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REALISING THE SUPPLY CHAIN IN THE CASE OF VIRTUAL COMPANIES

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Abstract

The article describes different inter-organisational relationships from the point of view of logistics, similarly to virtual organisations, and deals with virtual organisations in particular: Strategic networks, Virtual companies, Regional networks, Operative networks. Virtual companies have several advantages for the participating firms, however, they need a logistics solution different from other inter-organisational relationships. The possible solutions are presented here, which can give answers to the logistics problems of virtual companies which – as it will be presented later – are rather special. The paper focuses on the creation of supply chain of virtual companies.

Keywords: logistics, inter-organisational partnerships, virtual company, supply-chain management.

1. Introduction

The virtual companies are a new phenomenon among the different forms of organisation. The keen market competition and the fast development of information technologies made it possible to form these organisations. Increasingly, inter-organisational firms find it necessary to be flexible in responding to changes in the market environment.

The paper is divided into two main sections. The first one discusses the different Inter-organisational partnerships, while the second one deals with the special logistics problems of virtual companies and analyses the possible solutions of these problems.

It should be noted that each virtual company is a networked organisation, but not all network organisations are virtual. In fact, virtual companies can be regarded as rather specialised forms of these networks. These firms are linked primarily over a supply network and they deal with the production of tangible goods.

The supply chain is a loop which starts from the customer and finishes with the same. The process of this loop includes the flow of all materials, finished products and the information belonging to them as well as the financial transactions which are related to them. The tasks of supply chain management:

- Reducing the total costs of the supply chain by using efficient marketing, production and distribution strategies;
- Reducing the time of response to the fluctuation of consumer requirements and other changes;
- Approaching the minimum possible duration of time;
- The utilisation of the competitive advantages originating from the efficient supply chain in case of launching new products and services.

2. The Various Forms of Production Networks

When we look at the inter-organisational relationships which are similar to virtual companies, the following relevant features are usually considered: stability, openness, interdependence, redundancy and particularly the degree to which the relationships are organised [5]. The problem will be examined from the point of view of logistics.

Strategic Network

In this case the strategic leader of the network is a big core firm which is often a manufacturer or a retailer close to the final customer. The member firms are usually closely linked to the core firm but they also offer their products to customers outside the network to preserve their autonomy and competitiveness. Well-known examples of this form can be found in the automotive industry and the famous apparel manufacturers like Benetton or Nike are similar as well. A model is shown by *Fig. 1*. It is based on [5].

This form cannot be termed as an authentic virtual company. Its main characteristics are:

- the member firms are relatively big firms,
- they are relatively stable,
- the network does not depend on the momentary state of the market.

Virtual Enterprise

The virtual company has been variously defined in the literature. We define it as a cooperation for a limited period between numerous independent firms for performing certain services or manufacturing products, that is they cooperate temporarily in order to achieve their common business goals. Similarly to a big firm, it can cover the complete life cycle of a service or product, then after the accomplishment of the order will be disintegrated.

The main characteristics of virtual companies are the following [2]:

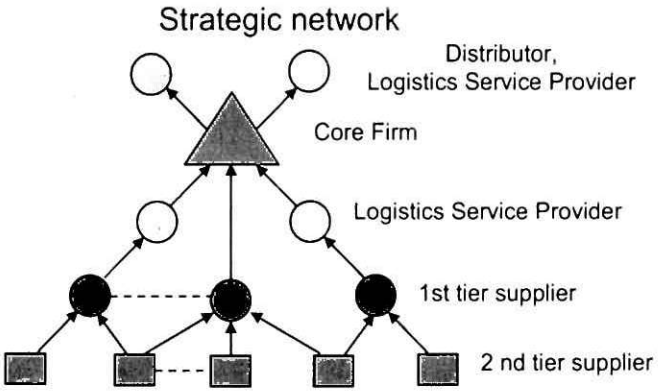

Fig. 1. A typology of strategic network

- focus on main function,
- new forms of order transaction and production,
- application of information and communication technology,
- formation of individual products,
- information flow instead of production flow,
- maximum flexibility and adaptability to environmental changes,
- development of a pool of competencies and resources,
- reaching a critical size to be in accordance with market constraints.

Virtual companies are only suitable for performing certain tasks because of their characteristics:

- supply of modules for an Original Equipment Manufacturer (OEM),
- supply of modules for a 1 tier supplier,
- salvage.

It is hard to imagine production in the FMCG (Fast Moving Consumer Goods) sector by virtual companies. They are not suitable for manufacturing final products because of the following reasons [2]:

- lack of offering servicing after selling the product to the customer,
- lack of providing component supply,
- problems of launching new product.

