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THE ROLE OF INFORMATION EXCHANGE IN LOGISTIC NETWORK STRATEGIES

Marek Matulewski

Poznań School of Logistics, Poznań, Poland

ABSTRACT. The author discusses the role of information and information exchange in logistic supply network strategies. First, the difference between the logistic supply chains and logistic supply networks are discussed. Next, two types of information flows are distinguished, that is to say: information flow aiding coordination activities and information flow aiding operational activities. The relations occurring in the supply networks, constituting the source of the advantage, are dealt with. The author touches upon the following factors affecting information exchange in logistic supply networks: changes in consumers' behaviour, the increase in the consumers' spending power, internationalization and globalization of economy, consolidation processes and technological development. Then, the main areas of potential conflicts affecting the information exchange preferences between industry and commerce are listed. Finally, two basic types of relations (as far as the interrelations between network links are concerned) are enumerated: (i) confrontative approach to the participant, and (ii) co-operative behaviour. The changeability and uncertainty of demand is also a very important logistic problem, which is especially visible in the so-called Bullwhip Effect (or Whiplash Effect). Many companies resort to forecasting when they try to protect themselves against the demand uncertainty and changes. Finally, the impact of new technologies on the information exchange is presented.

Key words: information, logistic chain, logistic network, logistic strategy, confrontative approach, co-operative behaviour, bullwhip effect, information exchange.

INTRODUCTION

The continuous increase in the market requirements which must be met by enterprises has resulted in the creation and development of supply networks. They have been developed as the continuation of supply chains. Supply chain - is a "(…) a net of relations and interrelated organizations which operating on the basis of mutual co-operation, jointly control, manage and improve the flow of goods and information from suppliers to final recipients." [Fechner I., 2007].

They have been created as a result of the progressive process of liquidation of barriers existing between entrepreneurs.

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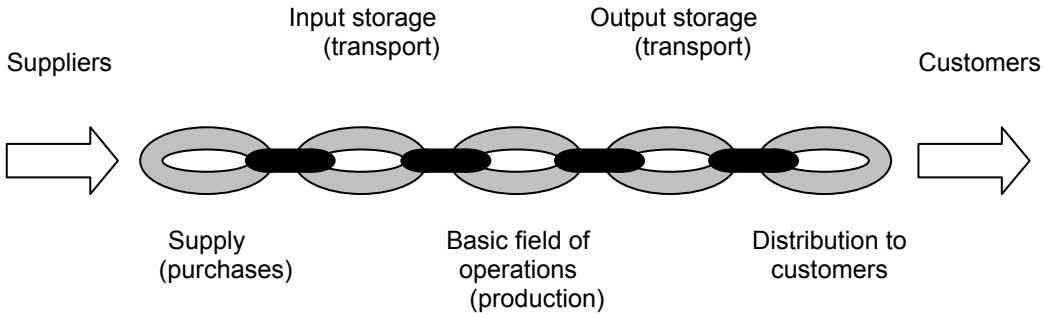


Source: Coyle J.J., Bardi E.J., Langley Jr. C.J., Zarządzanie logistyczne.

Fig. 1. A logistic supply network structure
Rys. 1. Struktura logistycznego łańcucha dostaw

The progressive development of world economy and the widespread globalization tendencies result in the fact that many companies operating in the market participate in more than one supply chain. Such chains constitute the elements of mutually bound chains. However, those chains analyzed separately still constitute independent undertakings. It means that the following processes: planning, organizing, processing and supervising of the flow of goods take place independently.

Supply networks are created by joining independent supply chains through which products and services travel from the place of supplying in raw materials and components needed for production up to the place of their consumption. [Świerczek A., 2007].

In such a case the mutually dependent chain links of different supply chains which create a supply network, on the one hand possess common information and on the other hand, co-participate in making common decisions. All applied solutions are to improve the flow of materials and information as well as to optimize activities designed to gain competitive advantage.

