Paweł Ślaski
Military University of Technology, Warsaw, Poland

Model of the integrated logistics processes management in the supply chain

Model zarządzania zintegrowanymi procesami logistycznymi w łańcuchu dostaw

The article presents the author's model of integrated logistics processes in the supply chain. The author draws attention to the need of an integrated process approach that improves logistics processes management and improves the efficiency of the supply chain.

Key words:
integrated process approach, logistics processes management, supply chain.

Artykuł przedstawia autorski model zintegrowanych procesów logistycznych w łańcuchu dostaw. Autor zwraca uwagę na potrzebę zintegrowanego podejścia procesowego, które usprawnia zarządzanie procesami logistycznymi i poprawia efektywność łańcucha dostaw.

Słowa kluczowe:
zintegrowane podejście procesowe, zarządzanie procesami logistycznymi, łańcuch dostaw.

Introduction

Modern organizations thanks to the skillful use of science and information technology become "intelligent" and "self-learning" enterprises and knowledge management should be a key factor in gaining their competitive advantage. The ability to acquire new knowledge and implement innovation is possible in a process company. Process management in such an organization allows to stay on a good market position and increase its value. An integrated process approach focused on the need for continuous improvement of processes enables in practice the creation and value management in the company (Szczepańska, 2010, 165).

Improvement logistics processes management should be a response to changing the environment and individualizing the customer's needs and expectations. In order to meet these requirements, it is necessary to manage logistics processes in an integrated system, whereas the starting point being an in-depth analysis of customer needs, and the goal is to optimize four basic determinants, i.e.: quality, cost, timing and risk. Integrated logistics processes management will significantly affect not only streamlining, but also growth of the integration and coordination processes and at the same time will improve the functioning of the organization (Witkowski, 2001, 2).

The aim of the article is a development of model of the integrated logistics processes management in the supply chain process. The research problem was posed in the form of a question:

How will the developed model of the integrated logistics processes management process improve the efficiency and effectiveness of the flow of goods in the supply chain?

The following research methods were used to solve the research problem:

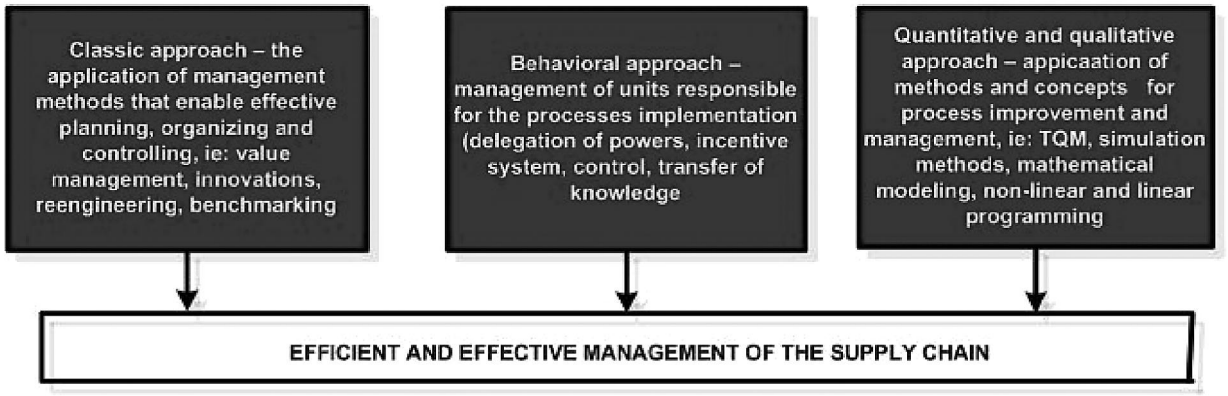
1. Process analysis.
2. Reference modeling.
3. Descriptive statistics.
4. Monte Carlo computer simulation.

Assumptions for the model of integrated logistics processes management

Assumptions for the model are divided into general and detailed. Figure 1 presents a general assumption related mainly to the need for an integrated management approach.

