

SELECTED IT SOLUTIONS IN LOGISTICS STRATEGIES OF SUPPLY CHAINS

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Zielona Gora, Poland, a.perzynska@wez.uz.zgora.pl**Keywords:** logistics, supply chain management, IT solutions**Abstract:** The aim of the chapter is to present some IT solutions which could be recognised as innovative solutions in both areas: technology and organisation. The above mentioned solution could be implemented by logistics. Currently, logistics is the field of knowledge which on the basis of IT systems is aim-ing at the integration of organizational divisions of enterprises. It is supposed to ensure the optimum shaping of the supply chains from the moment of acquiring materials, through processing and distribution in various fields of commerce, until the final purchaser. Companies are forced to constantly introduce more and more new solutions, resulting in innovation driving the progress of the market. This article is a part of research, which is considered to the problem of implementation of IT solutions logistics.**1 Introduction**

Logistics is the science of organization of production processes, warehousing, raw materials, materials and commodities aiming at the optimisation of chains of supplies (from mining the raw-materials to the consumer). Logistic management consists of formulating strategies, planning, steering and control (conducted in an effective way in order to minimize global costs) of the process of transfer and storage of materials, supplies of products in progress, finished goods and relevant information, from the point of acquiring the places of consumption, in order to adjust to and fulfill the customer's needs. On the other hand, the logistic systems are the deliberately organized and integrated - within a particular economic layout - flows of materials and products and the corresponding information that allows for the opti-mization of the supply chain management. Therefore, logistic systems must not be equated with IT systems (the latter serve as basis for logistics and without them logis-tics could not have been realized in its modern form). [1] The implementation of a logistic system results in changes within the enterprise organ-izational structure. The aim of these actions is to modernize technology, supplies and organization as well as the systems of storage, transport and sales. Due to the fact that logistics is closely bound with computer science, the above mentioned changes should proceed faster.

The supply chain is the network (series of links and shared) of processes that exists between suppliers and customers. These links and processes involve all activities from the acquisition of raw materials to the delivery of

finished goods to the end consumer. Raw materials enter into a manufacturing organization via a supply system and are transformed into finished goods. The finished goods are then supplied to consumers through a distribution system. Generally, several companies are linked together in this process, each adding value to the product as it moves through the supply chain [2], [5].

The supply chain includes all activities and processes to supply a product or service to the final customer. Often, the supply chain includes more than one company in a series of supplier–customer relationships. Supply chains usually include five functional components [13]:

1) Demand planning:

A planning process to predict the demand of products and services based on forecasts. Accurately forecasting customer demand improves customer service while decreasing costs by reducing demand uncertainty.

2) Requirements planning:

A Process of this planning answers onto demands of customers. Planning of demand defines need of renew supplement of supplies in knots of net of distribution.

3) Transportation planning.

A planning process to optimally schedule, load, and deliver shipments to customers while considering constraints, such as delivery date, mode of transportation, carrier, etc.

4) Manufacturing planning and scheduling,

A planning process that optimally schedules manufacturing orders with production capacity. This is performed by combining Material Requirements Planning

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(MRP) and Capacity Requirements Planning (CRP) to create optimized and constrained production plans.

5) Supply planning,

A planning process that meets customer demand based on available inventory and transportation resources. This includes Distribution Requirements Planning (DRP), which determines the need to replenish inventory at branch warehouses.

Integration of logistic activities depends on create of integrated organizational systems and informative, and time and space co-ordination of flow of products and information concerns not only relationships between suppliers and purchasers, but it treats also to procedures of management. Co-ordination of procedures of planning, organization, motivating and control of logistic connected action with flow of products and information be holds with regard of connections and consequence of this flow for different function of enterprise especially finances, production and marketing. [12]

2 The IT Technology in logistics systems

When speaking of an integrated IT system of an enterprise, one should bear in mind the modular IT system operating all areas of its activity, beginning from marketing, planning and supplies, through technical preparation of production and production steering, distribution, sales, managing renovation, until financial and accounting operations and human resources management [11]. The most popular integrated IT systems are the ERP systems (Enterprise Resource Planning). ERP allows the automating, integrating and analyzing of processes within an enterprise.