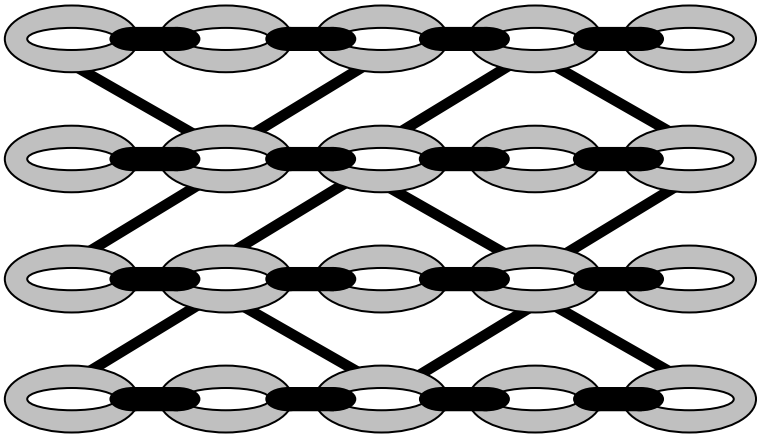


Fig. 2. Logistic supply networks
Rys 2. Logistyczne łańcuchy dostaw

Of course the existence of supply networks (which are very complex and not easy to present due to the number of links) poses many organizational and technological challenges. In order to take the maximum advantage of the opportunities given by logistic supply networks, it is necessary to create an effectively operating system encompassing all factors affecting the flow of goods, money and information within the network.

Information constitutes a basis for the operation of a contemporary enterprise. In logistics, in the broader sense one may distinguish two types of information flows that is to say: information flow aiding coordination activities and information flow aiding operational activities. The information flow aiding coordination activities is vital among others in the creation of demand schedules and planning the demand. On the other hand, the information flow aiding operational activities is essential in issuing and monitoring bills, invoices, allocation of stocks and dispatching consignments. Information is a specific type of resource which enables to increase the level of knowledge on a given enterprise and its closer or further environment [Kisielnicki J., Sroka H., 2005]. As far as the supply networks are concerned, it is the most important element affecting its functioning. One should realize that information may be encountered in every aspect of supply network operation (starting from offers, orders or other commercial documents, and ending with financial settlements, complaints or returns). At the same time, it is the information which enables to meet the needs and expectations of consumers. Of course, information must have certain features or parameters which are called information quality. Information quality includes information accessibility, information accuracy and the efficiency of information transmission.

SUPPLY NETWORKS

One should realize that in the face of the widespread market trend of the continuously increasing requirements of consumers and ubiquitous globalization, even the biggest enterprise is unable to compete with powerful supply networks. It results among others from the fact that the network (understood as an organization) generates additional profits in comparison with an enterprise operating on its own. The relations occurring in the supply networks (such as mutual co-operation, and widespread information exchange, continuous elasticity increase, development of co-operation relations, precise definition of the role, tasks and scope of responsibilities, fair distribution of risks, costs and profits which motivate and generate new initiatives) constitute the source of the advantage. The reasons of such state-of-fact are connected among others with such processes as: the change of consumers' behaviour, the increase in spending power, internationalization and globalization of economy, consolidation processes and technological development.

Changes in consumers' behaviour are connected with very numerous factors affecting the widespread social life model. Among those factors there are such elements as the changes in the style of life and consumer patters. Right now, we can observe a widespread trend of the growing importance of the quality of life, healthy life style, value of time and shopping consciously. All those factors result in the fact that the commercial companies change their approach to customers and they adapt their offers more to the needs and requirements of individual customers.

The increase in the consumers' spending power is the next factor affecting the observed changes. The power of consumers is growing together with their spending power. They become the 'pressure group' which is becoming more and more influential in the relations in the logistic supply networks.

Internationalization and globalization of economy is a more and more widespread phenomenon observed in the economies of selected countries or even continents (e.g. Europe, Asia etc.) The following trends create especially favourable conditions for this phenomenon: the widespread saturation of local markets, opening borders, the existence of customers having similar features in many parts of the world, the need to decrease the risk connected with business operation, making high profits or the trend of broadening ready markets. As a result of such processes the expectations of final customers are changing as well. The production capacity of manufacturers is also changing. Manufacturers may choose optimal location of raw materials and component parts necessary for the production process. The same applies to the location of factories, logistic centres or even whole sales networks, after-sale maintenance service points, etc. The biggest American sales network, Wal-Mart may serve as an example here. Its turnover in 2005 amounted to over $ 288 billion (the profit exceeding $10 billion). At the same time its share in the world market amounted to over 2%!

