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MODEL OF SUPPORTING DECISION-MAKING IN THE ISSUE OF LOCATION OF THE LOGISTICS CENTER

Currently, the decision to create an optimal logistics network is quite important for the leadership of the regions. The article discusses the methods used in the analysis of the economic situation of the regions. The choice of models used at various stages of design has been substantiated, allowing to develop a decision support model for choosing the location of a logistics center. Also considered are the schemes of bilateral partnerships (state – private capital) that allow implementing logistics projects in the region.

Keywords: *decision-making model, logistic network, logistic center, mechanism of public-private partnership, location*

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МОДЕЛЬ ПОДДЕРЖКИ ПРИНЯТИЯ РЕШЕНИЯ ПРИ ВЫБОРЕ МЕСТОПОЛОЖЕНИЯ ЛОГИСТИЧЕСКОГО ЦЕНТРА

В настоящее время решение о создании оптимальной логистической сети является для руководства регионов достаточно важным. В статье рассмотрены методы, применяемые при анализе экономической ситуации регионов. Обоснован выбор моделей, используемых на различных этапах проектирования, позволивших разработать модель поддержки принятия решения при определении местоположения логистического центра. Также рассмотрены схемы двусторонних партнерских взаимоотношений (государство – частный капитал), которые позволяют реализовать логистические проекты на территории региона.

Ключевые слова: *модель принятия решений, логистическая сеть, логистический центр, механизм государственно-частного партнерства, местоположение*

One of the main goals of the socio-economic development of the territory is to create a competitive advantage in the region, therefore the solution to the issue of creating an optimal logistics (distribution) network based on choosing the best location for logistics and distribution centers remains strategically important.

The quality of decisions of this kind depends on the information possessed by decision makers (DM). In a dynamically changing economic environment, the process of designing a logistics network, including choosing the best location and designing a logistics center, is a multi-step process that requires consideration of many external and internal factors. Taking into account external factors, it is necessary to remember about project implementation within the framework of legislation, social and geographical environment, etc. Internal factors include the qualifications of management personnel, as well as their attitude to innovation and organizational changes [1].

The choice of location for new logistics centers should be made taking into account export, import, transit and domestic cargo flows. It is necessary to take into account the fact that the main sources of cargo flows of the republic are free economic zones (FEZ) of regional centers, as well as cities: Baranovichi, Borisov, Zhlobin, Mozyr, Orsha, Pinsk, Soligorsk. The use of the advantages of urban agglomerations that perform distribution functions, as well as international transit corridors for the accumulation or

distribution of transit export-import cargo flows is confirmed by the world practice of creating a European distribution network¹.

When choosing the location of the logistics center one should be guided by the following principles:

1) use the expansion possibilities of the existing distribution warehouses or logistics centers in terms of a favorable geographical location;

2) it is advisable to reserve as much land as possible – not less than 100 hectares;

3) when designing, it is necessary to take into account the multifunctionality of the territory of a logistics center: the presence of a container terminal, warehouses, other service facilities (gas stations, vehicle service stations, catering establishments, hotels, etc.), as well as organizations requiring office premises (administration, customs services, banking and insurance centers, IT, etc.);

4) the combination of small distribution centers in one city into one major logistics center;

5) it is desirable maximum proximity to the highways;

6) use of the latest logistics technologies in the planning, organization and management of commodity, transport and financial flows;

7) the presence in the center of information companies (divisions) that provide support for the transportation process, storage, cargo handling, service and other types of logistic services;

8) ensuring the maximum synergy effect on the basis of establishing mutually beneficial partnership relations between the participants of the logistics process while maximizing customer satisfaction as a service [1].

Starting the preparation of a project for the construction of a logistics center, it is necessary to create a location selection model and develop requirements that it must meet to ensure its versatility. It is assumed that the model should include four stages: preliminary analysis; determination of a general location; making decisions about choosing the best location of the logistics center; project implementation [2].

Progressive computerization and universal access to information have had a positive effect on the acceleration of economic processes. These changes also have a direct impact on the speed of economic analysis, their accuracy and decision making. Certain fragments associated with the calculations, in the implementation of models of the methodology can be automated, which in its turn will lead to an increase in the speed of obtaining information necessary for decision-making.