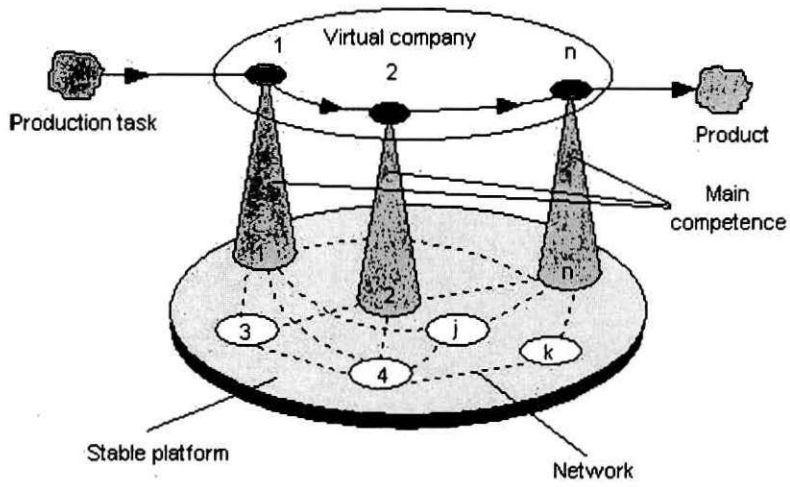

Fig. 2. Visualization of virtual company [9]

Regional Network

Small, highly specialised firms are situated in spatial proximity of each other and they cooperate repeatedly. The individual relationships do not have to be stable. The firms have latent relationships with a larger number of potential partners, which can be activated depending on current demand. The personal and social relations have a significant function. It is characterised by temporary cooperation changing partners, and shared leadership. It consists of several companies more or less at the same level in the supply chain. Frequently cited examples can be found in the northern Italian garment trade. This is shown by *Fig. 3.*

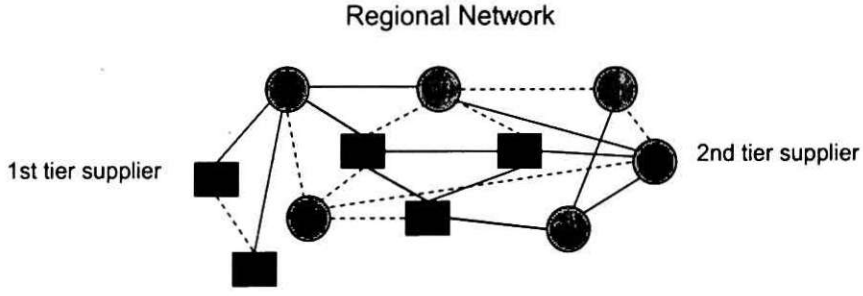

Fig. 3. Visualisation of regional network

Operative Network

The member firms can quickly get access to other resources of partners, at short notice, especially free production or logistics capacities. The transactions are relatively standardised. The purpose of this network type can be the use of pooled resources. The main concern is individual value adding activities rather than complex, common processes. This collaboration is similar to the electronic market but it is more highly organised than a simple market relationship. They can reach the common resources by a broker (agent). *Fig. 4* shows the visualisation of Operative networks. This Figure is based on [5].

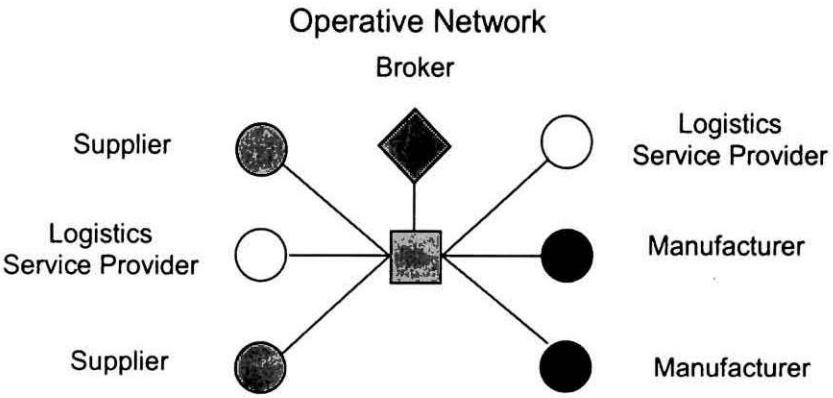

Fig. 4. Visualisation of operative network

Naturally, there is no cooperation in reality that would completly be correspondent to the models above, however, more and more collaborations display are similar to these models.

Four main types of supplier-customer relationships can be defined:

- *Horizontal relationships:* two suppliers cooperate in fulfilling logistical requirements, for example, they bundle their delivery volumes or one of them acts as a logistics service provider for the other supplier;
- *Lateral relationships*: two suppliers provide one and the same customer at the same time independently of each other;
- *Circular relationships:* the customers supply their supplier at the same time;
- *General reciprocal dependencies:* the performance of a supplier depends directly on the activities of an other supplier. The customer might change his productions plan because one of the suppliers' delivery problems causes problem for other suppliers as well.