Consolidation processes are the direct consequence of the increasing competition fights which are commonly observed phenomena in the contemporary markets. Those processes are especially visible in Europe. "In 2001 30 biggest European retailers had a market share of 68.5%, in comparison with the share of 51.5% in 1992. This increase is a result of a ruthless fight with small retailers who either did not manage to compete successfully or were taken over. It is estimated that within a few next years 30 retailers may have a share of 90% in the European market." [Rutkowski K.(red.) 2005].

Technological development affects the supply networks in a very visible way. The popularization of such technologies as the Internet (new solutions include e-mails, WWW (World Wide Web), discussion groups and lists (Usenet), FTP (File Transfer Protocol) or IRC (Internet Reley Chat)), EDI (Electronic Data Interchange), GPS (Global Positioning System), GSM (Global System for Mobile Communications) or RFID (Radio Frequency Identification) has changed the world. It results from the fact that the distance is no longer vitally important. We have become the inhabitants of a global village in which apart from traditional solutions there are new solutions enabling to take advantage of new technologies which are used on a mass scale. One of such solutions is the so-called e-commerce. (One should realize that e-commerce is not limited solely to the usage of the Internet. There are also other types of solutions such as t-commerce (cable and satellite television) or m-commerce (telephone commerce).

The characteristic feature of the supply systems in the 70-ies was the producers' domination, whereas in the 80s it was the consolidation of the retail market as a result of which the new force a so called 'consolidated retailer' appeared. Such a retailer became an equivalent partner for producers. In the 90s retailers gained an additional advantage over other market exchange participants. Retailers became a domineering force in the existing chains and emerging supply networks. The existence of the advantage of that sort in relations generates different conflicts between producers and retailers as well as leaders and other market participants of supply networks. In extreme situations such a situation may lead to the network destabilisation and operational commotion and disturbance connected with it.

Table 1. Main areas of potential conflicts between industry and commerce
Tabela 1. Główne obszary potencjalnych konfliktów między przemysłem a handlem

Areas of aims	**Producer's aims**	**Commerce aims**
Product and price policy	– Creation of the trade mark image – A wide array of product innovations – Forcing producers' trade mark – Policy of high prices – Elimination of too-high margins	– Creation of the point-of-sale image – The best possible permanent offer of products – Forcing brand name – Policy of low prices – Forcing additional discounts
Distribution policy	– Large orders – Advantageous localization of own products on the shelf – The best possible array of additional services – Expecting the commerce readiness to accept deliveries	– Fast deliveries of small consignments – Optimal localization of product range – Avoiding rendering additional services – Low volume of stocks
Communication Policy	– Product advertisement – Taking care of preferential treatment of the product make – Privileged product make localization – Promotion steered by the producer – Increasing the loyalty towards the product make	– Shop advertisement – Taking care of preferential treatment of the shop – Localization of the product make according to the product range – Promotion steered by the commerce – Increasing the loyalty towards the shop

Source: Heldt A. 1998, Peter Lang 2005.

There are two basic types of relations as far as the interrelations between network links are concerned:

- Confrontative approach to the participant, and
- Co-operative behaviour.

The direct consequences of such relations are strategies (strategy is a method of operation via which the organization intends to achieve a specified goal) adopted by particular entities. In the case of confrontative relations there is a widespread trend of confrontative behaviours. The fixed role-model is present then. The purchaser (or contractor) designs the final product and the methods of its manufacturing. The producer processes the order. The information exchange is limited to the absolute minimum (the producer gives the contractor only one information - the price) Co-operation relations differ significantly from the confrontative ones. There are three basic forms of co-operative relations that is to say:

- Marketing approach,
- Operational co-operation,
- Conceptual partnership

Marketing approach enables to make purchases effectively and profitably and to influence the behaviour of suppliers. When adopting that approach the receiver may aim at joining operational management procedures with the supplier's system.

