METHODICS AND ALGORITHMS FOR CREATION OF INTERMODAL LOGISTICS PARK

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S u m m a r y . In this article the state and development of transport infrastructure of the transport system for border territories of Ukraine is considered. It is noted, that creation of the logistics parks on these territories will increase the appeal of international transport corridors, passing through Ukraine, will increase the scale, speed of transit for cargo flows and incomes. Method and algorithms for creation of the logistics park is suggested. The implementation of the method is considered, with regard to example of creation of the pilot project for logistics inter-modal park on Ukraine-Russia border, in Melovoe and Chertkovo regions.

K e y   w o r d s :   international transport corridor, logistics park, project, method and algorithm, effectiveness of the investment.

OBJECTS AND PROBLEMS

The efficiency of transport system in modern conditions, depends on technical level, scale, forms of service and organization for international cargo flow. The quality and forms of the service must be adapted to maximal degree for new requirements of the modern market of transport services.

PUBLICATION AND METHOD ANALYSIS

Comparative analysis for state of MTK Ukraine, especially on the border regions, indicated that transport system, judging by quantity measurements (in particular, carrying capacity) satisfies the requirements for attracting of transit on the territory of Ukraine, but judging by quality characteristics (speed, safety of cargo, information services, state of border infrastructure, comfort and service on highways, the process of traversing the border) didn't reach the level of European standards [6, 14]. Therefore, as indicated in theoretical and practical designs [6, 15, 16], it is wise to build logistics parks on the state border or close by, near the international transport corridors, as well as making sure that these logistics park will include state structures (customs house, border veterinary and other services), post office, bank, insurance company and other. Independently, on the territory of the logistics park, service areas for vehicles and passengers, zones of storages, terminals for temporary storing and processing transit cargo and forming local cargo flow [4].

This zone can include small agricultural production centers, assembly plants for components of different parts and materials of engineering purpose. The work of these logistics park will allow to significally decrease time for transit of cargo flow through customs house, will increase the quality of

service and respectively will increase attraction for this transport corridor, which is going through territory of Ukraine [19].

Currently there is no unified method and designed methods for creating such territorial and industrial structure, as logistics park in border zone. This why, the goal of this work is – design of method and algorithm for creating such logistics park.

RESULTS OF RESEARCH

Methodically development of project of logistic park can be divided into a few stages.

First stage for creating logistics park is the choice and characterizing of enterprises, which will be taking part in this project. If the logistics park is to be placed inside the country, in place of intersection for transport corridor or one of the parts for the main transport net of current region, the main participants would be regional administrations. These, by solving principal questions in possibility of creating logistics park, will delegate authority to identify and to grant land on adjacent territories to regional border administrations, which will simultaneously define the activity for this territorial-economical entity [7], depending on development perspectives [5, 18].

If logistics park is to be placed on or close by the state border with neighboring countries, the main participant will be state administrations of bordering territories, depending on international agreements. The other organization questions will be handled by corresponding subordinate state structures [8].

Second stage is the identification of investment idea and it's characteristics.

The idea is to take in consideration and valuation potential participants and customers for services of future logistics park, judging by activity, scale and investment perspectives.

The first investor must be the state or border territorial structure, which own the territory for future logistics park (region, federal district and such.) This way is needed and must be implemented, because on the dedicated area, in the process of forming the

logistics park, in first place must be installed and accredited the state services (administrative, customs, border, quarantine, legal, financial, informative and other.) During start process of functioning for created structure, some financial means will be needed. Further on, given structure, as administration will decide and design technology for functioning logistics park, considering his potential customers (investors) [7, 8]. The last mentioned, judging by their scale of production and services will rent from administration the land for installing production centers, equipment, storage terminals and other buildings and will invest in construction of these units and all needed infrastructure.

The investors also will fund project designs for transport infrastructure for development and maintenance of cargo flow, which are coming through given logistics park.

It must be noted, that transport-storage processing for cargo flow such, as transit and local ones is quite expensive and may sometimes reach from 7 to 30%, and sometimes even bigger net cost of products (from delivery of raw materials or basics to products for consumers) [2, 3], this why the optimization for parameters of technological processes for transport-storage services of different cargo flows is one of the main goals in designing projects for logistics parks.

