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Supply Networks: Evolution, Challenges and a Literature Review

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Abstract: In the current competitive market, manufacturing and productive agencies need to manage and monitor external organizations and resources, as well as internal resources and their organization. The reason is to achieve a competitive advantage with the aim of gaining a greater share of the market. Accordingly, some activities such as supply and demand planning, procurement, production planning, goods maintenance services, inventory control, delivery time and customer service which have already been carried out in the company have moved to the level of Supply Networks (SNs). Key issues in a SN are managing, controlling and coordinating all these activities. Supply Network Management (SNM) is a phenomenon that carries out this issue in such a way that the costumers can receive reliable and fast services with high quality products at the lowest cost (Ayers). In general, a SN consists of 2 or more organizations that are legally separated and are related to each other by material flows, information and financial flows. These organizations could be the agencies that produce the raw materials, components, finished products or services such as distribution, storage, wholesale and retail. Even the final consumer can also be considered as one of these organizations. This study examines the concepts, definitions, general design and problems of SNs. Then the history of the formation of SNs (from the beginning of independent activity of plants and becoming a chain and finally the development towards a SN) is discussed. Finally, the management principles to make the network more efficient, the importance of speed and the accuracy in responding are examined. The purpose of this study is to familiarize the reader with the concept of SNs.

Key words: Supply network, challenges, evolution, strategies, literature review

INTRODUCTION

A SN consists of different entities, such as suppliers, manufacturers, distributors, retailers and customers who research together to reach a common objective (Hu *et al*., 2013). In today's competitive environment of business, companies and organizations are taking advantage of technology and management science. Their aim is to create a competitive benefit through data-management tools, KM (Kowledge Management) and optimization of enterprise processes such as the production or communications. Supply Network Management (SNM) is one of the most important management sciences which proposed very useful topics in this area (Cao and Zhang, 2010). By using the SNM as a management tool, the organization is able to develop its business relationships by exchanging data with trading partners such as raw material suppliers, distributors of products and transportation contractors. Thus, the business agency will be able to reduce the delivery time and waste costs (Roebuck, 2011). According to Christopher (2005, 1998), today the most efficient solution to achieve cost advantages is not necessarily the size of the products and economic scales but a SNM. He believes that the Supply Network (SN) is a network of upstream and downstream organizations which are involved in the processes and activities that make a value in the form of products and services for the final customer.

The concept of SNM has been described and analyzed by many researchers and they considered it with the synonyms of logistics, operations management, supplies or a combination of these 3 concepts (Chopra and Meindl, 2012; Monczka, *et al*., 2011; Lambert *et al*., 2005). There are 3 main approaches: Within some research works, they limited the supply-chain relations between the buyers and sellers. Such an attitude focuses only on the first-stage purchase operations in an organization (Meehan and Wright, 2012; Esmaeili and Zeephongsekul,

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2010). Another group has a wider view towards supply-chains and considers it as consisting of all sources of supply of an organization (Morita and Nakahara, 2004). By this definition, the supply-chain includes all stages of suppliers. Such an approach to the supply-chain leads to the definition of the supply-network.

The third attitude is the value chain approach in which the SN includes all the functions needed to provide a product or service to the final customer (Coccola *et al*., 2013). Within this approach to the supply-network, manufacturing and distribution functions are added to the network as part of the flow of goods and services. In fact with such an approach, the supply-chain and supply-network includes all 3 fields of procurement, production and distribution. Shukla *et al*. (2011) expressed that SNM is management of material, money, men and information within and across the SN to maximize customer satisfaction and to get and edge over competitors.

A comprehensive definition by the global supply chain forum can be cited: SNM is the integration of key business processes from the final customers to the main suppliers and is responsible for the products, services and information that create value for customers and interested parties (Supply-Chain Council, 2006).

This study is a conceptual study to provide better understanding in evolution and most common challenges between managers of supply networks regarding to the literature review. In the next study, researchers provide a literature review on supply networks. After that a general view for supply networks will introduce. Then, common challenges in the supply networks and their sources will be categorized. At the end, regarding to the literature, the strategies to have an effective and efficient SN will be discussed.

It is noticeable; this study is extracted of my Ph.D thesis at the university of Bremen.