This assumes the need to mutual complement with classical, behavioral and quantitative — qualitative methods for effective organization management. Managers should use classical management methods taking into account the quantitative and qualitative aspects to improve the functioning of the supply chain. One should also remember about the human

Figure 1
Integrated management approach



Source: Own, based on: Griffin, 2017, 57.

factor, that is mutual cooperation within the teams for the implementation of processes based on trust, competence and motivation.

Detailed assumptions of the model:

1. Analyzing each link in the supply chain from the point of view of basic processes.
2. Joint production and sales planning as well as synchronization of demand and supply streams.

Figure 2 — the first detailed assumption — presents five basic logistics processes: planning, procurement, production, distribution and logistics of recovery, which are the part of every link in the supply chain.

The process of creation and maintenance is very various. In the supply, plans for material needs are built for stocks and their sizes are coordinated in an optimal manner to cooperate in order to maintain continuity of power in subsequent processes.

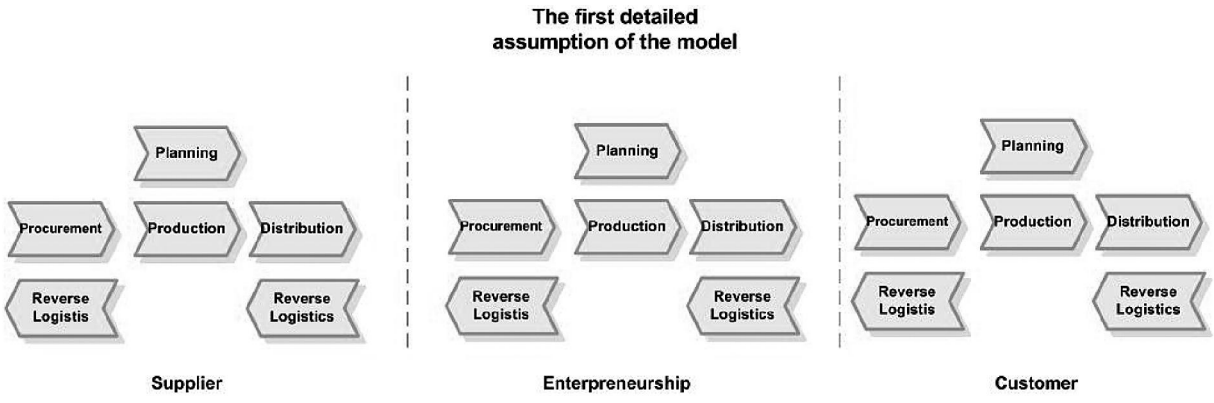
The quantities of subassemblies and parts in the production process are planned rationally to ensure delivery of finished products in the distribution process in accordance with the recipient's needs.

Inventories of products that have not been used as intended are subject to measures in the recovery logistics process under the so-called Closed Loop Supply Chain.

Joint production and distribution planning in the supply chain — the second specific assumption — is possible thanks to the use of modern tools and IT management support systems.