Table 1 presents an overview of four types of production networks. This typology is partly based on reference [5].

Table 1. Realisation of the supply chain in virtual companies

Dimension	Strategic network	Virtual enterprise	Regional network	Operative network
Spatial Distance	Not relevant	Constitutive feature	In one region	Not relevant
Stability	High	Low	Medium	Low
Redundancy	Low	Low, each partner has a specific Competence	High, usually a large number of firms	High
Resources	Knowledge-transfer	Sharing without pooling	Access to partners' Resources	Pooling of resources if necessary
Information Technology	IT-use not necessary but often support of logistics processes	Use of IT as constitutive characteristic	IT-use not Necessary but useful For logistics	IT-use absolutely Necessary to Coordination
Trust	Important, but not a Constitutive Characteristic	Trust as the foundation of virtual company	Very important	Not relevant
SCM level	Aim: Suppliers' supplier to Customers' customer	To 1st tier supplier or a OEM	1 or 2 level	Not relevant
Head of SCM	Core firm	Logistics Service Provider	No direct control	No direct control

3. Realisation of the Supply Chain in Virtual Companies

Recent studies have dealt with the problem of SCM in detail. It has been a general principle that the whole supply chain has to be optimised from the 1st tier supplier to the customer. On the basis of the above mentioned it can be seen that this principle is not sufficient in its 'traditional' form due to the characteristics of the logistics tasks of various production networks.

This is specially true in the case of virtual companies, since in this organisational form final products are rarely produced. What happens is rather the supply to other big firms or OEMs.

3.1. The Problems of Supply to Original Equipment Manufacturer

The supply to big firms (OEM or 1st Tier supplier) is possible by interposition of a broker, who represents the virtual company, since these big firms can usually have only qualified suppliers. This is a big advantage for the firms which take part in a

virtual company but it is a disadvantage from the point of view of logistics because the global supply chain cannot be optimised.

If a virtual company is a supplier of an OEM, the global supply chain cannot be optimised because the OEM is only in contact with the broker, representing the virtual company but not with the participant firms; the latter are not recognisable. The OEM orders a product at a given price and requires it to appear at a given time and place. This model is shown by *Fig. 5.*

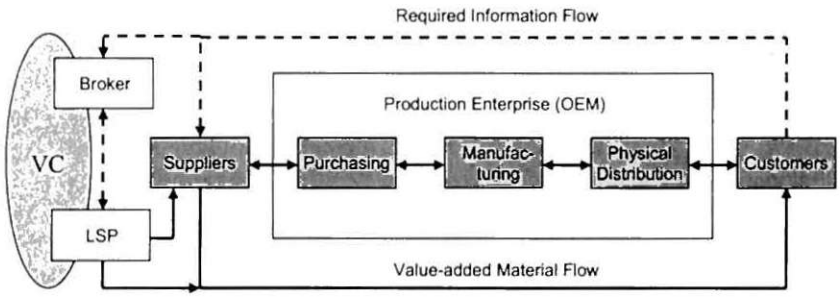

Fig. 5. Relationships between virtual company and Original Equipment Manufacturer (OEM)

Requirements of supply to OEM [4]:

- supply in accordance with JIT (Just-in-Time) or JIS (Just-in-Sequence)
- ability to respond promptly,
- short ordering transit time.

The above results in a very high demand on the coordination of inter-organisational logistics processes. Referring to virtual companies it cannot be a limitation that the supply chain should be one way. The firms connect to several supply chains and require varied logistics requirements. The aim of the participants is to create a flexible, dynamic network. The participating firms take part in the collaboration with their special know-how. The fulfilment of these coordination requirements is rendered difficult by the fact that coordination mechanisms are at a low level. One of the solutions could be the standardisation of processes, technical and organisational interfaces [8]. Standardisation takes place widely in the following domains:

- materials handling and transport units, transport units,
- vehicle sizes,
- production processes,
- machines and products.

However, in the course of standardisation it has to be taken into consideration that standardised systems have a lower efficiency as compared to logistics systems which are adapted to the production characteristics. We have to take into consideration the aim of quick reconfiguration [7].

One other obvious solution to the problems of coordination is the use of a Logistics Service Provider (LSP) which carries out all logistics activities. (Naturally, these tasks can be assigned to several LSPs, as well.) It is a precondition that the LSP (or LSPs) is able to understand the requirements of each firm and to react accordingly by adapting processes without any significant efficiency losses. But the idea that an LSP carries out is that all logistics activities in a virtual company have a main problem: the participant firms have to accept the LSP in a coordinator role in the network.