All participants and potential customers are interested in solving these problems, because in this case upgrading the technology can lead to decreased net cost of products. This why customers for logistics park, and in the same time investors, must take part in funding these projects.

Third stage must be evaluation of market environment, i.e. potential customers, who will use the services of logistics park, with analysis of their geographical and financial position with regards to future perspectives. Along with that, transport connection and communication must be analyzed, which must be considered in the process of designing the project [13]. On this stage it is possible to build and optimize transport net of regional and higher levels,

which unify neighboring territory and production centers in clusters for minimizing the volume of the transport work needed for functioning of the given logistics park [12, 17, 20].

Fourth stage is consisted of marketing research and building of marketing plan for perspective development of logistics park, for assuring ever changing production line and volumes, and other transport-storage services. These researches are needed, because during the functioning of logistics park, it is inevitable, that customers, service line and volume, the type of transport and infrastructure of transport-communication network will change.

Besides, on this stage the possibility of connecting and introducing individual territorial-production structures and objects, for attracting additional cargo flows in given region and logistics park respectively, to the system of logistics park will be researched, analyzed and evaluated.

Very important and, certainly, perspective will be evaluation of possibility for connecting transport network of the given region along with the logistics park, with the international transport corridor, if it is not already in the system of given transport corridor [1, 14].

Fifth stage is consisted of designing the production plan for implementation of investment project. On this stage, the construction projects of objects for common use, objects for potential customers (assembly plants, storage terminals and separate warehouses), objects for infrastructure, service centers and other will be held in consideration, with regard to the volume of services provided. Foremost the price (investment) for construction of basic objects and objects for infrastructure of common use, which are built with the state funding, will be identified. Further on the price for objects of individual customers, who are taking part in constructing the logistics park in the beginning of implementation of the project, will be identified. Emphasis is on building system of informative service, maintenance of cargo flows and other types of activity for logistics park, using modern IT technologies. This is due to the fact that, logistics park with his functional goal is the place of birth and branching of material flows, including transit ones. This why the objects for customs tracking and transit must be equipped with modern facilities with the possibility for upgrading and development, including the use of electronic signature for unloading and contact-less control of the cargo and other.

The general evaluation of investment for constructing objects during first 12 months is made. The planned volume of provided services from different types of activity, including: loading and unloading, storing and preparing cargo for transportation to the consumers (division into groups, completion, packaging, bagging and other), processing of containers, use of the parking lots, transportation of cargo and passengers, maintenance and other services in declaration of cargo, maintenance and repair for vehicles and other, is evaluated.

On this stage the spending and profit for changing transit cargo flows is researched, and that's very important for attracting those for processing through projected logistics park.

Sixth stage covers the drafting (development) of financial plan and program for investment, basing on the results from analysis of previous stages, that is selection of potential customers – participants of the project, analysis of investment idea and possible investors, evaluation of market environment, marketing researches and volume of investments, the economical evaluation of the effectiveness for the project is made.

The economic effectiveness of the project is identified, based on the growth of pure profit from it's implementation and pure profit from canceling the project. In case, if the logistics park is created, as new territorial-production structure and there is no existing objects in it, which process the cargo flows, then it is possible to consider only the time for paying back the investment value. For each customer (investor) of the logistics park the time for paying back it's investment will be individual, because it will depend on the type

of activity and the volume of the work performed (services provided). This why, on this stage, it is wise to evaluate (identify) the average value of effectiveness for logistics park in general, considering all the investments from all participants.

Besides, the value of effectiveness, aside from the time of paying back for investments, which complement given value, should include:

1. size of investments, USD,
2. discount rate, %,
3. discounted payback time – DPB, months,
4. average rate of return ARR, %,
5. net pure profit value NPV, USD,
6. discounted profitability index DPY,
7. internal rate of return IRR, %,
8. time for calculation of integral values.

Further on, depending on the volume of funding and set time for construction of the project, the time of paying back is identified, based on the income stream from the investments in each subsequent year from the start of the project. For example, if the time for implementation of the project is set for 5 years, and the time for construction is set to 12 months, then the income stream will start only from the second year, that is after the logistics park will start functioning.