On the basis of experiences of West European countries it appears appropriate to pay attention to gradual development of logistic management, from improving the available IT systems to the more common use of instruments with algorithms of logistic solving of management problems [10]. The control of these processes requires relevant information and its processing. The tools applied for this purpose are e.g. automatic product identification, computer simulation, electronic data interchange, complex cost accounting and instruments of controlling. Owing to the integration of logistics and controlling it is possible to create solutions which might be of help in the decision-making process.[14]

The complexities of getting material ordered, manufactured and delivered overload most Supply Chain Management (SCM) systems. The fact is, most systems are just not up to handling all variables up and down the supply chain [7].

For years, it was thought that it was enough for manufacturers to have an MRP or ERP system that could help answer fundamental questions such as:

- What are we going to make?
- What do we need to make the products?
- What do we have now?

- What material do we need and when?
- What resources/capacity do we need and when?

Manufacturers need to know a lot more today to have a truly effective supply chain. There are a number of fundamental weaknesses in the old system logic. Many planning and scheduling systems in use today assume that lead times are fixed, queues do not change, queues must exist, capacity is infinite and backward scheduling logic will produce valid load profiles and good shop floor schedules. These assumptions are totally illogical, and following them causes many schedule compliance problems. An effective fix is first to streamline operations and then to apply predictive, preventive forms of advanced planning and scheduling.

Manufacturers need to develop flexible supply chain processes that can adapt to the needs of various customer segments. They must also develop supply chain strategy, processes and supporting systems that conform to current and future requirements.[6]

Supply Chain Management (SCM) software solutions coexist with, but are not the same as, Enterprise Resource Planning (ERP) software solutions. ERP software generally encompasses all aspects of the business—order entry, distribution, procurement, production, logistics, inventory, and finance. The primary purpose of an ERP system is to control the flow and execution of transactional information across the supply chain. [11]

SCM involves two flows. Information flow signals the need to start the flow of material. In a supply chain, the fast flow of high-quality information and material is inextricably linked and of paramount importance to SCM success. Untimely or low-quality information virtually guarantees poor performance.

While Supply Chain Management software is related to Enterprise Resource Planning software, SCM is focused on planning and ERP is focused on execution. Two of the most beneficial supply chain practices are:

- matching the correct supply chain strategy to the product and
- communication between supplier–customer partners in the supply chain.

Supply Chain Management systems provide decision support for those decisions that must be made prior to execution. It essence, it performs the planning required to allow ERP systems to execute the plan.

For superior competitive advantage, companies must implement a “closed-loop” supply chain management system that interacts with its ERP system. In a closedloop, the ERP system includes operational data (inventory movement, customer orders), tactical planing tools, and strategic planning tools brought together into a fully-integrated environment. This environment must also be able to adapt toadjust to the ever-changing needs of the company.

Information technology, and in particular, the Internet, play a key role in furthering the goals of supply chain integration. While the most visible manifestation of the

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Internet has been in the emergence of electronic commerce as a new retail channel, it is likely that the Internet will have an even more profound impact on business-to-business interaction, especially in the area of supply chain integration. The Internet can redefine how back-end operations – product design and development, procurement, production, inventory, distribution, after-sales service support, and even marketing – are conducted, and in the process alter the roles and relationships of various parties, fostering new supply networks, services and business models.

The term “e-business” – as distinct from “e-commerce” – can be used to describe this exciting adoption of the Internet to accelerate the goal of supply chain integration. In this context, e-business specifically refers to “the planning and execution of the frontend and back-end operations in a supply chain using the Internet.”

How and where do we see the impact of e-business on supply chain integration? There are four key dimensions in which the impacts can be found [4]:

- Information integration
- Planning synchronization
- Workflow coordination, and
- New business models

Information integration refers to the sharing of information among members of the supply chain. This includes any type of data that could influence the actions and performance of other members of the supply chain. Some examples include: demand data, inventory status, capacity plans, production schedules, promotion plans, and shipment schedules. Ideally, such information can be accessible by the appropriate parties on a real-time, on-line basis without significant effort.

