Department of Management and Law, Poznan University of Life Sciences,
Wojska Polskiego 28, 60-637 Poznań,
e-mail*:* wajszczuk@up.poznan.pl

KAROL WAJSZCZUK

Structure model of information system for identification and analysis of logistics costs for farms

Modelowe ujęcie systemu informatycznego identyfikacji i analizy kosztów
logistyki dla przedsiębiorstw rolniczych

Summary. The paper presents a proposal of a model system to identify and estimate of logistic costs for farms. Taking into account the process aspect of the proposed model to estimate logistic costs, a costs section following three main basic elements of logistic processes will be used in the system: costs of physical flow of materials, inventory costs, costs of information processes. This model will make it possible to estimate effectiveness of both of logistics subsystems and a whole logistics system for such enterprises.

Key words: logistics costs, model, farm, logistics management

INTRODUCTION

In recent years, introducing the concept of logistics into the enterprise management sphere is one of the more effective ways to achieve a competitive advantage [Christopher 2000]. The optimization of logistics costs is the main issue of the concept. In many sectors of economy, logistics costs have such a big share in the total production costs (on average 20–30%) that a fundamental reengineering or a certain modification of logistics processes could become the main factor of costs reduction in the enterprise [Rzymysz-kiewicz 1995, Pfohl 2001; Skowronek and Sarjusz-Wolski 2003]. But to make an effective decision in the area, the management staff should have proper tools assisting management processes in the enterprise. Undoubtedly, one of those is a well-functioning and properly organized record-information system. Such a system should make it easier to receive information and create possibilities to conduct different analyses of enterprise activities. The results of these analyses should make it possible to use alternative solutions in the management process.

In Poland some attempts at the identification, estimation of the level and structure of logistics costs, despite the importance mentioned above, still do not take a systematic and complex character of research [Blaik 2001]. The main limitation on the development of such a complex approach to logistics costs is the application of traditional cost accounting (TCA) in the enterprises. The TCA system does not provide useful information because of two reasons:

– it does not identify logistics costs in the whole system of value creation,

– it is not adapted to explain problems of modern logistics in the process and market aspects.

Purpose of the model of logistics costs

Results of some research on farms logistics (transport, loading and unloading processes, storage of means production and final production, diversification of production, relationships between farmer, supplier and consumer), indicate that this issue is one of the most important management problems in such enterprises. Studies conducted in selected large-area agricultural enterprises showed their high share in the total production costs (from 38% to 47%) in comparison to enterprises in sectors other than agriculture, for which this index ranges from 20% to 30%. [Wajszczuk and Wielicki 2004; Wajszczuk 2005]. Taking the above into consideration, the aim of the paper was to present a proposal of a model system to identify and estimate logistics cost for farms.

MATERIAL AND METHODS

In view of an increasing importance of process-oriented management of enterprises, in terms of logistics cost is necessary to focus on activities and processes realized in a given organization [Ciesielski 2006]. Based on these considerations the so-called activity based costing (ABC) was developed. The ABC method allocates direct and indirect organization costs to actions (activities) consuming resources of the organization and next ascribes the costs of performance of these actions to the products, customers or channels of distribution using these actions [Kaplan and Cooper 2000]. Due to the fact that within the supply chain management (SCM) the logistics system includes the flow of materials and information, the basic assumption when building the model was that the information system should reflect the flow of any material and information accompanying production processes. This means that the model should identify all costs, which are generated at every stage of production processes both in the farm and over the entire supply chain (from suppliers through the farm to end-buyers).

The first stage of model development consisted in the identification of logistics processes in selected agricultural enterprises. In each analyzed process the following components were included: subprocess – activity – task.

Due to the scale of logistics problems, farms selected for the study had the area of over 500 ha UAA. In the Wielkopolska province, where investigations were carried out, there are 60 such enterprises. All of them were sent a questionnaire, which included process cards for each product. After feedback information was received, the obtained data were verified in selected surveyed enterprises.