After that, discount payback time and discount profitability index are identified.

Based on the calculation of economic effectiveness for the project of logistics park, the decision on expediency and perspective, from constructing objects on it's territory, is made.

Methods for evaluation effectiveness of the investment project is listed below.

International practice of evaluating investment projects uses few indexes, which allow to prepare the decision on expediency (inexpediency) for investment of money [11].

These indexes can be divided into two groups:

1. Indexes, defined by using concept of discounting (evaluation of effectiveness for investment projects):

- pure current value,

- profitability index for discounted investments,

- internal rate of return,

- payback period of investment with regards to discounting,

- maximal cash outflow with regards to discounting.

2. Indexes, which don't imply using of concept of discounting (evaluation of effectiveness for investment projects):

- simple payback period for investments,

- indexes of simple return for investments,

- pure cash flow,

- index of profitability for investments,

- maximal cash outflow.

Period payback (*PP*) – it is a period, during which the profits from investments reaches the value, which is equal to the seed money (i.e. period, needed for fully paying back all the cash invested in the project).

Net present value (*NPV*) together with internal rate of return (*IRR*) is used as an instrument in evaluation of investments.

Payback period of investments – is the index, which present to investor simple way to identify how much time it is needed for enterprise to pay back the primary cost. It has special meaning for business, situated in the countries with the unstable financial system, or business, that is lied with modern technology, where rapid aging of the product is the common practice, which transforms the fast pay back of investment funds in serious problem.

The general formula for calculating payback period for investments is:

$$T_{ok} = n, \quad \sum_{t=1}^{n} \frac{CF_t}{(1+k_t)} > I_0, \qquad (1)$$

where: T_{ok} – payback period for investments, n – number of periods, CF_t – cash flow in t period, I_0 – the value of seed money in zero period, k_t – inflation factor in t-period.

Depending on goal at hand, it is possible to calculate payback period for investments with different precision.

Discounted Payback Period (*DPP*), is the payback period for investments in current values (payback in terms of current cost)

The general formula for calculating *DPP*, in terms of current cost:

$$T_{ok}TC = n, \quad \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} > I_0, \qquad (2)$$

where: $T_{ok}TC$ – payback period for investments in current cost, r – hurdle rate (discounting rate), I_0 – the value of seed money of investments in zero period.

By transforming the term of payback, we can get two additional instruments for analysis of investments. Thus, payback index in terms of current cost (we will call it discounted payback period, *DPP*)), also used in identifying the number of time periods, needed for paying back investment expenses, takes in consideration the timed cost of cash. While, calculating payback yearly cash income is summed, for identifying the year, during which those will surpass seed money investment expense, calculating *DPP* the discounted cash will be summed.

Net Present Value (*NPV*) – is the difference between current cost of cash by project or investments and the current cost of cash payments for receiving investments, or for project funding, calculated with fixed discounted rate.

Method for identifying Net Present Value consists of:

1. Identifying the current cost for expense (I_0), i.e. deciding, which volume of investments is needed to reserve for the project.

2. Calculating the current cost of future cash income from the project, wherefore income for each year *CF* (cash stream) is reduced to current date.

The results of calculation shows, how much cash is currently needed for funding and receiving projected cost, if the rate of return would be equal to hurdle rate (for investor – it is a rate of alternative return, for enterprise – the cost of cumulative fund or through risks). Summing the current cost of income for all years, we will get the present value (*PV*):

$$PV = \sum_{t=0}^{n} PV_t = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}. \qquad (3)$$

3. The current cost of investment expenses (I_0) is compared with Present Value (*PV*). The difference between them is the Net Present Value (*NPV*):

$$NPV = PV - I_0. \qquad (4)$$

NPV is showing pure income or pure expenses for investor from funding the project, compared to keeping money in the bank. If *NPV* is greater than 0, we can say, that this investment will multiply the cash of enterprise and it is wise to make this investment. If *NPV* is less then 0, then the profit from this investment isn't big enough to compensate for the risk within the project (or from the point of view of the cost for funding, there will not be enough cash to pay dividends and interest on the loan) and investment memorandum must be declined.