Planning synchronization refers to the joint design and execution of plans for product introduction, forecasting and replenishment. In essence, planning synchronization defines what is to be done with the information that is shared; it is the mutual agreement among members as to specific actions based on that information. Hence, members in a supply chain may have their order fulfilment plans coordinated so that all replenishments are made to meet the same objective – the ultimate customer demands.

Workflow coordination refers to streamlined and automated workflow activities between supply chain partners. Here, we take integration one step further by defining not just “what” we would do with shared information, but “how.” For example, procurement activities from a manufacturer to a supplier can be tightly coupled so that efficiencies in terms of accuracy, time, and cost, can be achieved. Product development activities involving multiple companies can also be integrated to achieve similar efficiencies. In the best-case situation, supply chain partners would rely on technology solutions to actually automate many or all of the internal and cross-company workflow steps.

Adopting e-business approaches to supply chain integration promises more than just incremental improvements in efficiency. Many companies are discovering whole new approaches to conducting business, and even new business opportunities not previously possible. E-business allows partners redefine logistics flows so that the roles and responsibilities of members may change to improve overall supply chain efficiency. A supply chain network may jointly create new products, pursue mass customization, and penetrate new markets and customer segments. New rules of the supply chain game can emerge as a result of integration fueled by the Internet.

Integration cannot be complete without a tight linkage of the organizational relationships between companies. This linkage must take place on many plans. The success of any supply chain integration effort is predicated on close cooperation inspired by a perception of mutual benefit. As we will see, e-business approaches can go a long way toward fostering the necessary level of trust and commitment.[4]

3 The integration of logistic activities

The supply chain management refers to the strategy of integration in order to simplify the flow of materials and goods through the company. It takes place by way of strategic alliances, various forms of partnership, concepts of selecting the key suppliers and recipients, etc. Irrespective of the form of cooperation, it results in integration of logistic systems of enterprises and their logistic processes, in the search for ways of increasing trust and commitment in relations 'supplier - recipient', in linking the IT systems, etc. The cooperation and integration processes sometimes lead to the change of the centre managing the flow. The use of the supply chain management strategy leads to the improvement of market service and logistic costs reduction. The partners may participate in profits and the entire scheme of 'supplier - recipient' becomes more competitive. This tendency is naturally linked with the limitation of the number of suppliers. It constitutes a revolution with respect to the traditional principles of maintaining a large number of suppliers and raising competition between them. The supply chain integration should begin with internal integration. In order to achieve external integration and for an effective supply chain management, in the first place one needs a correct i.e. a well conducted internal integration, a well organized internal flow through particular phases of the enterprise. The concept of supply chain management cannot be realized on a large scale if a well organized, planned internal logistic chain is unavailable. The specificity of the integrated management should be examined from two points of view:

- integration of management functions,
- integration of management areas.

The integration of logistic activities includes the creation of integrated organization and information

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systems and a space-time coordination of product and information flow does not only concern relations between suppliers and recipients, but it also refers to the procedures of management. The coordination of procedures of planning, organizing, motivating and controlling the logistic activities connected with the product and information flow is performed with the consideration of relations and consequences of this flow to other functions of an enterprise, especially the finance, production and marketing. [12] An analysis of the strategic potential of logistics conducted early enough may prevent an unjustified commitment to improve this scope of the enterprise activity, when it turns out that the existing level of reserves of effectiveness and competitiveness growth is scarce. As J. Weber aptly remarks, not every enterprise identifies the possibility to improve its strategic position here. In order to determine the legitimacy of the controlling 'entering into' logistics, an examination of logistics attraction for an enterprise is used with the application of a portfolio analysis. It is appropriate to examine the potential effectiveness of the complete logistic system and its fundamental processes. If it appears justified to support logistics by controlling, then its main strategic tasks will be as follows [8]:

- organizing the planning process, including the introduction of logistics into the strategic planning and control, linking and synchronizing the strategic and operational logistic planning and control,
- introducing and developing modern concepts, methods and tools of logistic management (e.g. just in time),
- coordinating the strategic fragmentary plans and - documenting the planning process.

