

## FUTURE SUPPLY CHAIN – CLUSTER SUPPLY CHAIN

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**Abstract:** Resource scarcity, climate change, more recent political and economic regulations makes necessity to changes, which the enterprises will have to cope in coming years. Cost efficiency, on-shelf availability are the factors forming the supply chain, which by the necessity of further changes reveals harder to implement issues such as: city traffic, energy consumption, carbon dioxide emissions or sustainable growth of transport costs. This puts into question the creation of new supply chains in future, and the goal of this article is to show a new way of thinking during future design process.

**Keywords:** supply chain, cluster, cluster supply chain

### 1. Introduction

Increasing economy means for companies to be always one innovation ahead of competition. This involves constant readiness to market responses, one hundred percent availability of the inventory and being out against the lean management mentality. It is obvious that for individual companies is difficult to meet such requirements as time and capital / cash. Not only long term cooperation in the chain may provide additional benefits in the form of a wider spectrum of responsiveness and flexibility. A particular form of cooperation between organizations is cluster. The term has been introduced to economy managing by M.E. Porter, who drew the attention that clusters constitute a source of strong and sustainable competitive advantage [see more in 8.]. With the development of organizational paradigms and globalization, cluster became also one of the main weapons used in competition for individual small and medium sized enterprises. Clusters by specific form of cooperation have become important to logistics, which resulted from their knowledge of cooperation in networks and supply chains. By its broadest sense, the network can be considered as social, economic and / or political relations between businesses (owners) and organizations. On forming of a regional value-added network consist a large number of companies from the same region, which are linked together by means of cooperation and competitiveness in the vertical and horizontal dependencies. Characteristic for these relations is branch, industry and technologies associated with these processes [3.].

Designing of supply chain is focused on specified levels of a single supply chain, which takes into account only the vertical co-operation thereby ignoring the dependence of horizontal. Reference to study of the supply chain network looking like multi-chain can be found in literature. However, network contains basically in itself only one company that dominates entire supply chain. Fan-shaped structure provides combination of both ends chain along the into network of companies, where one leading enterprise, more than once

plays the leadership role in decision making on location capacity, inventory policies, transportation, etc. [7.]. This kind of network connection is essentially a single supply chain operating in general principles such as cluster, but not a multi-chain system.

## 2. Supply Chain - future design

Supply chain designing is taking place in two ways. Qualitative approach uses a partner's financial status, quality, efficiency, selection of markets, product changes, etc. The quantitative approach is focused on minimizing costs or maximizing profits throughout the supply chain, which refers to determination of production capacity, determination of transport and retail sales and wholesale records. Constructing of the supply chain requires a decision concerning location, capacity of each level along supply chain, the allocation of submarket and suppliers of components and materials, etc. The initial phase of designing the chain considered as the problem of object location (Facility Location Problem-FLP) were grouped into three categories [1.]:

- P - Median Problem → model defining that the N retailers ordered from M warehouses and selects P warehouses as the optimal solution. This model does not participate in availability and fixed cost and consideration about unlimited possibilities of individual warehouses;
- Capacitated Facility Location Problem (CFLP) → model declaring the number of warehouses as a variable, takes into consideration the availability, fixed costs and storage space;
- Distribution System Design Problem (DSDP) → expanding model from one product to K products.

The supply chain is fusing usually many participants and is not limited only to the same consumers, suppliers, manufacturers and distributors. The supply chain is a complex system that consists of many different stages of manufacturing and supply through one or more distribution points. Various problems of supply chain network may be caused in production planning area, warehouse management, transport logistics (which function fully), or even vendor selection. These problems are the kind of decision problems which companies have to face while building supply chain [2.]. Unfortunately, modern economy, and more specifically its development poses increasingly difficult rules of the game. Globalization of individual companies is reflected in the smooth functioning of the supply chain adapted to new - economic image of the past. Therefore, companies which constitute the supply chain recognize the increasing political impulse around the issue of resource scarcity, climate change, security, or new regulations. These issues are challenging for them the next few years their activities on global market. Creating a chain so far primarily concerned costs, efficiency and availability directly from the rack (on-shelf availability). Since then, however, they must be identified with such factors as traffic volume in urbanized areas, energy consumption, CO<sub>2</sub> emissions and increase of sustainable transport costs. Enterprises building future supply chain [based on 4.] should take into account the components of four key areas of solutions.

