cross-effects in the decisions made rather than to variations in a product's final demand. In other words, a lack of communication between the companies that make up the Supply Chain may give rise to raw material shortages or gluts, which will impact on the consumer/user in the form of surpluses or deficits in final demand and will lead to mismatches between sales forecasts and actual demand.

To help explain the Supply Chain's critical aspects, we shall discuss two examples of how the demand can undergo drastic changes and thus affect the final demand, the consumer, and the entire process.

On the one hand, we have the case of Demand Loading. Here, we assume that a given product has a constant real demand of 150 units/month but the vendor has set itself a sales target above this level: 200 units/month. During the first
few months the vendor will try to meet its target, but after a certain time it will be forced to reduce its sales, as the real demand is less than the supply. Such a situation will give a variable final demand, as follows:

As a consequence of these variations in the demand, not all of the organization's resources are used and optimized, as there are variations in production, inventory surpluses, variations in orders, etc. This in turn leads to a deterioration of our efficiency and effectiveness vis-à-vis our competitors, implying reduced satisfaction on the part of the customers affected by the changes in the demand.

Our second example is focused on construction. In this example, three main factors are involved: customer, developer and builder. During periods of economic prosperity (such as the present), the demand for new dwellings may increase, for example, from 100 to 200. Consequently, developers make medium-term forecasts, but these forecasts are based on sudden, rapid changes in demand. Because the forecasts assume rapid change, there may be a period during which the supply of dwellings exceeds demand (400), leading to a mismatch between supply and demand, until they finally balance. In other words, for a certain period, based on the forecasts of rapid growth in demand, developers and builders produce more dwellings than are actually needed, so that, during that period, the supply of housing exceeds demand. The diagram below illustrates this example.
Most common errors

Other significant errors that are made when implementing the Supply Chain are:

- Incorrect use of current technology, so that we do not use all the resources available to us. We should use our technological resources to optimize our response and our actions. Otherwise, instead of being an asset and a source of advantage for the organization, the use of technology becomes a burden, leading to a loss of financial and human resources.

- Integrating information systems does not guarantee that the Supply Chain itself is integrated. This is because even if companies are linked by communication networks, they also need to coordinate their actions so that they act as a group rather than each one separately.

- Another common error is to confuse organizational centralization with centralized location. Organizational centralization is necessary in all companies as, without it, the decisions made in the company will not be consistent and will not form a whole. However, it can be counterproductive to seek to group the entire organization physically in a single location. Therefore, we must use the technology available to us to create an organizational centralization that harmonizes the actions of all the organization's members, without having to have a geographical centralization.

- The so-called distribution of responsibilities can prevent an integrated vision of the goal to be achieved within the company and among the companies belonging to the same Supply Chain. At the other extreme, top management
may be reluctant to delegate responsibilities, so that there is only one person "who does the thinking" in the organization. As a result, the decisions he or she makes may not be optimal (effective and efficient) for the organization.

- All of the above leads to long response times between companies, which ultimately impacts negatively on the end consumer.

**HOW CAN THIS BE IMPROVED?**

Given the problems raised in the previous section, there are two main methods for improving the Supply Chain. First, we can optimize it as a whole. Second, we can simplify it.

**Optimization**

The first method (optimizing the Supply Chain as a whole) may appear more attractive conceptually. However, it requires advanced technology and centralized decision-making, as we will have to construct optimization models and intelligent systems. We will need technological innovations, which ultimately makes it a complicated and expensive method that is unreliable.

**Simplification**

The second method for improving the Supply Chain (simplifying it) involves concentrating on basic, simpler decisions and analyzing the opportunities for cooperation between the companies that make up the Supply Chain. This leads to decentralized decision-making and takes us back to a theory that was popular in the 1980s but is now “out of fashion”: Just in Time.

By reimplementing the Just in Time theory, it is possible to optimize logistics processes again and thus also optimize the Supply Chain. However, instead of everyone having their own individual stock of all the raw materials and in-process products that will be needed for the production processes, the best option is to form strategic alliances with other organizations and so share inventories and reduce costs.

This system is not intended to solve the problem but to completely eradicate it. Solving a problem does not eliminate it but merely conceals it. If we go to the
root of the problem, however, we can study the cause-effect relationship; and when the cause has been eliminated, we will also have eliminated the effects the cause produces, thereby eliminating the problem.

Another advantage of simplification over optimization is that it does not produce any waste. This is because nothing is produced that is not needed. By planning the different processes involved in the Supply Chain, it will be possible to know at any given moment what will be needed for each of these processes. Thus, this method effectively eliminates excess materials and stock surpluses, and makes the process more efficient.