Net Present Value (*NPV*) is one of the basic indexes, used for investment analysis, but it has few flaws and cannot be the only instrument for evaluating of investment. *NPV* identifies absolute rate of return for investment, and, likely, the bigger is the investment, the bigger is Net Present Value. Hence, the comparison of few investments of different scale using this index is impossible. Besides, *NPV* don't show the time at which the investment will be payed back.

If the investment funding, lied with the implementation of the project, is made through few stages (periods), then calculating *NPV* is made using this formula:

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - \sum_{t=0}^{n} \frac{I_t}{(1+r)^t}, \qquad (5)$$

where: I_t – the sum of investment (expenses) in t period, n – summed number of periods (spans, steps) $t = 1, 2, ..., n$ (or investment duration).

Usually for Cf_t the value of t is situated between 1 to n, the case, when $Cf_0 > 0$, is the costly investment (for example: the funding for ecological program).

Discounted Profitability Index (*DPI*): One of the option, for understanding the term of payback period, is in summing all discounted cash streams (incomes from investments) and dividing this sum by discounted investments.

The formula for calculating the discounted index for rate of return:

$$DPI = \frac{\sum_{t=0}^{n} \dfrac{CF_t}{(1+r)^t}}{\sum_{t=0}^{n} \dfrac{I_t}{(1+r)^t}}. \qquad (6)$$

Internal Rate of Return (*IRR*) – is the rate of return (hurdle rate, discounted rate) whereby *NPV* (Net Present Value) for investment is equal to zero, or it is the discounted rate, whereby discounted profits from the project are equal to investment expenses.

IRR defines maximal acceptable discounted rate, whereby it is possible to invest the funds without any loss for the owner.

$IRR = r$, whereby $NPV = f(r) = 0$.

It's value is found from this equation:

$$NPV(IRR) = \sum_{t=0}^{n} \frac{CF_t}{(1+IRR)^t} - \sum_{t=0}^{n} \frac{I_t}{(1+IRR)^t} = 0. \quad (7)$$

The economic sense for this value is that, it shows the expected rate of return (profitability for investments) or maximal acceptable level of investment expenses in the given project. *IRR* must be greater than average cost for investment resources.

If this condition is maintained, investor can accept the project, if no, then this project must be declined.

The pluses for this value of Internal Rate of Return (*IRR*) are in the fact, that besides, defining the level of profitability for investment, it is possible to compare projects of different scales and different duration.

The Internal Rate of Return (*IRR*) has three basic flaws:

1) By default, it is considered that positive cash flows are reinvested, using rate equal to Internal Rate of Return. In case, if

IRR is close to the level of re-investments for the enterprise, then there is no problem, when *IRR*, for especially attractive investment project is equal to, approximately 80%, then it refers, that all incomes must be reinvested with rate of 80%. But it is unlikely, that enterprise has yearly investment possibilities, which insure profitability in 80%. In this case, Internal Rate of Return (*IRR*) overstates the effect from investments (in the value of *MIRR*, Modified Internal Rate of Return, this problem is solved).

2) There is no possibility to define, which profit will bring this investment in absolute values (cash).

3) In case with alternating cash flows it is possible to calculate few values for *IRR* or it is possible to define wrong value.

The method of successive approximation is also used for calculation. By selecting values for hurdle rate for finding the minimal values for *NPV* using modulo, and then we carry out approximation. Standard method – the problem with multiple definition of *IRR* still persists and there is possibility of the wrong calculations (with alternating cash flows). For solving this problem usually a graph *NPV*(*r*) (Fig. 1) is constructed.
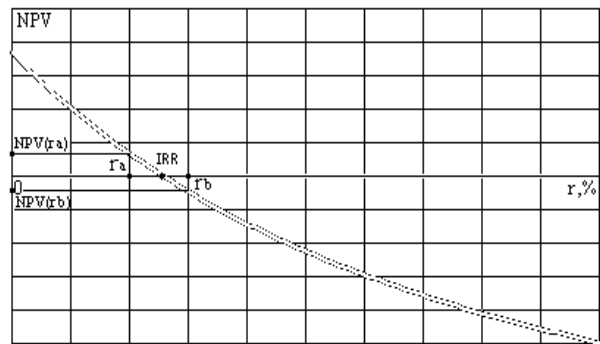