Solutions area → focusing on innovation physical supply chain, which are related to the identification of key areas, such as:

- in-store logistics: availability of products, interference with consumers;
- collaborative physical logistics: the mutual use of transport resources, its infrastructure and storage facilities;

- reverse logistics: recycling of products, packaging;
- demand fluctuation management: action of planning, implementation and monitoring are held jointly;
- identification and labeling: common for all participants;
- efficient assets: using alternative forms of energy, green buildings, efficient transport equipment;
- scorecard and business plan: built on common and clearly defined purposes.

Guiding practices → providing examples integrated into a model showing the direction of solutions and ability to achieve of their benefits.

Translating on sample supply chain → presentation on the simplified supply chain, example of application for new solutions and to show its operation after adaptation in to the individual businesses. This will allow illustrating real solutions, taking into account characteristics of an exemplary supply chain.

New ways to calculate the impact on the supply chain → specifying effects of leading practices and solutions in the future supply chain; this model is an important element which applies new parameters.

The total impact of redesigning supply chain (including exploitation of transport means and technology of storage), according to report by the Global Commerce Initiative (GCI) and Capgemini (one of the world's Foremost providers of consulting, technology and outsourcing services) [4.] can improve the products on shelf availability, and per unit of pallet potentially lead to:

- reduce transportation costs to order of 30% and the manipulation costs up to 20%;
- reduce the delivery time by 40%;
- to reduce emissions of carbon dioxide by 25%.

These benefits can be achieved provided, that all components of the future supply chain will be in the right place, ensuring a clear positive effects on society, industry, individual companies and finally for buyers and consumers.

Commercial aspects, ecological also demographic changes and new technologies are the components of external forces which are shaping the future supply chain (fig. 1.). It is difficult to affect these forces, but the industry by shaping the future chain in terms of major market trends in areas such as consumer behavior, the flow of information and products is able to affect the direction and intensity.

Changes made concerning genuine cooperation and new opportunities. A new era of cooperation in industry will be an important factor for future success, fulfilling a key role bringing to the authorities to adopt appropriate legislation. In many cases, companies will be obliged to reconsider the areas of competitive advantage, while others can stand to cooperate with competitors in order to supplement urban centers. Specific challenges will require from managers new working methods, tools, and thus new opportunities for supply chain management. "Reformed" managers will understand how important it is to realize the potential of innovation and collaboration, while a different way of thinking about management will be supported by additional training, the development of new skills and tools.