SUPPLY CHAIN AND TECHNOLOGY

The fast pace of technological progress has brought both benefits and disadvantages for logistics systems, and thus also for the Supply Chain. On the one hand, it has brought a significant advantage as "the world is getting smaller". Order times have been cut to virtually zero, as orders can be sent immediately to any part of the world.

Lead times, however, have not been shortened to the same extent. Consequently, delivery time (order time plus response time) continues to be relatively long. Also, because the orders we make today are smaller and we expect greater product variety and quality, distributors must find ways to optimize their carriage operations and reduce cost.

Considering what has been said so far, the use of new technologies is clearly not producing any economic value. So, who is earning money in e-commerce? As we have already said, the order time is virtually zero while the lead time continues to be long. Therefore, the companies that will be able to earn money will be those that are readily able to sell goods or services over the Web, i.e. those that sell intangibles, and it is these companies that will be able to profit from all the advantages of the new technologies.

E-commerce

The technological changes brought about by the use of e-commerce have shortened order times, enabled acquisition of customer data, made it possible
to adapt products to customers’ orders and, finally, enabled companies to trade across frontiers.

However, the story also has a downside. With the use of e-commerce and the new technologies, several principles of logistics have been broken. With the introduction of the “e”, concepts such as business to consumer (B2C) and business to business (B2B) have come into being. This has led to various changes in the way we approach logistics, distribution and, therefore, the Supply Chain.

The introduction of B2C has brought about the following changes:

• Shipments are fragmented, as we no longer order large volumes of any one product. Now, what we want is more variety, less quantity. This means that any given shipment will be segmented for different recipients. This, in the long run, means higher costs and more problems for distributors, as they have to divide up shipments between different recipients.

• Economies of scale are lost at the level of logistics. Now, the distributor must deliver smaller orders with shorter delivery times. This leads to increased carriage costs as it will not be possible to realize economies of scale and obtain price reductions for smaller orders.

• Seeing a reduction in order times, the end consumer of a good or service demands a similar reduction in delivery times, without considering the difficulties the distributor might be experiencing.

• With market globalization, end users are looking for more product variety, high market availability, and rapid distribution.

• All these new logistic “problems” raise costs considerably, and eventually this impacts directly on the end consumer or user.

On the other hand, with the introduction of B2B, the following problems arise:

• The markets come close to being perfect markets composed of two parties, the producer and the consumer, without any intermediaries or third parties involved in the transaction.
• Zero-profit markets appear; increasing competition forces prices down in an effort to gain more market acceptance.

• Free riders take advantage of external advantages for their own personal profit.

• Companies try to make a profit by reducing the cost of obtaining services, when this profit should be obtained by exploiting synergies.

So, if not everything in technology is plain sailing, very few companies are actually making money through the Web, and using new technologies is expensive – why all this fuss over technology?

• On the one hand, it is a complicated segment, but also a necessary one, as the use of these technologies makes it easier for us to communicate.

• Also, demand creates supply, such as technology vendors, computer product suppliers, technology consultants; and all this leads to the end consumer being affected by the supply and creating demand.

• Lastly, it is an immature sector characterized by rapid technological change, so that a lot of technologies have not yet been absorbed by end consumers.

In spite of all this, we must find the best way to develop and optimize the Supply Chain, and this will consist of combining simplification of the Supply Chain with the Just in Time theory. The following questions therefore need to be asked:

• Where is the Supply Chain's margin and how can it be obtained? Variations in demand, production, raw materials inventory, etc. may lead to a substantial fall in production of a certain good. In this case, the margins in production will fall and it will be necessary to find out where the margin is for entering that segment and so turn the threat into an opportunity. To explain this better, we can cite a very specific example in the Ecuadorian fishing industry. Ecuador is one of the largest producers of shrimps, but because of El Niño the shrimp banks have been devastated by a plague (the “white plague”) which has wiped out most of the stocks. Faced with this threat to the shrimp industry, the ones earning the biggest profits are those who realised that the highest margins were no longer to be found in shrimp production but in shrimp distribution.
• We must also investigate the sources of improvement of the Supply Chain, and apply whichever is most economic and reliable to our system.

• Finally, we must understand the role of communication systems, as that will enable us to make better use of the technologies available to the company.

**BAS: ACTIONS AND STRATEGIES FOR THE SUPPLY CHAIN**

Going back to the initial subject discussed in the follow-up development program, we can see that there are different actions among the organizations belonging to a Supply Chain, depending on the type of relationship there is between them.

All organizations have a Business Activities Sequence (BAS) for creating and producing a particular good or service. The BAS consists of three chains: the design chain, the operation chain, and the service chain. The activities comprising the BAS cover all operations activities, i.e. the entire process from idea to satisfied customer.