Fig. 1. Graph of changing *NPV* depending on rate of discount *r*

Defining *IRR* with method of selection. It is assumed, that in the sector from point *a* to point *b*, function of *NPV*(*r*) is rectilinear, and we are using formula for approximation in the sector of straight:

$$IRR = \frac{r_a + (r_b - r_a) \cdot NPV_a}{NPV_a - NPV_b}. \qquad (8)$$

The Average rate of return (*ARR*) – is the profitability of the project, as the ratio between average yearly income from his implementation and the cost of seed money. Average rate of return is calculated using this formula:

$$ARR = \frac{\sum\limits_{t=1}^{n} CF_t}{N \cdot I}. \qquad (9)$$

where: I – seed money, CF_t – pure cash flow for period i, N – project duration.

The economic sense for average rate of return – average yearly income, which can be received by implementing the project.

Thus, by calculating economic effectiveness for the project of inter-modal logistics park, we can decide, if it is expedient and perspective to build object on the chosen or given territory, or no.

Seventh stage is the analysis of the risks for implementation of the project. The most significant risks depend on general situation in the given country, lied with the political and financial instability, perspective for development of economic in general and geopolitical changes.

Political instability in the country defines and affect the stability of priority goals for developing the economic, one of those is the intensification for international economic collaboration and developing transport systems and their infrastructure. Reducing such risks can be achieved through insuring stability for economic ties through development of competitive environment for exchange of goods and services.

The influence of financial instability can be reduced with financial appeal of the project, with the support of various stabilization funds and other.

The other types of risks and their possible negative influence at the stage of preparation, investment and functioning of the logistics park are listed in the Table 1.

Decreased influence of these factors on the effectiveness for functioning of the logistics park can be achieved through additional measures, developed as they arise.

Table 1. Risks and their negative influence

Risks	Negative influence
– volatility of demand,	– reduction in demand for goods and services, reduction in profit,
– emerging of alternative enterprises,	– reduction in demand for goods and services, reduction in profit,
– insolvency of the clients,	– decline in the volume of services,
– dependency from the clients, no alternate types of activity,	– reduction in profit, also due to the price increase,
– staff qualification,	– decline in the quality of services provided,
– insufficient level of motivation for workers,	– liquidity of staff, decline in the quality of services provided,
– breaking of the equipment,	– decline in the quality of services provided, increase in service time,
– stricter requirements for ecological technology processes	– increased expenses for ecological protection of environment

On eighth stage we are considering social-economic aspects for implementation of the business-plan. The information about social-economic aspects for the investment project of the logistics park, as enterprise, is provided [9, 10].

The essence of this aspect is that any increase in cargo and passenger flow through logistics park will increase the number of jobs. It is very important for depressive regions and especially border territories. This will contribute to development of various production centers, various types of transport and infrastructure for the neighboring territories. Besides, economic development of the neighboring territories adjacent to logistics park will inevitably contribute to development of cultural ties between individual territories and countries, it will also serve as positive effect.

EXAMPLE FOR IMPLEMENTATION OF METHOD

Stage 1. Characteristics of enterprises-participants.

«Transport systems» department of Volodymyr Dahl East-Ukrainian National University and public organization «Institute of strategy for security and development of

border territories» (Lugansk city) over the years are working on the project, which will ensure the creation of modern transport-logistics infrastructure for border territories of Lugansk region, which border with next regions of Russian Federation – Rostov region, Voronezh region, Belgorod region. On the current stage, in transboundary cooperation of Lugansk region, the idea for creating network of international inter-modal logistics parks, in border regions of Eastern Ukraine, is developed. The perspective of creating and developing Euro-region «Donbass» is taken into account. Since, the logistics park is to be created in border region between Ukraine and Russia (Melovoe village – Ukraine, and Chertkovo – Russia), the main participants are state administrations, i.e. Lugansk and Rostov regions, which may delegate their authority to mentioned above regional centers.