Operational co-operation is based on the full information exchange between the supply network links the aim of which is to share the responsibility for the occurring risks.

Conceptual partnership is a solution which requires two conditions to be fulfilled: a large portfolio of orders and a low level of competition between suppliers. Such a strategy is based on consultations between sub-contractors referring to particular components of a given product. Of course, the success of the adopted strategy depends on many factors. However, the closer bonds between business partners the highest probability that both parties will strive at achieving the following aims:

- Shorter delivery time,
- Delivery reliability,
- Less schedule disturbances,
- Lower level of stocks,
- Faster changes (including new models),
- Less problems with quality,
- Fixed competitive prices. [Christopher M., 1998]

The role of information is always fundamental no matter the type of relations. Information exchange limitations lead to slowing down or disturbing or even stopping the product flow. Moreover, it may be noticed that the final product price may be lower only if the information is more accessible (it is among others connected with the information flow speed in the information system of the whole supply network). Efficient information flow (that is to say proper quantity, quality, time and price of necessary raw materials, components, and products meeting all requirements) between particular links is a guarantee of the effective operation of the network. As a consequence the supply network becomes more competitive.

There are, however, also problems connected with information flow and transmission. Such problems occur when a company is supposed to reveal and pass the information which is considered the competitive advantage. In such a situation the company is not willing to make the information available for other participants of the logistic supply network. Such a situation is unfavourable and often leads to the increase in the level of stocks. It happens so due to the increase in the level of insecurity as to the availability of stocks or the operational capacity of the particular network elements

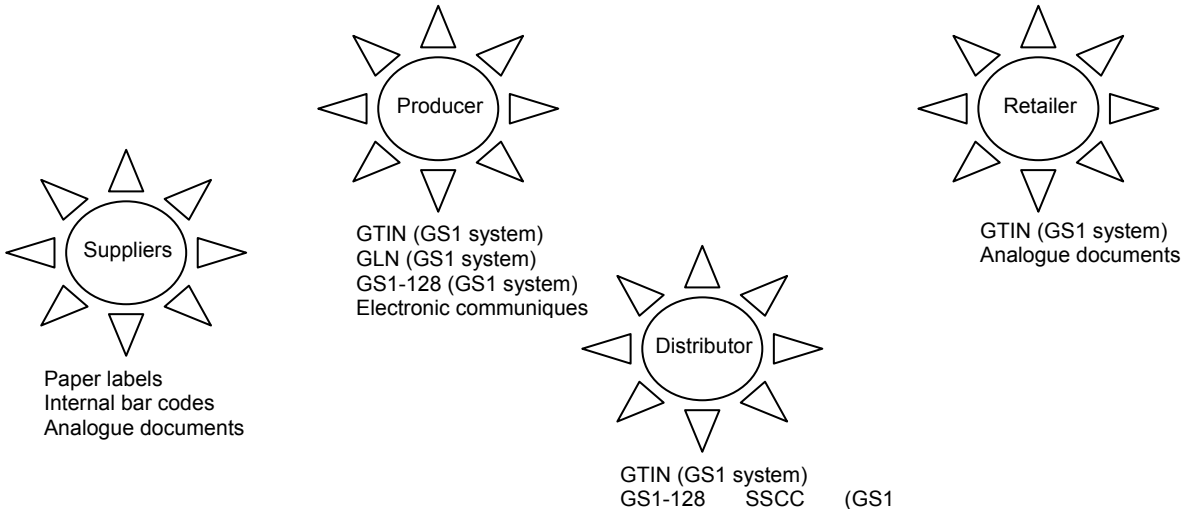
(including enterprises). Consequently, the process of replacing physical stocks with information is hampered or ineffective.

Outsourcing is also a tool enabling to gain additional profits provided that there is an effective information exchange system between the company and the hired contractor. It is used for performing all non-key processes outside the enterprise. Such a situation is possible only when the information system operates effectively.