LITERATURE REVIEW ON SN PROCESS

In the 1960 and 1970, organizations have struggled to increase their competitiveness by standardizing and improving their internal processes to make a higher quality and lower price for the products. At that time, the prevailing thought was that strong engineering, design and coordinated production operations are prerequisites for achieving the demands of the market and gaining more market shares. For this reason, organizations focused all their efforts on increasing efficiency (Goldratt *et al*., 2012). In the 1980s, by increasing diversity in the expected patterns of customers, organizations became interested in increasing the acceptation flexibility in production lines and developing new products to satisfy customers requests. In the 1990's, along with the improvements in manufacturing processes and the use of re-engineering patterns, many industry executives found that improving internal processes and flexibility in the company's capabilities were not sufficient to continue the participation in the market (Shukla *et al*., 2011). Moreover, the suppliers of components and materials needed to produce materials with best quality and lowest cost and the distributors had to be closely associated with the development policies of the producer's market. With such an attitude, the supply-chain management and supply-networks came into existence (Goldratt *et al*., 2012). Here, researchers describe a brief history of production systems, logistics and SN from 1898 to present.

Evolution of supply network: yesterday, today and tomorrow: Formation processes of SNM and its evolution to the present time may be classified in 5 steps (Shukla *et al*., 2011):

- Step 1: Decentralization of procurement
- Step 2: Cost management
- Step 3: Integration of functions
- Step 4: Supply chain management
- Step 5: Towards supply networks and their data electronic management

It can be said that the concept of SNM is a combination of the 5-step management (Fig. 1). The 1st step can be described as the field of internal logistics. In the 2nd step, the attitude towards the organizational decentralization changes to the centralization of core functions which are derived from the new attitudes associated with cost optimization and customer service. In the 3rd step, the supplies significantly expand and cover warehousing, internal shipping and the relationship of inside operations with the functional areas of business partners. As the concept of channel relationships grew in the 4th step, the concept of supplies transformed to the supply-chain management. With the growth of complexity in supply chain structures, they cannot be named as chain anymore. They were transformed into complex networks and the management of these networks, became one of the main concerns of researchers (Serdarasan, 2013). Today's, one of the efforts in this field is the use of information technology applications in SNM. It can be said that the SNM is entering into the 5th step, namely the electronic SNM and the complex SNM (Fritz and Hausen, 2009). In the next study, history of each of the 5 steps is briefly described.

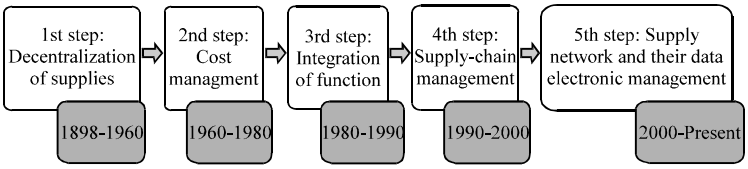

Fig. 1: History of SN process (with some modifications) (Shukla *et al*., 2011)

Step one; decentralization of supplies: This stage was developed from the late 19th century to the early 1950's. During this period, the area of logistics was not known as an important source of competitive advantage. Basically, logistics were known as a mediator's duty with inventory and delivery management. Agencies believed that logistics cannot make profits and are therefore, not worthwhile to be invested in (Johnson and Leenders, 2004). Here, researchers examine the major events of this period.

The word logistics was seen for the first time in the oxford english dictionary of Simpson and Weiner (1998) to be used in military activities in military science journals to introduce the packaging and storage techniques (Lummus *et al*., 2001). In 1919, transport and traffic researchers and professors of Syracuse University carried out their initial researches on the supply of goods (Whitman, 2012). At that time; the companies suffered from the low research efficiency, until, Henry Ford in 1927 made some changes in the layout of the machines allocation, as chain-shaped (Line-shaped) and decentralized supplies to reduce the production costs of the car class A. Finally, he managed to invent the mass production system (NSF, 2003).

Mass production system of ford not only revolutionized the industry in Europe and America but also the combination of the mass production of goods with high wages for workers and lower prices, created such an effect on the economy and society of the 20th century that it was called Fordism (Hudson, 2009). The growing trend of research towards increasing efficiency in manufacturing firms continued until in 1950, Wroe Alderson, then presented the strategy of postponement. This strategy was the next step in order to avoid errors in estimating demand and reducing costs. The strategy of postponement is based on the fact that the business entities postpone changes in form and identity of products to the latest possible point in the marketing flow and postpone changes in inventory location to the latest possible point in time (Brassington and Pettitt, 2003).