Stage 2. Characteristics and description of investment idea.

The concept for the project is the creation of international rail and road cargo-passenger checkpoint and inter-modal logistics park (ILP) in Melovoe village, Lugansk region, and Chertkovo village, Rostov region [7].

The creation of inter-modal logistics park «Melovoe-Chertkovo» will allow to form basic background for attracting local transit cargo flow, partially relieving southern part of «Moscow–Caucasus» highway. Using Melovoe region in unified Euro-Asian transport-logistics system of transit cargo flow is profitable due to few reasons. Melovoe village, Lugansk region, is situated equidistant from such regional centers as Kharkov, Donetsk, Voronezh, Rostov (aproximately 350 km). The creation of inter-modal logistics park «Melovoe-Chertkovo» will give opportunity to relieve part of railway cargo flow from Chertkovo russian railway station and will direct it on Ukrainian automobile transport with appropriate customs clearance, partially «relieving» the flow on «narrow» sector Lisky (SER) – Likhaya (NCR), which is «locked» between two overloaded gateways.

This option excludes demmurage of trains on gateways of Lisky and Likhaya for cargo destined to Lugansk region, Donestk region, Kharkov region and further on, including western regions of Ukraine.

The advantages of using Melovoe region in transit freight turnover (through, created international railway checkpoint «Melovoe – Chertkovo») are listed below:

– the cargo will go only through one customs clearance station and that will reduce the time of cargo arriving to destined station,

– the cargo will be transported by railway from the station, situated directly on the highway «Moscow – Caucasus» and does not wait his turn on the gateway for «entering» the highway from adjacent branch,

– excluding option of shipping delay due to the mistakes in customs clearance,

– assurance of high quality and fast interaction for rail and road transport during international trafficking.

The perspective for development of inter-modal logistics park «Melovoe-Chertkovo» is assured not only by effective use of change for the type of transport, from rail to road, but also by further possibility to develop transport infrastructure, which can implemented step by step:

– stage 2.1 – creation of international rail and road checkpoint «Melovoe – Chertkovo» and inter-modal logistics park «Melovoe – Chertkovo»,

– stage 2.2 – construction of railway branch line Melovoe – Starobelsk – Svatovo (approximate length 150 km), which will allow to connect railway «Moscow – Caucasus»(RF) with two railway branch lines of Ukraine: Valuiki – Lugansk and Kupyansk – Debaltsevo.

Stage 3. Evaluation of market environment.

Interacting with the system of road-transport communications of Lugansk region, the cargo owners, their providers acquire the possibility to transport transit cargo from Northern, Central and Southern Europe in direction of Southern Federal District of Russian Federation, further on to regions of Northern Caucasus, to Volgograd, in Caspian regions, countries of Central Asia and Indo-China.

It is important for Ukraine to construct and develop Ukrainian transport system, in such way, that international transport corridor Europe – Asia with the exit to Trans-Syberian highway, will be passing through Lugansk region to Volgograd. This direction gives the possibility of the shortest exit to corridor North – South, reducing the length of both corridors approximately by 900-1000 km. It is profitable for all participants of traffic. These areas currently have around 30% of all the volume for traffic, besides Russia is planning to invest huge amount of money in development of infrastructure for Transsiberian up to 2030 year, to replace sea trafficking with trafficking through Transsiberian and increase those by 4,5-5 times, reducing the expenses for transport-storage operations, in cost of products from 15-20% right now, down to 7-8%.

Recently the government of Kazakhstan is developing new transport corridor, which will go from China in the destination of Volgograd and further on, through eastern, central and western regions of Ukraine, to European countries.

The value of transit cargo flows from European countries, passing through, Lugansk region further into Russian Federation territory and back, in 2011 year according to experts opinion was more than 200 billions of UAH. The volume of transported transit cargo by road exceeded 26 million of tons [4].

However, analysis showed some negative trends in this activity. The transit trafficking through Ukraine, using all types of transport, starting from 2007 year, is diminishing.