Another important element which must be taken into consideration is the demand and its forecasting. The process of forecasting itself may be done in various ways (e.g. quality forecasting techniques, time ranking models, simulation techniques or combined forecasting), however, information is crucial in every one of them. Moreover, due to the general trend of the increase in the probability of error occurrence the longer the forecast time, the fastest the information system created to deliver the information on the demand. Such a solution will significantly decrease the number of errors made in forecasts.

The changeability and uncertainty of demand is a very important logistic problem. It is especially visible in the so-called Bullwhip Effect (or Whiplash Effect). Entities try to protect themselves against the demand uncertainty and changes by using forecasting. However, there is also the risk of an error. Of course it is possible to minimize possible discrepancies between the forecast and real demand e.g. by speeding up the information flow. Unfortunately, it is not possible to eliminate those discrepancies. There are also other methods of decreasing the gap between the forecast and reality e.g. by keeping the stocks, having economic capacity exceeding the average production, or flexible change of production period. However, all of them are dependent on the information system operation. The higher the efficiency of the information system, the lower the probability of the discrepancy between the forecast and reality, and as a consequence the lower costs incurred by the enterprise and the more competitive the enterprise is.

Relatively small changes in the demand of the final consumers increase together with the increase in the information flow. It is a direct consequence of the fact of not transmitting the primal information but the modified data in the form of subsequent orders.



where:
GTIN – global identificator,
GLN – global identificator,
GS1 (*Global System One*) – the world identification and communication system for products, services, and localization based on the standards accepted in international trade,
GS1-128 – bar code.

Source: own draft on the basis of Fechner I. 2007

Draft. 1. Information carriers in different links of supply networks
Schemat 1. Nośniki informacji w różnych punktach łańcucha dostaw

The dissemination of IT and new forms of e-business results in the changes in the supply networks. This situation is especially visible in data exchange processes. Initially the information was exchange on paper and via phone. Later, the EDI and Internet-based solutions have become ubiquitous. Right now it is hard to imagine a contemporary modern enterprise not using the network communication technologies in the face of market requirements.

The fulfilment of requirements imposed by consumers (such as faster, better, cheaper) requires economical time management. It is possible only in the case of effective implementation of tools improving the functioning of the supply network. They include the following solutions:

- Computer systems for gathering and exchange of data e.g. Automatic Data Interchange ADC and EDI,
- Systems of tracing supplies - e.g. objects (among others supply materials, final goods), specialized equipment (code printers, bar code readers, portable terminals, etc.), software, or systems such as GPS or DGPS, (Differential Global Positioning System - is an enhancement to Global Positioning System that uses a special correction database to correct automatically the pseudo-ranges broadcast by satellite)
- E-logistics - using new IT in logistics.

All above-mentioned tools which facilitate supply network functioning operate on the basis of the effective data exchange system which should include the information which features the following criteria:

- information usefulness, that is to say adapting it to the users' needs,
- information relevance, that is to say adapting it to the time of usage,
- information reliability, that is to say the guaranteed information correctness,
- type of information properties, that is to say right of access to the information,
- type of information protection, that is to say methods of limiting the access to and modification of the information by the wrong hands.

CONCLUSIONS

In conclusion, it should be stressed that the supply network efficiency depends on its weakest link. Thus, the information which is an element of the links must be accessible, precise and effectively transmitted. Additionally, the information exchange in logistics supply networks and its flow pose a problem and are a challenge. Furthermore, information exchange systems must ensure that the defined logistic goals are realized. It means that the information must reach proper customer, inform him about a proper product. Consequently, manufacturers must know the features of desired products as proper products must be delivered in proper quantity and of proper quality, in proper place and at a proper time, and at acceptable costs. Those goals can be achieved when the information is up-to-date, complete and reliable (trustworthy). Whether the information is up-to-date or not depends on the method of its gathering, transmission channels, reliability of the network and intensity of the information flow. Information completeness depends on the method of measuring certain object features, accuracy of measurement and existing disturbances. The reliability of information on the other hand depends on the properties of the input and output signals, codes and used equipment.

It should be remembered that in competitive relations the quantity and quality of information differ in comparison with the co-operative relations. The more co-operative approach the more information and the better quality of the data.