Based on generally accepted stages of project implementation, we have developed a method for supporting decision making when choosing the location of a logistics center. Its most important elements are presented in Figure.

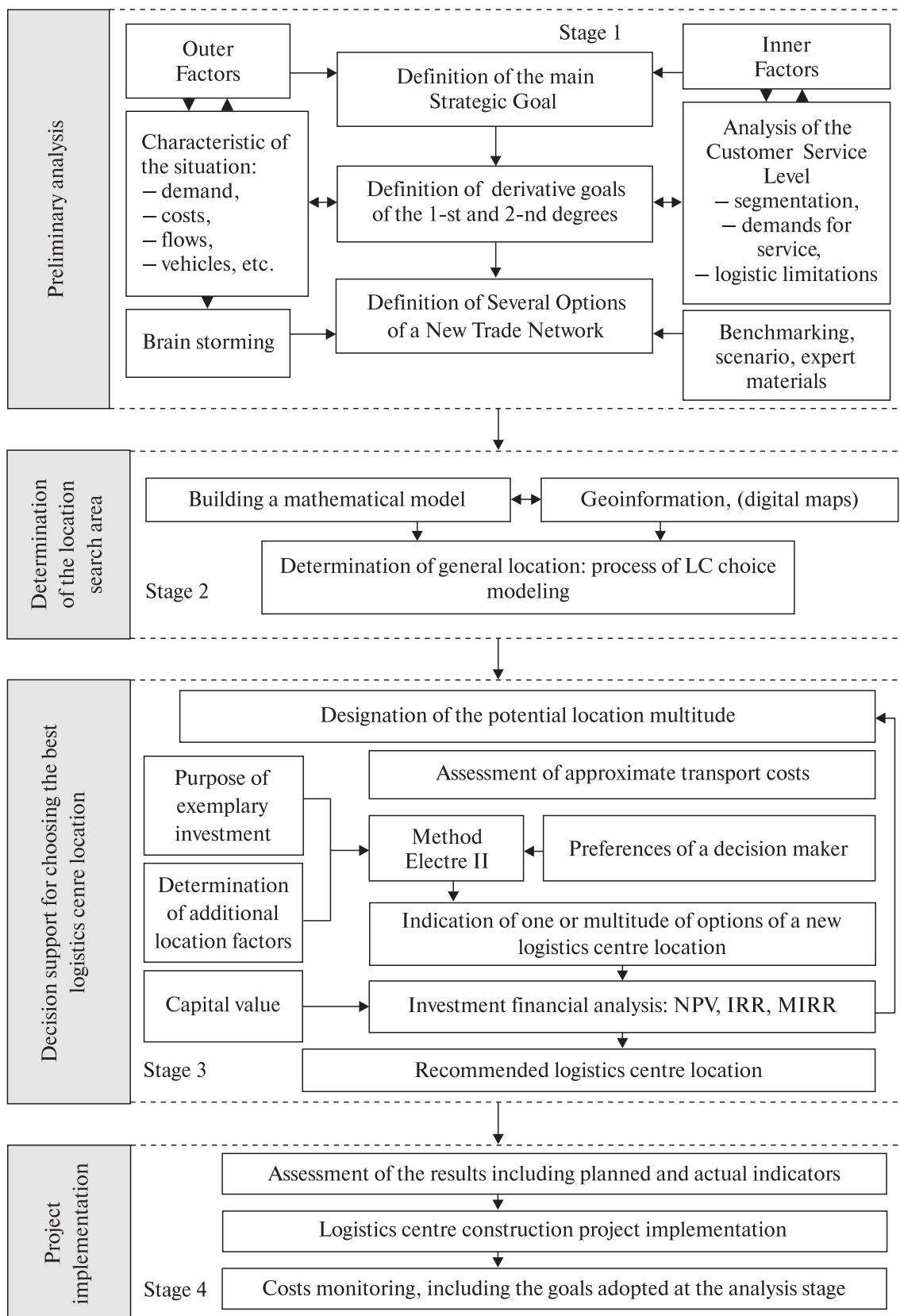
The first stage – a preliminary analysis, is the basis for understanding the situation and preferences of the decision maker, initiating the process of choosing the location of a logistics center. At this stage, the main goals of the project, goals of the first and second degree of importance are determined, the current situation is clarified, tasks for achieving the goals (control points) are formulated and possible solutions to the problem are identified. This step requires additional variables and data that affect individual elements. The definition of a strategic goal is determined by external and internal factors.