Among basic reasons, for diminished volume of transport cargo flows, are incompatibility road-transport infrastructure with international standards. Regarding this, until 2013 year, Ukraine planned to invest 125 billions of UAH in reconstruction of roads. Wherein, it is expected to build 2500 km of new highways, to overhaul more than 5000 km and to repair around 1000 km of highways. It was planned to allocate annually around 8 billions of UAH from state budget. The rest of funding is meant to be attracted through loans and investments.

The success of organizational-administrative and economic functioning of the logistics park on regional level, is due to existence of railway highway «Moscow-Caucasus» (ITC «North-South») [1], highway of republican value Р-07 «Chuguev – Melovoe», as well as existence of large number of towns with developed economic infrastructure.

The most significant social-economic infrastructure belongs to Lisichansk-Severodonetsk agglomeration (Lisichansk-Severodonestk-Rubejnoe), for which the highway Р-07 logistically the most favorable, because it gives enterprises the straight exit to railway highway ITC «North-South» (length 160 km).

Lisichansk-Severodonetsk agglomeration (Lisichansk-Severodonestk-Rubejnoe):

Chemical (Severodonestk, Lisichansk, Rubejnoe) and oil-refinery industry (Lisichansk), engineering (Severodonetsk, Lisichansk) and instrumentation (Severodonetsk), coal-mining industry (Lisichansk), food processing industry (Lisichansk, Severodonetsk, Kremennaya), glass, building materials production (Severodonetsk, Rubejnoe, Lisichansk), oil and gas industry (Severodonestk, Kremennaya, Lisichansk).

Severodonetsk:

Antex-automatika, Ltd. SPE, Armoplast, JSC, GLOBUS, IPE, Resistance plant, Impulse, Severodonetskoe JSC, METROCOM, SPE, Mriya-Novaya Technology, SPF, Azot Union, industrial state enterprise of Severodonetsk, Stekloplastik Union, JSC, Pirena, enterprise specialized in firefighter equipment, nonstandard chemical equipment plant of Severodonetsk, JSC, boiler-engineering plant of Severodonetsk, JSC, ORGKHIM of Severodonetsk, Company, engineering plant Severodonetsk, JSC, chemical-metallurgical plant of Severodonetsk, SE, Ukrvneshtradeinvest, Ltd. JE, Ukrhimenergo, JSC, Khimavtomatika, JSC, Khimpostavshik, PE, Khimtechnologiya.

Lisichansk:

Volcheyarovsk quarry, JSC, Lion, Ltd., Linos, JSC, Lisichansk soda, JSC, gelatin plant of Lisichansk, JSC, rubber technical instrument plant of Lisichansk, JSC, Lisichansknefteorgsintez, JSC, Neftekhimik, JSC, Proletariy, glass plant of Lisichansk, Company, Rare gases, JSC, Strommachina, JSC, Instrument plant, JSC.

Rubejnoe:

BKF, SPE, «Zarya», state chemical plant of Rubejnoe, «Krasitel», JSC, reinforced concrete plant of Rubejnoe, JSC, building materials plant of Rubejnoe, Ltd., paperboard mill of Rubejnoe, JSC.

Krasnorechenskoe:

Frunze machine-tool plant of Krasnorechenskoe, JSC, Stankomplekt, Ltd.

Kremennaya:

Kremenmash, JSC, Khimavtomatika, JSC.

The towns and villages, situated directly on the way of P-07 highway «Chuguev – Melovoe».

Kupyansk:

Milk cannery of Kupyansk Company, Sugar factory of Kupyansk, JSC, Meat processing plant of Kupyansk, «Torgperspetiva» (foundry of Kupyansk), Ltd., Machine-building plant of Kupyansk, JSC, cast iron foundry of Kupyansk, Ltd., Silicate plant of Kupyansk, «Bel-Ger» brewery, Company, reinforced concrete plant ZJBK-11, JE «UEFC» (Ukrainian Eastern Fishing Company), «Metiz» factory of Kupyansk, `TERMOTEKH` plant, Ltd.

Svatovo:

Merchandising Equipment Svatovo Plant, JSC.