After the successful implementation of mass production at Ford's plant and the increase of products, the next concern of manufacturers and factory owners was identifying and tracking the products. In 1952 Norman Woodland and Bernard Silver managed to provide the bar-coding system, they registered the strategy, as an invention with the code no. 2612994 in the United States Patent and Trademark Office's (USPTO) (USPTO, 1952). Then in 1957, an organization was established to develop a scientific framework for performance management in America-the American Production and Inventory Control Society (APICS). At the time, companies went to the APICS for training, prestigious international certifications and a comprehensive resource and a global network of industries. Today, APICS continues its reserach; as a leader and academic primary source in the scientific body of the supply chain, manufacturing operations management, inventory control, material management and logistics. After providing the bar-coding system, most of the managers focused on the control and management of production and warehousing costs. Thus, the second stage of development began.

Second step; cost management: In the mid-50s, it was found that existing the structure and purpose for logistics and its management can be a competitive advantage for the company. The second step in the SNM emerged in order to evaluate the 2 main points. The first focus is the efforts of companies to focus on the logistics activities in an independent management system. It can be examined by the combination of a series of activities distributed through an independent section. Thus, the separate costs associated with transportation, physical distribution and inventory can be decreased. Thereupon, simultaneously the efficiency throughout the logistics system can be increased as a whole. The second critical point is the centralization of companies to use the concept of total cost in logistics. The strategy attempts to minimize the total costs of logistics by decreasing the costs of 1 or 2 specific functions of logistics such as transportation or warehousing (Kulmala, 2004). The main activities during this period are stated after.

In 1961, Forrester could identify the forrester effect in the supply chain management to increase control and enhance demand in his book entitled Industrial dynamics, MIT Press in 1961. Forrester's research showed that demand could be erratic with peaks and troughs,

commonplace within most organizations. These variations in requirements and supply are amplified within the supply chain when re-orders are made (Forrester, 1961).

In the same year, Gene Thomas in IBM Company managed to develop the concept and application of Bill of Material or the basic version of MRP.

With increasing interest in the supply-chain issues, Proctor and Gamble company held a contest titled Traveling Salesment Problem (TSP) in 1962 and asked the participants to solve this problem for 33 different cities. The winner was Professor Gerald Thompson of Carnegie Mellon University and he presented the first solution to reduce the cost of a TSP (TSP, 2005).

Researchers felt that there is a need for a community to develop and improve the skills of companies in the field of logistics, increase the theoretical and practical knowledge and also an efficient scientific source to teach the concepts of production and logistics. To this end, the Council of Logistics Management (CLM) that began its research as the National Council of Physical Distribution Management was established in 1963.

The importance of the relationship between supply chains was examined for the first time by Shaw *et al.* (1969) in a study entitled customer-supplier relationship. Their study can be considered as the start point of analyses associated with the relationship between supply networks. In 1971, Zicmund and Stanton stated that a production system cannot be considered as a result of a one-sided and linear relationship. They presented the initial idea of reverse logistic in order to reduce costs. In this theory, the relations of production machinery and logistics are considered as circular and rotational and good flows can also occur in the opposite direction and create a backflow. Reverse logistics, including the process of returned goods and a suitable deal with these items and all operations related to the reuse of products and materials are in order to increase productivity and profitability of efficiency of the producer. Reverse logistics is one of the ways to reduce costs and increase revenue and customer service levels (Wrigh *et al*., 2011). The term Supply-Chain Management (SCM), emerged for the first time in an interview of Keith Oliver, the consultant of the Booz Allen Hamilton company with the financial times in 1982 (Blanchard, 2010).

With the growing research interest in the field of reducing production costs, the researchers found that it needs the integration of functions and thus they entered the third step.

Third step; integration of functions: During the 1980, corporate executives realized that focuses on the total cost of logistics is a positive way to manage the distribution channels (Smichi-Levi and Kaminsky, 2000). Until this time, most corporate executives looked at logistics as a tactical activity that has a very little effect on the company's strategic planning. In the mid-70s, the companies realized that due to the continuous improvement and integration with logistics, partners can provide great strategic values. The main activities carried out in order to improve logistics system and supply networks are expressed after.