In the operational logistic controlling the goals established in strategic planning must be specified. The assumption that appropriate products in relevant quantities must be delivered to the right stand in the right time is insufficient. It is required to develop a system of goals for every functional area of an enterprise which is 'supervised' by logistics. A current support of planning and budgeting within logistics as a development and rationalization of the adopted goals is also desired. It includes the assurance of planning and control of logistic processes as well as their synchronization and optimization within the entire enterprise by a systematic support of the decision-making process of managers responsible for logistics by means of preparing and providing appropriate information in time. According to H. CH. Pohl, within the logistic controlling system one can distinguish the internally oriented tasks [9]:

- planning and control of goals,
- planning and control of systems,
- coordination of logistic subsystems,
- control of planning and realization,
- planning and control of deliveries,
- providing information helpful in decision-making,

- planning and control of logistic costs,
 - deviation analysis within logistics,
 - analysis of weaknesses,
 - optimization of supplies,
 - reporting,
 - transport planning,
 - material flow planning,
 - preparation of orders,
 - programming and consulting,
- and the externally oriented tasks:
- production control,
 - planning and control of run times,
 - deadline control,
 - purchasing planning,
 - production planning,
 - sales planning.

4 The logistics strategies

Activities within logistics are assigned to the logistic strategy which is one of the functional strategies within an enterprise. Logistics may constitute the element or even basis of a competitive strategy of a company. The relations between logistics and the enterprise strategies play a significant part in strategic management and have a large influence on the development and implementation of new communication strategies. The logistic strategy may either be a manner of competition, a crucial element of competition or an operational extension of the adopted mode of obtaining competitive advantage. The logistic strategies may be analysed in the context of a business line model by M.E. Porter. In that case, within the low cost strategy logistics may be used in the following ways [3]:

- The logistic cost reduction is a fundamental way of maintaining the position of the cheapest manufacturer;
- The low cost position is obtained by combining logistic strategy with another functional strategy of an enterprise;
- Logistics is the heart of the low cost strategy in the long term.

The observation of logistic strategies used in practice allows the decoding of their general idea. It is about a simultaneous realization - at least fragmentarily by the use of the same means - of the two goals:

- Increasing competitiveness;
- Improving supplies' utilization.

The following logistic strategies are used for this purpose:

- Supply chain management;
- - Cooperation;
- - Shortening the cycles;
- Reduction or elimination of supplies;
- Logistics of diversifying the mode of competition.

Supply chain management assumes that the benefits formerly assigned to vertical integration within logistics

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may be obtained by way of coordinating independent operations of companies. The problem of the vertical integration recedes into the back-ground - it becomes a tactical issue. The crucial point - of a strategic dimension - is the creation of cooperation links working to the advantage of both parties. The cycle shortening strategy appears to have resulted from a belief that the race against time is the most important kind of competition. It assumes shortening three cycle types:

- Cycle of accepting and realizing the order;
- Cycle from receiving materials to finished goods delivery;
- Cycle of introducing the finished goods to the market.

The cycle shortening strategy imposes numerous solutions within the scope of re-resource utilization. Their layout should make their flow possible without storing. More-over - although it is not obvious - it is connected with the mode of competition. The carrier of the cycle shortening concept results from the growing role of solutions in which the adopted mode of competition requires from a logistic system a constant broad offer of goods of high availability to customers with a simultaneous elimination of all forms of resources.

The idea of differentiating the strategies of competition (acc. products or markets) with the use of logistic strategies is relatively new and bound with recognition of many unused chances in logistic service of the market and the related negligence. It is ex-pressed by organizing the companies' activity by means of the logistic strategy of market competition. It is underlined that a product is not only a thing of specific fea-tures, but also a set of services connected with it.

5 The realisation of logistics strategies

J. Witkowski indicates that one should control the realization of the logistic strategy for the purpose of the enterprise management.[12] The follow-ing table presents the indexes of monitoring the logistic strategy realization.