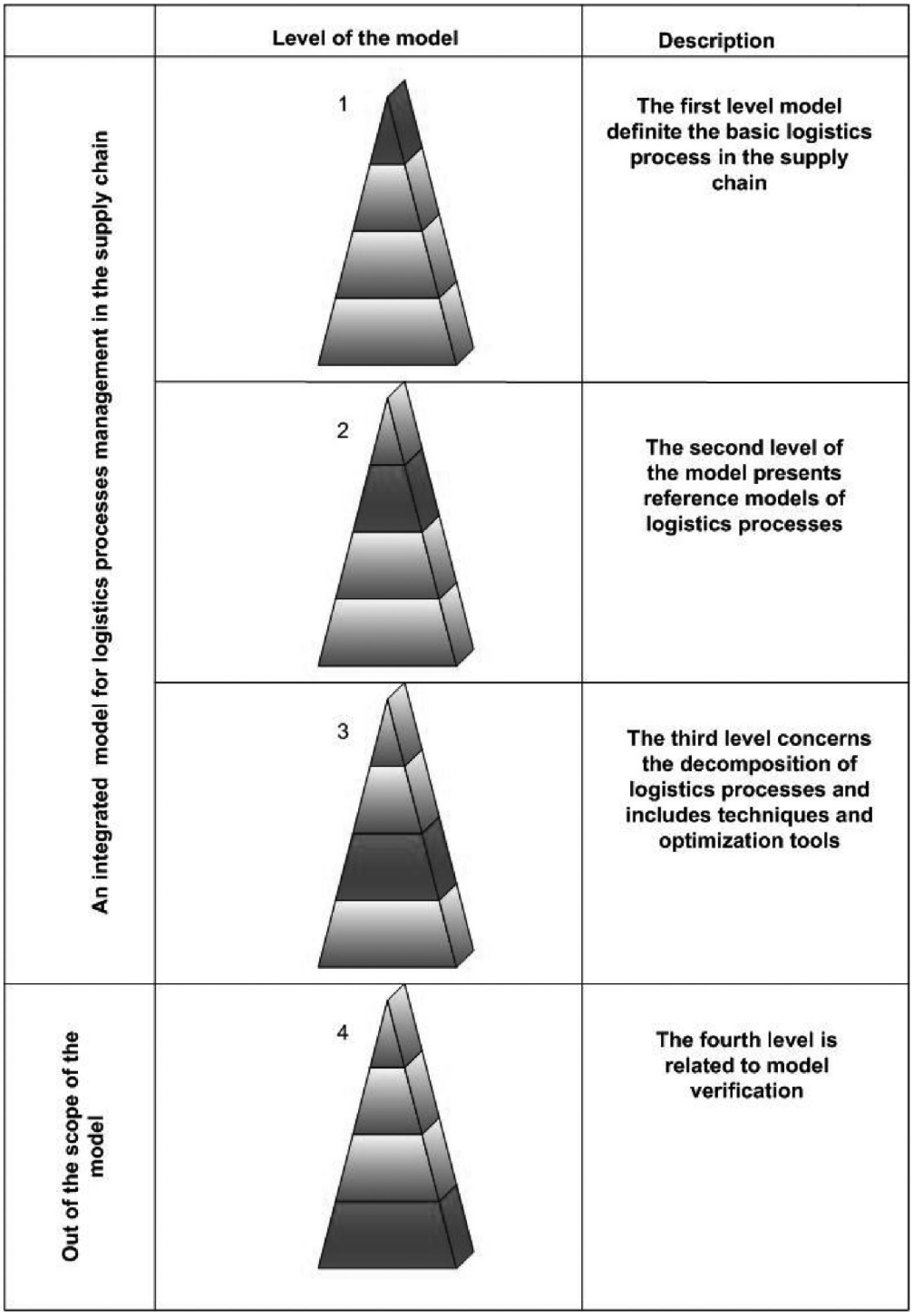
The following techniques were used in the model: VMI (Vendor Managed Inventory) and CPFR (Collaborative Planning, Forecasting and Replenishment), as well as EDI (Electronic Date Interface) messages. When using VMI, the supplier is responsible for managing the goods of the recipient.

Figure 2
Assumption of the model of the integrated logistics processes management



Source: Own, based on: Kasprzak, 2005, 162.

Figure 3
Four-level model structure

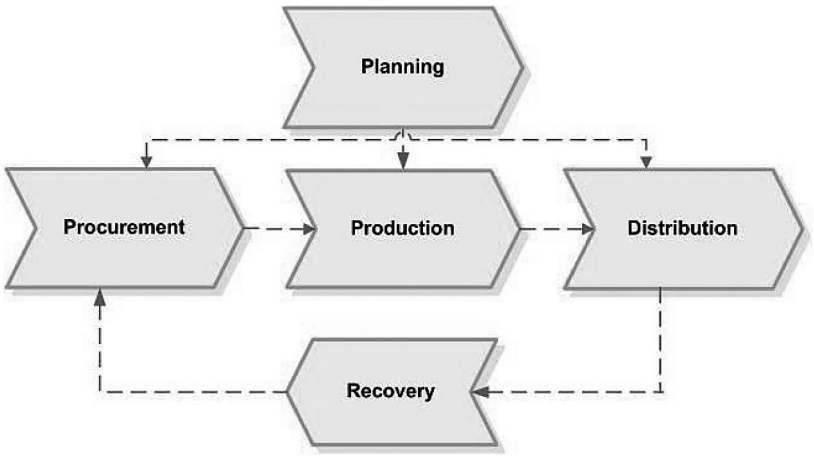


Source: Own.