Theory of constraints is one of the new approaches within the field of continuous improvement that was introduced for the first time by researchers in 1984. Perhaps, the basis of this theory can be expressed in 1 sentence: Limitations of each system, determine its function (Goldratt *et al*., 2012). Goldratt defines the constraint as anything that limits the system performance relative to its target. He also defines the goal of a business agency as making money, now and in the future. Goldratt describes the concepts of constraint theory as a story in the book entitled goal. This book gradually revealed the philosophy and applications of this theory in the form of daily production. Until about 10 years ago, the theory of constraints was limited to the production. However, today this theory is used in a wide range of organizational topics such as finance, project management, production management, supply-chain management, marketing, sales and strategic management (Bhatnagar and Sohal, 2005).

In 1985, due to strong growth in the competitive environment of textile and apparel industries around the world, the leaders of these industries in America established Kurt Salmon associates group in order to recover the chain activities. In the same year, this group analyzed the supply chains of textile and apparel industries in order to accelerate the response time. Previous studies showed that the delivery time for the apparel supply chain from raw materials to consumer is generally 66 weeks of which 40 weeks are spent in the storage or in transportation (Fernie and Sparks, 1999). This time causes major damage to the chain goals. The results of this research became the trigger of Quick Response (QR) strategy. In QR strategy, suppliers and distributors research together in order to reduce the response time to the needs of consumers by sharing the necessary information (Lummus *et al*., 2001). In the same year, Ken Ackerman and Dean Wise, published a study on the Third Party Logistics (TPL) in the council of logistic management annual conference and examined for the first time the issue of outsourcing in key activities of a supply chain to external companies. The one of the main advantages of the outsourcing of logistics activities is the focus of plants on their key competencies through which they can increase their production efficiency (Cai *et al*., 2013; Hertz and Alfredsson, 2003).

After implementing the system of mass production by Henry Ford and the first revolution in manufacturing industry, Krafcik (1988) published a study entitled Triumph of the lean production system and introduced the new system of lean production that reduces costs and enhances the efficiency to the mass production. The introduction of this system after its implementation in the production systems of toyota company can be considered as the second industrial revolution. Lean production uses the continuous improvement philosophy and tries to analyze the losses during the production process using teamwork culture (Black and Hunter, 2003). Following a lean system reduces production time, increases staff efficiency and product quality, generates greater flexibility to market, reduces inventory levels, increases life expectancy of machinery and equipment and reduces the overhead costs (Pettersen, 2009).

Due to the outstanding principles and systems such as lean production and QR strategies, researchers found that they need an expertise to handle them in the entire chain levels. Thus, the supply-chain management concepts were formed.

Fourth step; supply chain management: During the 1980s, companies developed concepts of integrated logistics and supply channel management to exploit new market realities. Supply chain goes beyond the logistics and includes other activities such as handling multiple manufacturing companies, setting goals, determining internal and external buying strategies, enhancing the quality of manufacturers marketing and customer service to multiple clients (Shukla *et al*., 2011). During this decade, some activities were carried out in order to improve the SNM. A history of some important activities is stated after.

Michael Hammer in 1993 introduced a new management system called Reengineering in a book entitled Reengineering the Corporation: A Manifesto for Business Revolution. He stated that the old methods of management were no longer useful to succeed in the competitive market and that new methods were needed to have the simultaneous successful ability in the 4 areas of fast delivery, high quality, high flexibility and low cost. He introduced the re-engineering method as a fundamental idea business process to improve the four criteria of critical management (Hammer and Champy, 1993).

With the rise of using supply-chain management in production, the Supply-Chain Council (SCC), in 1996 started its activities with 69 volunteer companies to promote the objectives of supply-chain management (Supply-Chain Council, 2006).

The problem which is not managed in the supply chains due to the Instability is the bullwhip effect (Costantino *et al*., 2013). This effect causes a fluctuation in the supply chain and its major cause is changes in the level of demand. In other words, a minor change in the customer side of demand, make a major fluctuation in the first level of suppliers demand. As a result the network will face large fluctuations (Delhoum, 2008). Each organization and member in the supply chain tries to solve the problem from its own perspective. The bullwhip effect is considered in all industries and shows its effects by increased costs and poor service levels. Lee *et al*. (1997) published a study entitled information distortion in a supply chain: The bullwhip effect and presented ways to reduce and control this effect.