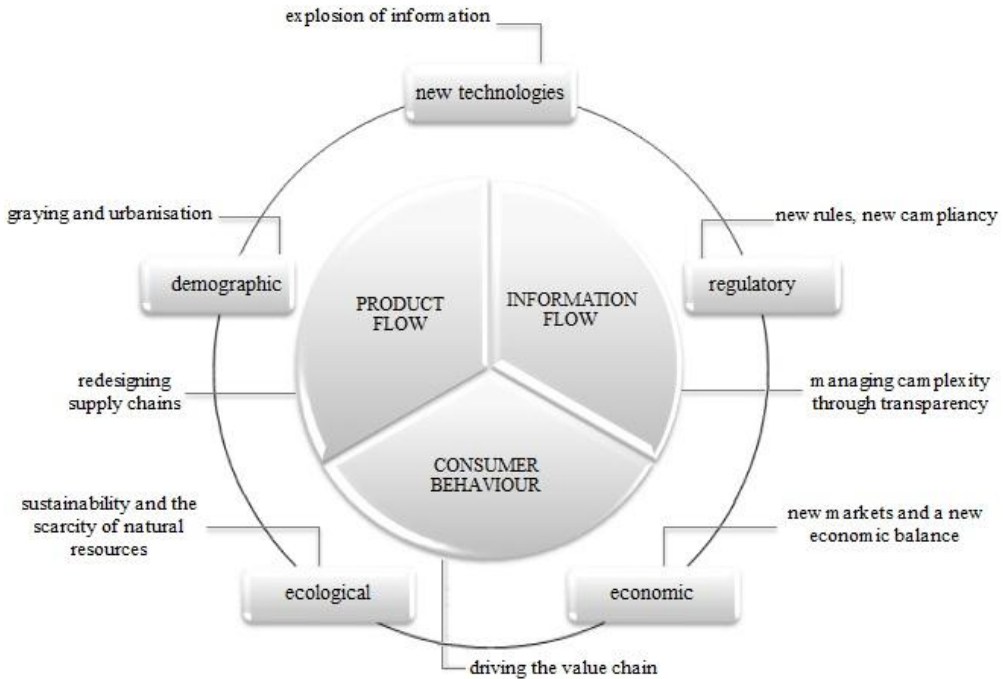


Figure 1. Future Supply chain – impact forces and trends

### 3. Cluster Supply Chain

The most of literature shows the designing of the supply chain from the viewpoint of the strategy. From the perspective of economic globalization, elaboration is carried out starting from global scale where the provider factor is added, and ending with the configuration of the supply chain including tariff and non-tariff exchange rate. For large enterprises designing of supply chain is most intended to reduce direct costs and eliminate the trade barriers. In the case of supply chain design for small and medium-sized enterprises cannot be simply transfer and apply this model. The reason for this situation are the aspects such as geographical, cultural and language differences, exchange rate fluctuations as well as legal and economic factors which characterize the company of district. SMEs sector needs to create its own multi-chains or cluster supply chains to enable them operating at the global economy level [6].

Considering the development situation of SME it should be taken into account the structure of cluster supply chain [based on 5.] consisting of two single chains and several assumptions. Each individual chain contains one supplier, manufacturer and retailers well that the producing similar or the same products. In addition, there is no direct competitive correlation, at the supplier, manufacturer retailer level. Taking these arguments into consideration, you can start designing of supply chain , starting in the first phase from the election, determine and optimize the business in every single chain in terms of their structure size, e.g. the vertical structure of the cluster supply chain. The next stage refers to verify that is there a lateral relationship between horizontal constructions of the cluster supply chain. This occurs through the introduction of variables to determine the horizontal dependencies between these two separate supply chains. While creating of such cluster supply chain is very important to face the following issues:

- verify that for a particular product additions occur in the lateral relations in chains between the supplier in one chain and manufacturer in the second, or manufacturer in one chain and seller in the second chain;
- determining position of suppliers and group of their supplies;
- determining transport route, as well as volume of delivery between suppliers and manufacturers;
- determining manufacturer's production batch;
- determining routes and groups of transport between producers and retailers.

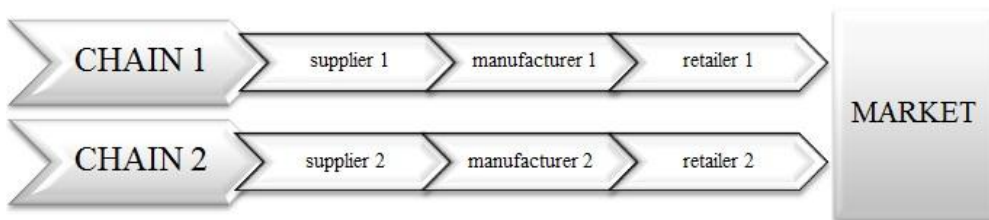


Figure 2. Cluster supply chain system without across-chain horizontal cooperation

According to reflection over the construction of cluster supply chain two cases should be considered characterized by two separated models, in which one will be excluding transverse depending, while the second shows a lateral relations occurring in horizontal cooperation.

Lack of horizontal collaboration throughout the chain indicates that two separate supply chains, are existing in the same geographic space as industrial cluster, while does not occur any relations between them as well as cooperation with the exception of functioning on the same market. This means that two separate supply chains among cluster supply chain system produce similar or identical products and compete with each other exclusively, as traders. Such dependence shows figure 2.