Using EDI messages, it receives data from the provider via the Internet and thus can create optimal delivery schedules beneficial for both parties. The CPFR technique, which task is to compare the forecasts of cooperating companies and the automatic capture of significant differences in these quantities, enables the cooperating companies to react flexibly and take corrective actions adequate to the situation (Ślaski, 2012).

When considering specific assumptions, one should also pay attention to the sequence in planning

Figure 4
The first level of the model — the value chain of processes



Source: Own.

processes in the supply chain. The size of the goods' needs determined by the market then becomes the subject of analyzes in the processes under consideration, as the "finish" of one process is at the same time the "start" of the next one.

The structure of the model

The model consists of four levels, three of which are an integral model structure, while the fourth one, associated with verification, is outside its scope (Fig. 3).

The first level of the model was presented in the form of a value chain. It is used to indicate a general scheme of basic supply chain processes and links between them. The value chain preserves the clarity of the description of processes in the organization, and thanks to the possibility of model links, it enables navigation between various levels of detail of the model (Figure 4).

The second level presents reference models developed in the form of chains controlled by events. At this level, the basic processes decompose into a sequentially and logically connected sequence of actions. The essence of this level is a detailed description of all optimization activities related to logistics processes. The presented reference models are specific maps that enable the development of a set of tools to increase the efficiency of logistic processes management, and their sequential course formulates the form of an integrated supply chain.

Figure 5 shows an example of a reference model for the recovery logistics process associated with the return of stocks (regardless of the reason for return). This process is included in after-sales customer service.

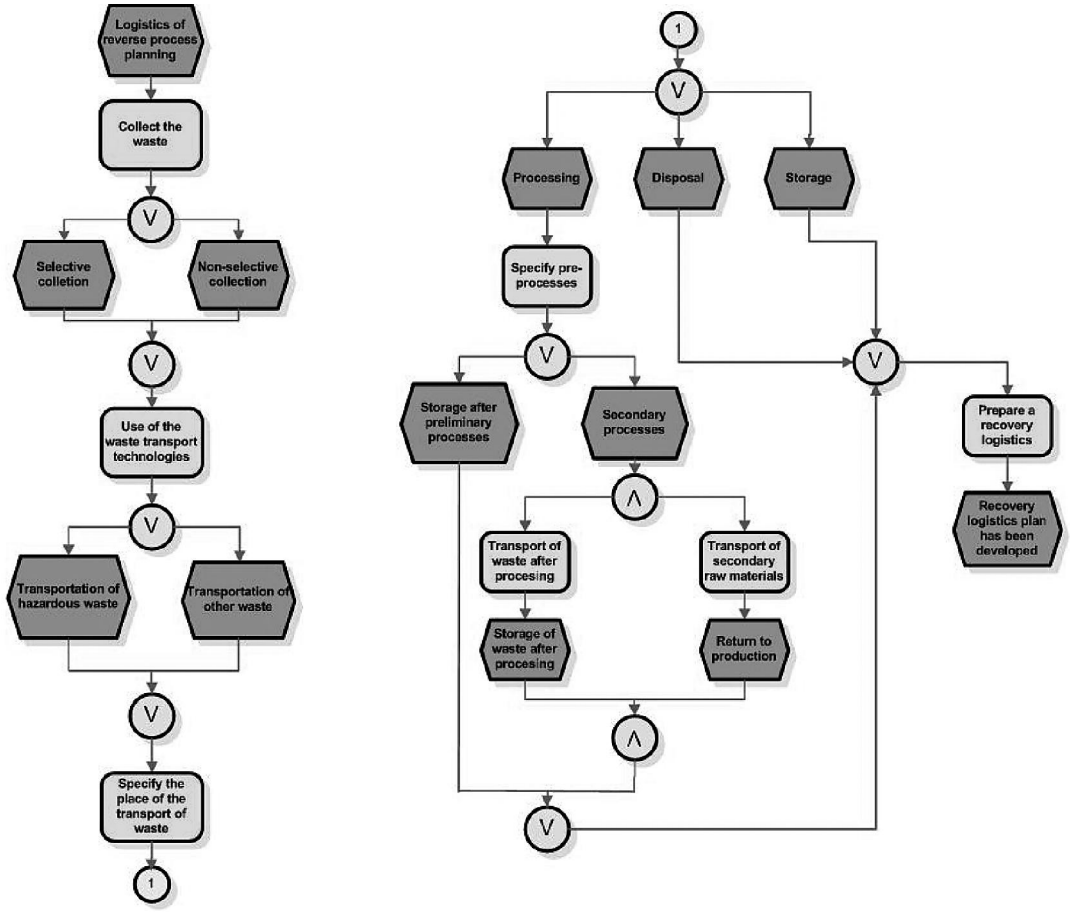
The third level of the model contains computer tools and applications, starting with determining the size of demand and ordering parameters in the procurement process (Monte Carlo computer simulation method), statistical quality control in this process, material requirements planning including Kanban operational control and determining the optimal production volume, until after the distribution of goods to the recipient according to his needs (Figures 6 and 7). The developed set of tools comprehensively optimizes logistics processes in the supply chain, and in cooperation with the first and second levels triggers the synergy effect and builds an integrated logistics processes management model in the supply chain.