With the increasing development of research on supply-chain management, supply chains converted to complex networks. The one of the most basic needs prevailing in these networks was making relations in order to maintain integrity. With the advancement of science, researchers began to think of SN problems and e-SNM.

Fifth step; towards supply networks and their electronic data management: Over the past 2 decades, due to the increase of customers expectations and consequently increasing industrial competitiveness, there was a belief that not only competition between the companies and even the supply chains but also cooperation among several integrated supply chains are needed. This collaboration which is called supply network is done between several chains and is no longer like a simple linear collaboration. The quality, delivery time and services to the customer are widely dependent on the factories and plants which have been involved directly and indirectly (Blanchard, 2010). So, these issues create challenges for legally separated companies, coordination of material flows, information and so on which did not occur before. In the end, the information technology extended the functional area of supply-chain management. The aim of e-SNM is to reduce the data-transfer and product's costs on the one hand and extend the business opportunities and cooperation between companies on the other hand (Lancaster *et al*., 2006).

In the early 20th century with the rise in need for specialists who are able to handle the logistics management, the united states department of labour in 2000, released its new category of professional as logistician and introduced this expertise formally as a profession Invalid source specified.

Due to the increasing potential risks of greenhouse gases, a protocol was adopted in 1997 to reduce its

emission. Until 2001>1000 companies and organizations following the protocol of Green House Gases (GHG), developed and improved the environmental conditions in order to reduce emission. This was the first step towards a green supply network.

SNM became gradually an expertise until O*Net, one of the main contributors to the American job center, presented the job class to the SN managers in 2010 and introduced SN managers officially as a career. Given today's competitive business market and also satisfying the demands and expectations of customers, the managers mostly use the complex supply networks rather than linear supply chains to enhance their flexibility. Most current researchers deal with cost reduction, quality increase and delivery time reduction in these networks (Shukla *et al*., 2011).

A GENERAL VIEW OF A SUPPLY NETWORK

SN includes all activities associated with the flow and transformation of goods from the raw material's stage (extraction) to delivery to the final consumer, as well as the associated information flows. It is composed of the following components (Singer and Donoso, 2008):

Upstream supply network: This study contains the primary suppliers (they can be assemblers or manufacturers) and their suppliers and all directions come from the material. The main activities in this study are purchasing and delivery.

Internal supply networks: It covers all the processes used by an organization to convert the carried data and materials into the organization by the suppliers from when the materials enter the organization until the final product moves to the outside of the organization. Activities here include material handling, inventory management, manufacturing, quality control.

Downstream supply network: It covers all the processes used by an organization to convert the data and materials carried into the organization by the suppliers from until the final product exits the organization. Activities here include packing, warehousing and transporting. These activities may be carried out using several distributors such as retailers or wholesalers.

Supply networks occur in all shapes and sizes and may be very complex. SN for an automobile manufacturer includes hundreds of suppliers, thousands of workshops and assembly workshops, warehouses, brokers, direct commercial vendors, wholesalers, customers and supportive functions such as product engineering, procurement agencies, banks and transportation companies (Serdarasan, 2013). In general, the SN is a network of organizations that are involved with upstream and downstream processes and activities (Monczka *et al*., 2011).

In fact, a supply chain or in the more complex cases a supply network, consists of 2 or more organizations that are legally separated but are interrelated by the flow of material, information and finance. (Shukla *et al*., 2011). Figure 2 is shown the main components of a supply chain.

SNM includes all the integrating activities related to the materials flow and transportation of goods from the raw material (extraction) to the final product (for consumers) and the related information flow. This is done by improving the relationship within the network and chains to achieve the reliable and ongoing competitive advantage. This management philosophy aimed at reducing costs and delivery times take place (Huang, 2013).

For a better analysis of the supply network, its aspects must first be understood. In general, as shown in Fig. 3, the SN can be measured in 2 dimensions (Li *et al*., 2009).

Horizontal dimensions: It represents the number of horizontal cells in a network (A SN consists of several cells (e.g., suppliers, manufacturers, distribution centers and customers).