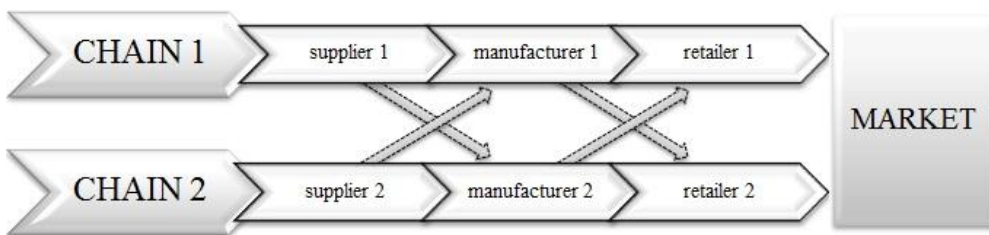


Figure 3. Cluster supply chain system with across-chain horizontal cooperation

The model of design cluster supply chain with transverse horizontal cooperation (fig. 3.) indicates that cluster supply chains exist not only among the vertical chain cooperation between enterprises which are above and below the structure along a single individual supply chain. It is equally well suited for lateral cooperation at the horizontal level. This type of transverse cooperation, applied in two individual chains allows avoiding a situation in which occurs by an excessive number or lack of stocks. Then, support has to be run, as an additional delivery channel or emergency procurement channel, where the regular supply channels and procurement is not able to prosper through the supply pipeline in vertical cooperation. Two single supply chains located in an industrial cluster is characterized by similarity of production, thus causing exchange of products between themselves in the market.

Supply chain cluster (fig. 4.) compared to traditional supply chain, distinct by layout having a several parallel individual supply chains, in one action area. This applies not only companies operating together within a single supply chain, but also cooperation and coordination to take place with the various other individual supply chains functioning in the area. What's more, there are many companies in the SME sector, which support process and complement the production in the supply chain leading their local economic activities. Taking into account a single supply chain in cluster system supply chain, it is assumed his importance by providing significant quantities of common components for further business.

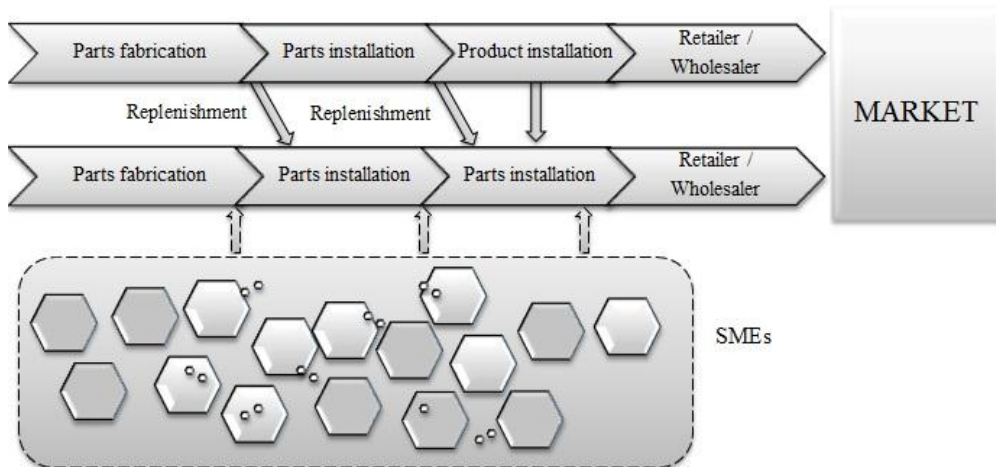


Figure 4. Cluster supply chains

Sometimes, however, individual supply chain serves as supporting one for the adjacent supply chain located on the common activities field, in order to complement the essential elements of process. The idea of cluster supply chain is a system in which small and medium-sized enterprises coordinate within the individual supply chains in the same geographical location to strive for maximum flexibility while minimizing their instability, supporting each other in order to achieve competitive advantage.

#### 4. Summary

Future supply chain should be based primarily on cooperation, which would include its reach every process within the supply chain. Information should be the most important factor fusing cooperation, understood as an exchange of information process between stakeholders. This procedure in the same way should include suppliers, manufacturers and retailers as well as logistics service providers and even customers. They are demand signal factor making consumer choices at home (online shopping) and directly in the store. The combining point of the manufacturing and distribution process should be common stores for manufacturers in chain from which the common transport relevant products from different manufacturers would provide them to the appropriate nodes of individual cities and regional consolidation centers. Warehouses located on the outskirts of cities should be operating as distribution centers, while outside urban areas as regional consolidation centers. In both cases cross docking would be made replacing the terminal distribution. Appropriate transportation would provide products, for urban and outside urban areas, to final customer both stores and homes using consolidated deliveries. Such classic, but very well-functioning supply chain is able

to meet the ever-changing customer's tastes with benefit of all parties. The arrangements for its operation are possible, however, for large chains that have adequate facilities or even production facilities assets. The solution for companies in SMEs sector is cluster supply chain that combines a number of smaller chains providing a common storage and disposing transportation, diminishing therefore fixed costs and increasing their competitiveness on the market. Regardless of choice the way, these solutions will improve the competitive position and more importantly will enable to compete in global markets.

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