Verification and risk analysis of the developed model

The fourth level concerns the verification of the model, i.e. checking whether the output data is adequate to the requirements set by the relevant input data. The verification was preceded by empirical studies of the supply chain, whose main link was the automotive industry manufacturing company. The obtained statistical data allowed to check the adequacy of the model.

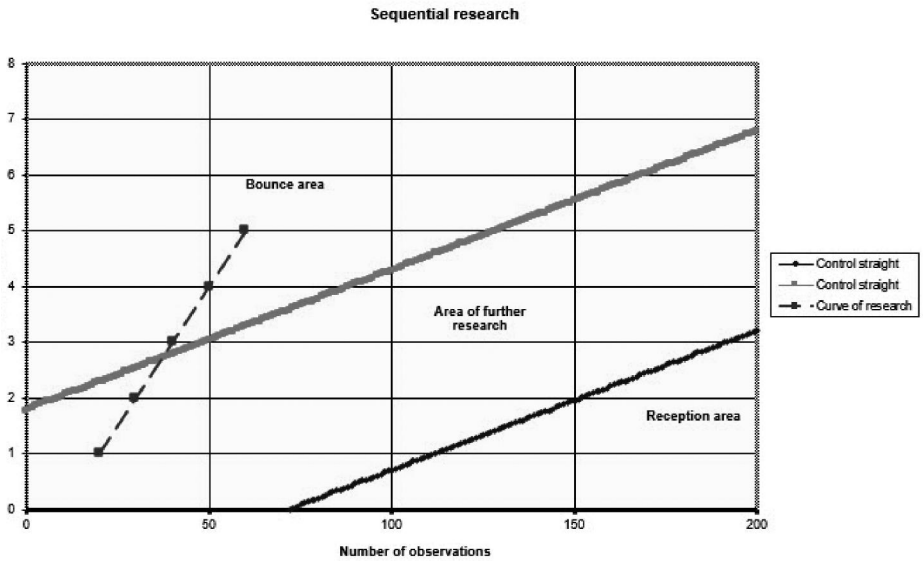
The Student's t-test was used for verification based on statistical data from the company producing mechanical bearings. Figure 8 shows the verification process to which the following input data was used:
Annual demand for bearings — P = 12,000 pcs
Annual production capacity — MP = 20,000 pcs

Figure 5
Reverse logistics process



Source: Own, based on: Aris 6, 2003.

Figure 6
Monte Carlo simulation and statistical sequential research of batches of goods in the procurement process



Source: Own, based on: Ślaski, 2016, 106.