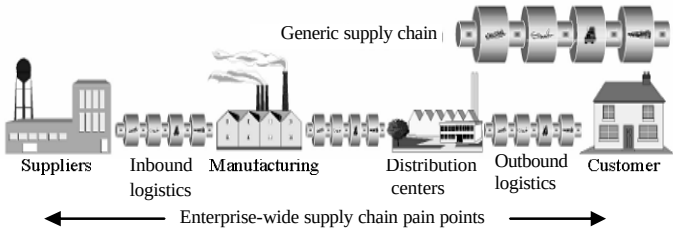

Fig. 2: The main components of a supply chain (Chopra and Meindl, 2001)

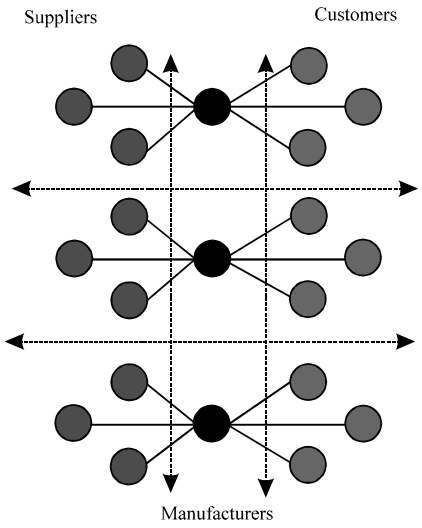

Fig. 3: Dimension of supply network

Vertical dimensions: It represents the number of each cell separately (e.g., number of suppliers, manufacturers and customers).

COMMON CHALLENGES IN SN AND THEIR SOURCES

In the business world, there are many examples of companies that are not able to reach their demand level and thus, suffer from the costly inventories. In this study, researchers describe these problems and their causes. Generally, the problems of SN arise from 2 sources: Uncertainty and lack of coordination (Arshinder *et al*., 2011).

Uncertainty: A major source of uncertainty for the SN is predicting demand (Van Donk and Van Der Vaart, 2005). Predicting demand is affected by several factors such as competition, price, current conditions, technological development and the general level of customer commitment. Another factor of uncertainty in the SN is delivery times (Safaei *et al*., 2011). They dependent on some factors such as the breakdown of machines in the production process, traffic density which is involved in transportation, quality problems of materials that may cause production delays and the network structure and network partners.

Lack of coordination: These types of problems occur when one sector of the company has not a good relationship with other sectors when the communications and messages are incomprehensible to business partners and the company departments are not aware of some issues or when it is too late to become aware of what should happen (Qi *et al*., 2004).

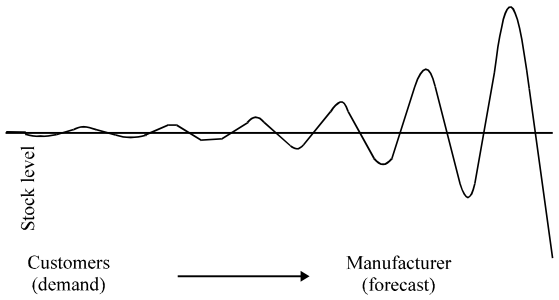

Fig. 4: Stock variability amplification in a SN due to bullwhip effect (Buchmeister *et al*., 2008)

As it was pointed out, numerous problems can occur during the supply network from these sources. The two of the most persisting problems are cited here (Balan, 2008).

Bullwhip effect: This effect was observed for the first time by Procter and Gamble (P&G) in relation to one of their products. The bullwhip effect means that small change in product demand by the consumer that occurs at the beginning of the SN is converted to larger fluctuations in demand during the reverse route through the SN (Delhoum, 2008). The bullwhip effect refers to the fact that the variability of orders received by suppliers are much more than the variability in consumer demand. Because of this, the companies that are in various stages of the SN will have a different idea of the market demand and this issue creates challenges for the SN (Buchmeister *et al*., 2008). Companies with this type of behavior in response to fluctuations of demands will face product shortage and then will be forced to provide additional products (Fig. 4).

Deceptive stock: This problem occurs when the customers want a product that is not available to them but generally is. This happens for example, when a product is placed at the wrong place or the wrong value is stored.