RESULTS

Taking into consideration the main methodical assumptions of the above mentioned model, an integral part of the input data base for the system consists of the specially developed charts for each product, used to record all activities (events) to be connected with the manufacture of this product at all stages of the process, i.e. supply, production and distribution. Figure 1 presents the identification of logistics processes in a graph form. Due to the complexity of these processes in an agricultural enterprise, in the presented figure a certain simplification was used, as logistics processes were presented for an enterprise with one business centre. For multi-unit enterprise additionally passages between objects would have to be included.

Each action will be ascribed a specific process index on an individual product chart. Thanks to this in further calculations it is possible to aggregate logistics activities properly according to the adopted range of logistics costs.

Supply chain at farm level
Łańcuch dostaw
przedsiębiorstwa rolnego

Logistics processes
Procesy logistyczne

Information and financial flows
Przepływy informacyjno-finansowe

Transport of means production
Transport środków produkcji do przedsiębiorstwa

Unloading-loading works at the farm entrance
Prace rozładunkowo-załadunkowe przy dostawach
do przedsiębiorstwa

Suppliers
Dostawcy

Passages between farm centre and fields
Przejazdy między ośrodkiem gospodarczym a polami

Unloading-loading works and passages over fields
Prace załadunkowo-rozładunkowe i przejazdy
po polach

Farm
Przedsiębiorstwo
rolne

Passages and loading-unloading works within the
farm centre
Przejazdy oraz prace załadunkowo-rozładunkowe
w obrębie ośrodka gospodarczego

Storage processes and transportation works inside
facilities
Magazynowanie i prace transportowe wewnątrz
budynków

Loading works at the farm exit
Prace załadunkowe na wyjściu przedsiębiorstwa

End buyers
Odbiorcy

Information and financial flows
Przepływy informacyjno-finansowe
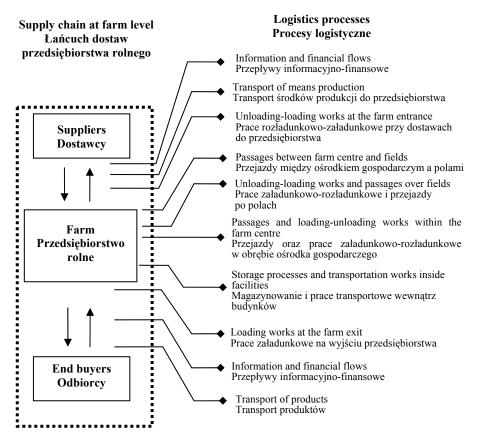
Transport of products
Transport produktów

Fig. 1. Logistics processes in an agricultural enterprise
Rys.1. Procesy logistyczne w przedsiębiorstwie rolnym

This make it possible to define indexes of logistics costs (in PLN/ha) for each final product, as well as to determine the level of one of the basic indexes of logistics costs for an enterprise, i.e. the share of these costs in total production costs [Nowicka-Skowron 2000; Twaróg 2003]. Taking into account the process aspect of the proposal model to estimate logistics costs, a costs section following three main basic elements of logistics processes will be used in the system: costs of physical flow of materials, inventory costs, costs of information processes.

Therefore, in the proposed model of logistics costs will be calculated as follows:

$$C_l = C_{fpm} + C_z + C_{pi} \tag{1}$$

where:

$$C_{fpm} = C_a + C_{dz} + C_{pr} + C_{mpe} + C_{zut} + C_{infpm} \tag{2}$$

$$C_z = C_{ad} + C_{pr} + C_u + C_k + C_{inz} \tag{3}$$

$$C_{pi} = C_{pr} + C_{me} + C_a + C_{ut} \tag{4}$$

Individual groups of logistics costs (C_l) include:

a) costs of physical material flows (C_{fpm}):
– costs of depreciation of fixed assets engaged in logistics processes (C_a),
– costs of rent (rent for store place, garages, umbrella roofs, service roads) (C_{dz}),
– costs of labour of staff engaged in processes of physical material flow (C_{pr}),
– costs of material, fuel and energy consumption (C_{mpe}),
– costs of external transportation services (C_{zut}),
– other costs (taxes and insurance of transport equipment, repairs and maintenance of equipment) (C_{infpm}).