To correctly define first and second degree goals, measures to achieve them and form a set of possible solutions to the problem, additional information is required (demand, volumes of material and financial flows, structure and number of available transport vehicles, timeframes at individual delivery points, etc.).

The choice of data and their time range depends on the intended goals. Brainstorming is most often used to improve information gathering and determine possible options. Other methods that support the identification of possible solutions to the problem are: benchmarking (comparison with the best organizations in the studied sector, this method allows to implement solutions that have already been tested), scenario methods, expert methods, including the Delphi method.

The second step, which determines the potential location of a center, is to determine the location search area. This stage is quite important and further affects the amount of transportation costs generated in the future.

¹ Государственная программа развития транспортного комплекса Республики Беларусь на 2016–2020 годы [Электронный ресурс]. – URL: http://www.economy.gov.by/ru/gr_trans-ru/ (дата обращения: 10.06.2019).



Methodology decision making support when choosing the location of a logistics center

Source: author's developed.

The stage consists of three elements: the construction of a mathematical model for choosing the location of a logistics center, geocoding and the process of modeling the selection of the location of a logistics center. The result of the calculation is the determination to of the search area for the detailed location. To obtain a more accurate solution, it is possible to use several mathematical methods, as well as software that generates digital maps.

However, mathematical analysis may not be enough. Economic reality is more complex, and limiting the analysis to including only the minimum distance can lead to a situation when a decision maker slips up.

When implementing the third stage, it is necessary to take into account the influence of factors reflecting the economic situation in the region. These factors may be specific to a particular industry, geopolitical situation and have to be considered. Existing mathematical models allow, as a rule, only the analysis of design factors. Consideration of other factors can be associated only with the subjective opinion of a decision maker.

When evaluating calculation options, the following criteria should be considered: the area of land, the availability of utilities, an analysis of the regional development plan, a possibility of creating a special economic zone for an emerging logistics center, the existing infrastructure. The assessment of the estimated transportation costs for the options being analyzed is another element supporting the decision to choose the best location for the center. This is the most important element, since correctly estimating these costs can have a significant impact on the final decision. Calculating the cost of transportation is possible by using specialized software that solves the traveling salesman problem with time intervals to find the best configuration for the distribution of goods. Using digital maps, taking into account the type of transport, orders, price lists and other available options, you can calculate the value of the logistics costs for a given location.

In addition to the estimated transportation costs, the estimated cost of the investment must be indicated. Depending on whether a logistics center will be formed on the basis of the finished storage areas, or if investment in a new project will be required, such costs should be considered for each option under consideration.

Also an important element is the identification of additional factors that may have a significant impact on the location of the logistics center, for example, the distance from a multimodal hub or an airport.

The choice of location should be verified in terms of cost effectiveness. The most popular method is the analysis of NPV, IRR, MIRR. Alongside with transport and infrastructure costs, you should consider the operating costs of the object and capital costs when assessing the value of the current project. Financial analysis should be confirmed by an additional recommendation for the selected location of a logistics center in accordance with the preferences of a decision maker. The result of the calculation process is the recommended location of the distribution center.

The fourth stage – the implementation of the project – consists of three elements: the assessment of the results, taking into account the planned and actual indicators, the implementation of the logistic center construction project, costs control, taking into account the objectives adopted at the analysis stage. Project implementation and results monitoring are necessary to confirm that all project assumptions have been fulfilled.

The use of multi-criteria decision-making methods makes the decision-making process more flexible, since it allows to analyze many quantitative and qualitative factors that have not been taken into account so far.

An integrated and universal approach to the problem of choosing the location of a distribution center, as reflected in Figure, is a multi-dimensional and innovative approach one. Highly detailed methodology allows to create processes that are easier to implement in each project.