Table 1. The indexes of monitoring the logistics strategy realization.[12]

Origins of monitoring variables	Quantitative or qualitative indexes and measures	Sources of information
1. GOALS OF LOGISTIC STRATEGY		
Improvement of customer service	average time of delivery standard deviation from average time of delivery number or value of deliveries realized in a given period of	register of orders and deliveries

	time number or value of deliveries realized in a given period of time to the number or value of all orders in general number or value of returned goods to the number or value of all orders in general	
Cost reduction	average worth of total logistic costs worth of total logistic costs within the worth of turnover or costs in general worth of total logistic costs within the worth of supplies and distribution worth of logistic costs according to cost centres worth of costs of transport, storage, supplies' maintenance and other logistic costs in the worth of logistic costs in general	register of costs
Optimization of the level of supplies	average worth of supplies in general average worth of volume of raw materials and materials, non-finished and finished goods, spare parts in the worth of supplies in general average worth of current seasonal, reserve and incorrect supplies in general index of supplies' rotation	warehouse statistics, cost registering

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	index of speed of supplies' rotation	
Minimization of product flow times	average time of transferring, storing and processing the groups of supplies during the time of their flow through the enterprise logistic system	as above: process examination
II. SITUATIONAL ARRANGEMENTS		
1. Internal:		
Human resources	number of employees on managerial and executive positions outlays on raising qualifications of employees indexes of work output	HR statistics and cost register
Organization	level of adjusting organizational structure and the organization of flow of products and information to the requirements of the applied logistics strategy	evaluation by experts
Technology	outlays on the development of the material database of logistic system technological and exploitation indexes of transport, warehouse infrastructure and its equipment	cost register
Product	worth, quantity, tonnage or volume of the materials delivered to particular production places and warehouses in a specific period of time worth of logistic	register of deliveries and sales cost register

	costs in unit sales product price	
2. External:		
Suppliers	average waiting time for deliveries worth of a minimum batch index of complaints	Register of deliveries
Customers	worth of purchases of particular customers in particular periods of time profitability of particular groups of customers expectations within logistic service standards the offered quality standards of logistic service	Register of sales and benchmarking costs
Competitors	level of logistic costs level of modernity and effectiveness of the organizational and technological logistic solutions	Interview, surveys etc.
Logistic service providers	unit prices for particular logistic services level of transportation and storage capacities the offered quality standards of logistic service (examples of indexes as above)	cost register, register of deliveries, export evaluations, customers' opinion

The above mentioned idea of monitoring the realization of logistic strategy based on the observation of the control variables, determination of concordance of the actual level of the assigned indexes included in the strategic plan, and finally specification of methods of processing and channels of information flow, complies with the concepts of the object (functional) early warning systems. It should be noticed that the objective control of the logistic strategy should also use indexes concerning the organization, technology, product, suppliers,

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competition and logistic service providers. Logistics has always played and it still does play a significant part in competitive strategies based on leadership within costs, differentiation (also within logistic service), shortening time cycles and the use of the company's capacities. The management-oriented integration of all logistic functions and processes becomes more important, because it is conditioning not only effective organization and enterprise modernization, but it is also opening new possibilities of solving problems and using potential effects in the operating and strategic activity. The introduction of controlling within the scope of logistics cannot be a simple coincidence, because it would have resulted in the waste of resources and unjustified cost increase. A complex procedure, supervised by the enterprise strategic goals, specifying goals, tasks and controlling tools sequentially in the intentionally selected areas and functions of logistics, is necessary. Only in such circumstances, the goals set towards logistics can be reached effectively.

Conclusions

In order to achieve significant reserves, the enterprise management should make comparisons of actual costs with the assumed costs or with the budget realization. There is a possibility to achieve better results in the decision-making process. The management board must make a choice between such alternatives as: renting additional transportation or increasing the company transport base, increasing deliveries or goods, developing or consolidating warehouses, automating the system of order and information processing. Broadening or narrowing the range of territory, sellers, products or recipients requires the knowledge of the current productivity of the existing segments and a potential change of profits and advantages of the above mentioned alternatives. For this purpose, one needs a database able to aggregate data so as to obtain information on such segments as: recipients, sellers, products, territory and channels of distribution. The system should store the data according to the fixed and flexible components in order to extend the rising profits and losses that refer to the alternative strategies.

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