b) costs of stocks (C_z):
– costs of depreciation or rent of storage facilities (C_{ad}),
– costs of labour of store-keepers (C_{pr}),
– costs of losses (C_u),(stock obsolescence, losses during evaporation, pests, diseases),
– costs of capital frozen in stocks
– other costs (costs of storage insurance; costs of energy) (C_{inz}).

c) costs of information processes (C_{pi}):
– costs of labour of staff engaged in information flow (C_{pr}),
– costs of material and energy consumption (C_{me}),
– costs of depreciation of information equipment (C_a),
– cost of telecommunications services (C_{ut}).

The structure of the model of the proposed information system for the identification and analysis of logistics costs in agricultural enterprises will be composed of three main modules. The structure of this model is presented in Fig. 2. The first module will be made up of individual data bases comprising separately input data, logistics infrastructure data, human resources data, data concerning suppliers as well as customers. The input data base will consist of individual charts for all products found at the agricultural enterprise.

The second module will contain identified logistics subsystems for individual types of products. Thanks to this it will be possible to provide individual assessments of the efficiency of each logistics subsystem.

The third module will be the identified logistics system for the entire enterprise, being the function of subsystems listed in the second module. Within this module it will be possible to assess the efficiency of operation of the entire logistics system.
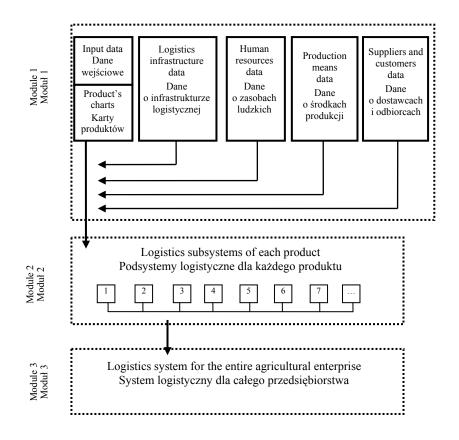

Fig. 2. The structure of a model of identification and analysis of logistics costs for farms
Rys. 2. Struktura modelu identyfikacji I analizy kosztów logistyki dla przedsiębiorstw rolnych

The evaluation indexes of logistics processes, established in the second and third modules, can be used in a benchmark analysis. In this case it will be a permanent comparison between processes in the farm and model ways of courses.

CONCLUSIONS

Such a structure of the proposed information system model for the identification and analysis of logistics costs for agricultural enterprises will make it possible to:
– estimate the level and structure of logistics costs and their influence on the whole farm activity,

   – identify the diversity of costs and profitability, being a result of supplying various products and logistics services to particular consumers,

   – identify changes in total costs and farm profitability caused by decisions concerning consumer and product category or distribution channels; indicate factors shaping the level and structure of logistics costs,

   – characterize the influence of behavior of participants of the supply chain (consumers and suppliers) on costs and farm profitability; point at possibilities to reduce logistics costs,

   – increase quality, efficiency or rate of particular activities and whole logistics processes in a permanent or temporary way.

   In view of the above such a model could be a valuable tool assisting the management process in this type of enterprise.

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Streszczenie. W artykule przedstawiono propozycję modelu systemu informatycznego dotyczącego identyfikacji i analizy kosztów logistyki dla przedsiębiorstw rolniczych. Biorąc pod uwagę ujęcie procesualne w proponowanym modelu określania kosztów logistyki, zastosowano przekrój kosztów według podstawowych składników procesów logistycznych: koszty fizycznego przepływu materiałów, koszty zapasów, koszty procesów informacyjnych. Model ten umożliwi ocenę zarówno efektywności podsystemów, jak i całego systemu logistycznego dla tego typu przedsiębiorstw.

Słowa kluczowe: koszty logistyki, model, przedsiębiorstwo rolne, zarządzanie logistyczne