As European experience shows, the construction of a logistics center is a rather expensive project and requires a long payback period. In the medium-range perspective, construction projects of logistics centers are highly profitable. Taking into account the specifics of state regulation in the Republic of Belarus, it is advisable to use the mechanism of public-private partnership (PPP) or similar projects in the construction of logistics centers. The variety of models of public-private partnership makes it possible to fairly widely

use the opportunities of the private sector in solving state-related social problems connected with logistics activities, in the development of transport and logistics infrastructure, including the construction of logistics centres [3].

The state can perform various functions in public-private partnership projects that largely determine the success of the project: partial funding, provision of the institutional environment, organizational structure, and risk reduction – by guaranteeing the return of loans, both directly and indirectly. Except for direct funding, the state can support the private sector in implementing PPP projects.

The main source of financing projects for the construction of logistics centers in the framework of public-private partnership should be private capital, because the concept of PPP is to combine the administrative, tangible (intangible) state resource with financial capabilities and private sector entrepreneurial initiative.

Public-private partnership provides an opportunity to finance a project for the construction of logistics centers from different sources and to combine own and borrowed funds, thus reducing the financial burden on each project participant [4]. In the future, real estate objects, customs terminals can be state-owned, but the implementation of logistics services can be carried out by private firms specializing in logistics. Also possible is the equity participation option in the development of logistics centers for foreign investors. Creation of joint projects with foreign investors will allow to establish good coordination of logistics processes, which will ensure the accelerated passage of transit cargo. It is advisable to focus private capital on the provision of a range of services for transportation, storage and ensuring the rapid passage of customs control.

In the Republic of Belarus there is a shortage of both universal and specialized warehouse complexes. Their construction in the implementation of the development programme of the logistics system through the mechanism of public-private partnership is possible using the following options:

1. “Acquisition – Construction – Operation” (BBO: Buy – Build – Operate). In this option, the transfer of state property to the private sector is carried out for modernization or operation in the contractual period. This option is considered in the case of combining urban storage facilities into one logistics center. At the end of the contract the property is returned to the state.

2. “Construction – Ownership – Exploitation” (BOO: Build – Own – Operate). Maximum participation of the private sector in the project implementation and further exploitation on the basis of life-long tenure or lease. The state acts as a regulatory body;

3. “Construction – Ownership – Operation – Transfer” (BOOT: Build – Own – Operate – Transfer). The implementation of the projects of this plan allows the private sector to obtain a franchise for financing, formation, building and operating the structure, and further to use logistic facilities for profit. Upon expiration of the contract, the right of ownership is transferred to the state. Taking into account the fact that currently there are no large logistic companies with large capital in Belarus, such a scheme of bilateral partnerships will make it possible to implement projects to create logistics network facilities, improving the regional economy.

Similar in content are the options «Construction – Operation – Transfer» (BOT: Build – Operate – Transfer) and «Construction – Rental – Operation – Transfer» (BLOT: Build – Lease – Operate – Transfer).

4. “Design – construction – financing – operation” (DBFO: Design – Build – Finance – Operate). The option of a long-term lease based on preliminary design, financing, construction. The private sector transfers a new facility to the public sector at the end of the lease. This scheme of bilateral partnerships relations allows to establish links with potential consumers of their services during the construction of a logistics center. This option is possible with the participation of foreign companies with sufficient experience in the implementation and operation of such a business in the global logistics market.

Interesting enough are the options for public-private partnership according to the following schemes: participation in financing (Finance Only), operating and maintenance contracts (O & M – Operation & Maintenance Contract), design – building (DB: Design – Build), operating rights (Operation License). As a rule, PPP projects for the construction of logistics centers are aimed at long life

cycles of objects that bring stable income, so they require long-term lending and retaining state control functions and property rights.

The use of the mechanism of public-private partnership gives a number of advantages to private business: the possibility of choosing a land plot for building a center; obtaining more favorable conditions for partial financing, for example, shared construction, the possibility of lower loan rates; gaining experience in the construction of specialized warehouse complexes. The establishment of partnership relations between the state and private businesses, including those of the world level, will allow to bring national logistics to the modern world standard.

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