There are 3 main types of techniques to deal with the network management problems:

- The first are techniques which are associated with the design and supply of products, suppliers, management of relationships between suppliers and the relation of organization with the suppliers (Smichi-Levi and Kaminsky, 2000)
- The second set of techniques is associated with production systems, inventory management and internal issues within the organization to solve the problems (Basnet, 2013)
- The third category of techniques considers distributors, buyers, buyer's fidelity and their coordination throughout the organization (Balan, 2008)

TOWARD AN EFFECTIVE AND EFFICIENT SUPPLY NETWORK

Definitions of supply networks cover some issues such as information systems management, sourcing and procurement, production scheduling, order processing, inventory management, warehousing and customer service (Ayers, 2000). Thus, it is necessary for the suppliers and customers to research in a coordinated way and share their information. The rapid flow of information between customers and suppliers, distribution centers and transportation systems, enables some companies to build highly efficient supply networks. Suppliers and customers should have the same goals and mutual trust. Customers rely on their suppliers about the product's quality and services. In addition, the suppliers and customers must cooperate with each other to achieve the common goals and facilitated communication and information flow (Sahay, 2003).

Some companies try to gain SN control using the acquisition and integration of all components along the SN from the procurement of materials and services to the final product delivery and customer service (Huang, 2013). But, even with this type of organizational structure, operational activities and units may be inconsistent. The organizational structure of the company must focus on the coordination of activities to achieve the overall goals within the company (Ayers, 2000).

To achieve efficiency and effectiveness in the management of supply networks, 5 functions are considered. These 5 functions are partly a factor in the organization. Skills and effectiveness of SNM will depend upon the accuracy of these 5 functions (Emam, 2003).

The structure of SN partners: The SN is designed according to the efficiency of strategic factors and customer requirements so that it covers the range of available products services and new products (Humphries and Mena, 2012).

Implementing a participatory communication: This section refers to the kinds of essential partnerships for the company. This function expands the performance of SN communications to partnerships with outside factors. Partners need to be notified of any changes in the supply network which must be implemented in the whole network. SNM requires the effective partnership of factors outside the company. Even so, the company's relationship with the outside firms is problematic (Safaei *et al*., 2011). Some issues such as the center of competition, partners motivations and their structure are described about the partners.

SN design for strategic profitability: Supportive operations of the SN processes comprise:

- Organizing changes in the SN
- Collaborative process to redesign the supply network
- Evaluations and their roles
- Position of the SNM function within the company

SNM information: The role of information systems should not be ignored in the improvement of the supply network. This study shows the role of technology in the improvement of the supply network. Systematic changes must affect the changes (modifications) of the company's processes and strategies (Hoppe, 2001). The main concepts in this area include:

- Elements of SN system
- Technological innovation
- Using the software complements
- Difficulties in the implementation process

Reducing the cost of the SN: The main indicator of SN improvement is the cost reduction. This effort is part of effective strategies and policies. The 5 main reasons of costs are (Pettersen, 2009):

- Lack of clarity in the SN process
- Changes in domestic and foreign policy of the company
- Weaknesses in the design of production
- Insufficient information for decision-making
- Weaknesses in the network design and lack of definition in relationship between partners of the supply network

CONCLUSION

Due to the importance of the term supply network as one of the main keywords, this study deals with introducing and explaining supply networks. First, researchers examined definitions offered in the literature review, so as to become familiar with supply networks. Then, the history of the development of supply networks, since their appearance was stated. The history was divided into 5 stages:

- Decentralization of procurement
- Cost management
- Integration of function
- Supply chain management
- Supply networks and their electronic data management

Following that a general view of SN structure was provided and its parameters and structural aspects were introduced. Later, the literature review was examined to categorize and explain problems and issues most SN researchers are facing. At the end, solutions for creating an effective and efficient SN were presented in the next step.

The main aims of this study were providing a better understanding of SN history of evolution, challenges and literature review. This study can serve as a tool for researchers in this field to clarify the most common challenges and strategies of solving them by highlighting these issues by this study.

This study can serve as a tool for research, clarifying the issues related to the network is provided. This study, by collecting all common subjects and challenges related to supply networks, creates a sight to the researchers who are beginning their study. Thus, it can provide a considerable saving time for them.

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