In turn, these chains are subdivided as follows:

• **Design chain:**
  1. Product design. In this stage, an idea is transformed into a product or service, with all its functional, organic, esthetic and economic aspects.
  2. Process design. This is where the operations process is developed and the operations that lead to obtainment of the product/service with the required quality, quantity and cost are defined.
  3. Quality assurance. This is the group of activities designed to achieve and guarantee the quality, maintainability, repairability and reliability of the element (or service) chosen by operations.

• **Operation chain:**
  4. Procurement. This stage groups together all the operations required to obtain the resources for producing the desired good or service.

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5. Input logistics. This is vital to ensure correct use of the resources obtained. It involves designing the system that will ensure that the necessary resources are available in the right place at the right time and with the right quality to carry out the operations.

6. Processing or production. This is the process of transforming the “inputs” into finished products.

7. Output logistics. This is identical to input logistics but involves putting the product in the place where the customer needs it, so that he can use it.

- Service chain:

8. Installation. This is the commissioning of the product or service to the customer's satisfaction, including user training, physical installation, advice about use, etc.

9. Maintenance. This comprises the group of activities not included in the previous stages which make the customer think that his purchase has been successful. It includes updates, adaptation to new uses and, in general, everything that completes and complements the product/service.

10. Upgrading. This consists of the group of aftersale activities that guarantee the product/service's fitness for use, as defined at the time of sale, during the product/service’s estimated (by the customer) service life. It includes activities related to performance of contractual guarantees, repairs, maintenance, etc.

These chains within the BAS are those which, in the Supply Chain, are interwoven to form the different types of partnership between organizations. Accordingly, we can see that there are three main types of action for joining together the different business activity sequences used by companies.

**Horizontal actions**

First, we have horizontal actions, where companies form logistic partnerships at the same stage of the BAS. In this case, they are connected by communication systems which link them at departmental level. That is, they form partnerships or alliances in, for example, input logistics, as shown below:
The main actions associated with this type of partnership are:

- Creation of logistics parks, such as the European logistics system, which is preparing for further expansion in the future, as new members join the European Union. This will imply major changes in the logistics networks and Supply Chains used by companies operating in EU member countries.

- Interconnection of logistics applications. A clear example of this would be the packaging companies that have adopted the EAN-UCC system for their international operations. This system provides a global infrastructure for the Supply Chain through numeric structures, data movements and standard electronic messages. The aim is to overcome the barriers created by the specific standards of national industries.

- Interconnection of ERPs (Enterprise Resource Planning – software programs designed to help companies plan their resources). Nestlé has signed a multi-million contract with SAP to install a global ERP system for the entire company. This system has been implemented to compete in e-commerce, and has forced the company to standardize its processes.
Previously, each factory managed its own business in accordance with its own standards and negotiated its own prices. Now, each employee will work from a home page (mySAP.com) adapted to his/her particular role or function, which will require that he/she follow a clearly defined series of steps in performing his/her work. It also acts as a security system. As part of its rollout of the system, Nestlé plans to create five data centers distributed throughout the world.

- **Joint design.** At present, companies operating in the oil industry are partnering to offer better service and reduce costs by launching an online site that will bring together buyers, suppliers and distributors.

- **Joint use of logistics networks.** Daimler-Chrysler, Ford and General Motors are trying to unify their supply chain trading exchange initiatives in a super-exchange, which will be unified in multimode logistics centers to reduce operational costs.

- **Distribution contracted with the product.** For example, with the help of ASTI, S.A., Wella has decided to automate control of its order picking system, installing the necessary communication and reporting systems to ensure fast, effective customer service. With this system, ASTI has succeeded in minimizing picking errors.

These horizontal actions seek to reduce companies' costs by sharing resources such as warehouses, distributors, etc. The result is lower final prices, shorter lead times, optimized material management, and consequently, greater customer or end consumer satisfaction.

**Vertical actions**

The second type of association that can be created in the Supply Chain is the vertical association, by which organizations form partnerships without considering at what point in the BAS they are joined. In other words, communication between organizations is interdepartmental, as shown below:
This vertical partnering between organizations creates the following actions:

- Supplier development and involvement. Unlike what used to happen in the past, today Chrysler’s suppliers that are members of the Chrysler "Extended Enterprise" and have become partners with Chrysler in a value chain focused on the needs of the retailer and the consumer. By working as a team, the "Extended Enterprise" has enabled multi-million dollar savings, while substantially increasing profit margins and product quality.

- Design to produce. DaimlerChrysler has radically changed its European SC. Using computerized simulation as a re-engineering tool, it has relocated its 22 national warehouses with 8 regional facilities. By this means, it plans to reduce costs and increase the efficiency of its production processes.