This brings up further questions:

Whether the LSP is suitable for the task or rather how much learning time it needs considering time constraints?

Whether its leader role will be accepted?

Generally, there is a leading firm in every collaboration, which does not let an other company especially an 'external firm', have the control over the organisation.

3.2. The Main Tasks of Logistics Service Provider

Transport Management

The best possible utilisation of transport vehicle. One of the obvious solutions is the bundle of consignment coming from different firms and having the same destination.

Choice of Convenient Vehicle of Transport

Main points of view:

- length of haul:
  - long-range: intercontinental;
  - medium: among countries;
  - short-distance: inter-regional.
- transport time;
- carriage;
- connection of different modes of transport (roadway, railway, waterway and airway).

A further point is the existence of the adequate transport infrastructure. In lack of that [7]:

- the manufacturer or customer may use inventory to protect production against fluctuations in the supply chain caused by uncertainties;
- the transport firm may operate through the night and weekends to avoid peak traffic periods.

Scheduling

The goods should be produced with appropriate timing so that no waiting period is necessary in warehouses or logistics centres. It should be noted that recently several studies and programs have been created in this field.

One of them is the *Production Network Management System* (PNMS) by MTA SZTAKI (Computer and Automation Research Institute of the Hungarian Academy of Sciences) [1]. This program is involved in the creation, control of virtual companies and the scheduling of their tasks. However, some constraints appear just in the field of logistics:

- The program supposes that all the capacity is available within a given time for each user;
- Besides, transport distance is not considered.

Due to the temporary character of the cooperation, a further disadvantage can be the cost of purchasing and installing software. In this case an Application Service Provider (ASP) can have an important role.

Information Management

The LSP should be informed of the appropriate time and day of delivery. The information comes from:

- the broker (delivery to customer),
- the member firms (delivery from the supplier).

Formation of Virtual Supply Chains

Safety stock is usually held in the form of finished goods because this is the most straightforward way of ensuring the availability of the required product. An alternative to holding stock as finished goods would be to define the supply chain through which the stock can be made available, and to secure the required capacity and resources within that supply chain [8].

4. Conclusions

Logistics play a key role in the development of these new organisation forms, especially of virtual companies. The application of virtual companies for small and medium sized firms is a possibility. This is a good solution that they become a supplier of a 1st tier supplier or an Original Equipment Manufacturer. But they have slim chance of playing role in the global market.

As we have presented, the pronounced specialisation of the member firms of virtual companies results in a very high demand on the coordination of the logistics processes. The demands of virtual companies could be satisfied by a logistics service provider but this role may be beyond the scope and competence of a conventional transport firm.

SCM has been defined as the better way. It has been claimed that the day is near coming when companies will no longer compete against other companies, but supply chains will compete against other supply chains for market supremacy. But as long as just some tiers can be dealt with, it will remain a theory. The management of entire supply chain from suppliers' supplier to customers' customer cannot be realised.

References

[1] ZUDOR, E. I. – MONOSTORI, L. – KUZMINA, E., Constraint Programming Based Support for Production Networks Management, *7 – th IFAC Workshop on Intelligent Manufacturing Systems*, Hungary, 2003.

[2] WIRTH, S. – BAUMANN, A., Wetschöpfung durch vernetzte Kompetenz, Huss-Verlag, München, 2001.

[3] FAWCETT, S. E. – MAGNAN, G. M., The Rhetoric and Reality of Supply Chain Integration, *International Journal of Physical Distribution & Logistics Management*, **32** No. 5 (2002), pp. 339–361.

[4] BEHLMER, A., Auf in den Park, *Automobile Industrie*, No. 7–8 (2001), pp. 48–51.

[5] PFOHL, H-C. – BUSE, H. P., Inter-Organizational Logistics Systems in Flexible Production Betworks, An Organizational Capabilities Prespective, *International Journal of Physical Distribution & Logistics Management*, **30** No. 5 (2000), pp. 388–408.

[6] WIENDAHL, H–P. – LUTZ, S., Concept for Production-Management in Networks, *Proceedings of 16th World Computer Congress, Information Technology for Business Management,* (2000) Beijing, China, pp. 424–431.

[7] CROWLEY,J. A., Virtual Logistics, Transport in the Marketspace, *International Journal of Physical Distribution & Logistics Management,* **28** No. 7 (1998), pp. 547–574.

[8] CLARK, M. P., Virtual Logistics, An Introduction and Overview of the Concepts, *International Journal of Physical Distribution & Logistics Management*, **28** No. 7 (1998), pp. 486–507.

[9] KULCSÁR, B., *Ipari logisztika*, LSI Oktatóközpont, Budapest, 1998.