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WYMIANA INFORMACJI W STRATEGIACH SIECI LOGISTYCZNYCH

STRESZCZENIE. Autor omawia rolę informacji i wymiany informacji w strategiach logistycznych sieci dostaw. W artykule zostały omówione różnice pomiędzy logistycznymi łańcuchami i sieciami dostaw. Następnie wyróżniono dwa typy przepływów informacji tzn. wspomagający działania koordynacyjne i wspomagający działania operacyjne. Opisano relacje występujące w sieciach dostaw i stanowiące źródło przewagi nad konkurencją. Autor omawia następujące czynniki wpływające na proces wymiany informacji w sieciach dostaw: zmiany w zachowaniu konsumentów, wzrost siły nabywczej konsumentów, internacjonalizację i globalizację gospodarki, procesy konsolidacyjne i rozwój technologiczny. Następnie przedstawia obszary potencjalnych konfliktów mogących wpływać na sposób wymiany informacji wybierany na potrzeby przemysłu i handlu. W artykule zostały także przedstawione dwa zasadnicze typy relacji tj. konfrontacyjne podejście do drugiego uczestnika i zachowania kooperacyjne. Zmienność i niepewności popytu jest również istotnym problemem logistycznym, który jest szczególnie widoczny w tzw. "efekcie byczego bicza." Wiele przedsiębiorstw wykorzystuje prognozowanie, by chronić się przed zmiennością i niepewnością popytu. Na koniec, autor prezentuje wpływ nowych technologii na wymianę informacji.

Słowa kluczowe: informacja, łańcuch logistyczny, sieć logistyczna, strategia logistyczna, podejście konfrontacyjne, zachowanie kooperacyjne, efekt bullwhip, wymiana informacji.

DIE BEDEUTUNG DES AUSTAUSCHES VON INFORMATIONEN IN LOGISTISCHEN NETZWERKSTRATEGIEN

ZUSAMMENFASSUNG. Der Autor diskutiert die Bedeutung von Informationen und deren Austausch auf Strategien für logistische Versorgungsnetzwerke. Zunächst wird der Unterschied zwischen logistischen Versorgungsketten und logistischen Versorgungsnetzwerken beleuchtet. Danach werden zwei verschiedene Typen des Informationsflusses beschrieben: Der Informationsfluss als Unterstützung von Koordinierungs- und Planungsmaßnahmen sowie der Informationsfluss als Unterstützung für operative Tätigkeiten. Die Beziehungen innerhalb von Netzwerken und deren Vorteile werden ebenfalls behandelt. Folgende Faktoren für den Informationsaustausch in logistischen Versorgungsnetzwerken werden vom Autor beschrieben: Änderung des Verbraucherverhaltens, Steigerung der Kaufkraft des Verbrauchers, Internationalisierung und Globalisierung der Wirtschaft, Konsolidierungsprozesse und technologische Entwicklungen. Danach werden die potentiellen Hauptkonfliktpunkte beim Informationsaustausch zwischen Industrie und Handel aufgeführt. Im Anschluss werden zwei Arten von Beziehungen beschrieben: Konfrontative Beziehungen und kooperative Beziehungen.

Die Schwankungen und Unsicherheiten in der Nachfrage sind ebenfalls ein wichtiges logistisches Problem, dessen Auswirkungen zum Beispiel in Form des Peitschen-Effekts beobachtet werden können. Viele Unternehmen führen daher Prognosen durch, um sich vor Nachfrageschwankungen und Unsicherheiten im Verbraucherverhalten zu schützen. Zum Schluss des Artikels werden die Auswirkungen von modernen Technologien auf den Informationsaustausch beschrieben.

Codewörter: Information, Lieferkette, Logisitiknetz, Logistikstrategie, konfrontativer Ansatz, kooperatives Verhalten, Peitscheneffekt, Informationsaustausch.

Marek Matulewski PhD
Poznań School of Logistics
Chair of the Logistics Bases
ul. Estkowskiego 6
61-755 Poznań, Poland
tel:+48 061 850 47 92
fax:+48 850 47 89
e-mail: Marek.Matulewski@edu.wsl.com.pl