- Operations interconnection. In Spain, Sony runs a high productivity plant and a distribution center financed with Spanish capital which, within 10 years of its construction, will be able to serve Sony's French, Portuguese and Greek subsidiaries as well as a competitor, EPSON, by storing their products, installing software, defining their configuration, and delivering them to the chosen carrier.

- Operations outsourcing. TNT Benelux has formed a strategic partnership with the computer manufacturer Compaq for distributing spare parts. The
agreement covers 31 countries, more than 50,000 SKUs and generates approximately 150 million Dutch guilders in annual savings.

- Demand management. The generalization of the postponement strategy by which companies postpone production, assembly or design of their products until they receive orders from the customer, in order to achieve a closer match with the customer’s wishes, will give rise to changes in logistics. Goods movement will be delayed and storage will take place within the distribution chain. By 2005, more than half of the inventory will be in the form of semi-processed product. Implementation of this system requires fluid exchange of information.

These actions, like the previous ones, seek to improve the effectiveness and efficiency of organizations’ Supply Chains. The advantages are the same as with horizontal actions, but in this case the goal is a greater degree of communication with organizations’ suppliers and distributors, which means that the cost reductions will be greater. This will require an improved communications system that optimizes the technological resources available to the organization.

**Integrated actions**

Finally, there are the interorganizational integrated partnerships in which there is total communication between organizations within the Supply Chain. Thus, communication between them is absolute and they can integrate with one another, optimizing production, storage, inventory handling, distribution, etc. This partnership takes the following form:
The actions associated with this kind of integrated partnership are:

- Creation of joint material management parks. The concept of a multimode transport center, an industrial park whose facilities provide access to multiple transport modes plus a variety of related services, is becoming popular in Europe. Governments are supporting this type of initiative as a means of reducing road carriage. A good example is the airport in the French town of Vatry, whose facilities include a 24-hour air freight complex, a road and rail carriage center, a logistics center with a complete range of international business services, and a material assembly, storage and postproduction area.

- Development of industry software. As an example of this type of integrated action, IBM will help CEM build an IT platform to facilitate supply procurement. In addition, this system will offer increased flexibility in materials management, which will lead to reduced costs and increased efficiency for CEM and improved consumer satisfaction.
• Availability of specific applications. ERL Internet has transformed the traditional supply chain management techniques into dynamic e-supply chain solutions. While the global connection through Internet has given rise to previously inconceivable levels of productivity in the major economies, in the chemical industry the changeover to e-supply chain solutions in order to improve efficiency is picking up speed. The benefits of a supply chain linked over the Internet include, among others: 8%-35% reductions in the supply chain's costs, and 22%-85% inventory reductions.

• Creation of standards. Given the need for fluid communication between the SC's operators, by any route but above all by electronic routes, some groups have undertaken a major effort to create international standards for operating within the SC. Some examples of such SC standards include: Internet (IETF, ISOC), STEP Program, Intelligent Transport Systems, the European effort in e-commerce (ProcatGen) and barcodes (SC31).

• Creation of lobbies. In order to gain greater strength against attacks by competitors, associations of distributors, producers, etc. are being created, forming partnerships and logistics alliances while at the same time reducing operating and labor costs.

• Creation of marketplaces. With the increased internationalization of companies, faster logistics and distribution services are needed. This has led to the creation of large distribution centers where the logistics networks of several companies and even several countries are pooled. One example of this is the creation of pan-European logistics services networks in Holland.

Integrated actions seek to increase optimization of the company's resources. The benefits include those of the previous two types of action (horizontal and vertical). Again, they are based on improved communication between organizations, creating specific information systems (SAP, BAAN, etc.) for the entire Supply Chain.

**CONCLUSION**

To conclude this report, we must remember that, in order to be stable, the Supply Chain needs forecasts, but the forecasts must be consistent all along
the chain. That is, we cannot make them hastily, taking into account only the changes in the demand brought about by sporadic factors, as this will eventually lead to variations in the forecast demand that have little bearing on actual demand.

However, through the correct use of technologies, information systems, etc., we find that it is now possible to communicate facts, and that these facts can replace forecasts. Consequently, rather than basing ourselves on forecasts, we will have more accurate information on what is needed at any given time. By making good use of the appropriate information systems and making them available to our suppliers, we will enable them to know at all times what our needs are. As a result, it will no longer be necessary for our suppliers to make forecasts, as they will know at any given time the status of our inventory. This will increase our the effectiveness and efficiency of our actions, reduce costs, increase production speed, and improve the quality of the service offered.