Starobelsk:

JSC „milk substitue factory of Starobelsk" (production of skimmed milk powder, butter), Branch of JSC „Karavai" „Bakery of Starobelsk" (production of crackers, bakery and confectionary), PE „Fruit-mineral water plant „Aidar" (sparkling water, vinegar), Ltd. „Garment factory of Starobelsk", Company „Mechanical factory of Starobelsk".

Besides the specified enterprises, logistics park «Melovoe-Chertkovo» is territorially favorable for many agricultural enterprises of Belevod, Belokurakino, Kremen, Markov, Melovoe, Novoaidarskoe, Novosopskovskoe, Svatovo, Stanichno-Lugansk, Starobelsk, Troitsk regions in Lugansk area.

From the Russian side, logistics park «Melovoe-Cherkovo» will be profitable for JSC «Russian Railroad Highways», enterprises of agricultural-industrial union Chertkovo, Verkhnedon, Sholokhov, Bokov, Kashar, Miller regions of Rostov area, Kantemir, Boguchar, Rossoshansk, Petropavlovsk regions in Voronezh region.

Currently, the exit for the most of the enterprises to international checkpoints, situated to the north-east of Lugansk region, is limited. The status of international checkpoint have these points «Krasnaya Talovka» and «Markovka». The rights of international checkpoints for full customs clearance in northern direction, needed for enterprises of Lisichansk-Severodonestk agglomeration, have only those, which are situated in Kharkov region. In Lugansk region enterprises of the Lisichansk-Severodonestk agglomeration have exit to the international checkpoint of full customs clearance only to the south-east, and that's very uncomfortable.

Stage 4. Marketing plan.

Considering the perspective for development of inter-modal logistics park «Melovoe-Chertkovo», listed below in 2.1, 2.2 of STAGE 2, in combination with creation of international rail and road checkpoint «Melovoe – Chertkovo» on the territroy of Melovoe region, it is perspective to use a range of enterprises, which lost their relevance after the collapse of USSR.

Currently, there are more than thousands unused square meters of storage capacity in ex-inter-regional base of Lugansk regional customer union. The railway branch line was connected with this inter-regional storage base, through which trains were unloaded. While creating logistics terminal, using specified storage capacity, based on international rail and road checkpoint «Melovoe – Chertkovo»,

allows to exclude demmurage of automobile transport and trains during customs clearance. The cargo will go through customs clearance on the warehouse of the terminal. Using these storage capacity will allow to exclude mileage of empty transport, by loading «passing» cargo along the way.

On the territory of Melovoe village, oil base with the existing railway branch line is situated. Using oil base of Melovoe in railroad trafficking will decrease expenses in delivery of fuels and lubricant to the region.

Directly on the railroad highway, there are two grain elevators: Chertkovo elevator (RF) and Zorino elevator (Ukraine). Both elevators have working railway branch lines and possibility to load (unload) the grain by railway transport.

Unifying the specified objects in one logistics park, the existence of large rail and road highways, will allow to attract additional cargo flows in to the region, and the combination of two border, rail and road, checkpoints will assure fast customs clearance for cargo and will accelerate the transit of cargo flows.

The system of international corridors, passing through Lugansk region (Ukraine) and Rostov region (RF), includes sectors of Euro-Asian ITC "North-South" and "Transsiberian", as well as Pan-European corridors prolonged in the direction of Russia:

– ITC «North-South» (Helsinki – St. Petersburg – Moscow – Astrakhan – Caspian Sea – Iran), with the branch lines through Rostov up to Novorossiysk, Stavropol – Kochubei –Makhachkala – Azerbaijan,

– Branch line of Transsiberian (Novorossiysk – Salsk – Volgograd – Samara – Transsiberian),

– Danube water transport corridor № 7 (Danube – Don – Volga),

– ITC № 3 (Berlin – Dresden – Kiev) is prolonged through Rostov region up to Vladikavkaz and Tbilisi, as well as through Belaya Kalitva up to Volgograd and further on, into Central Asia,

– ITC № 4 (Vienna – Budapest – Bucharest – Kishinev) – Odessa – Rostov – Astrakhan and further on, up to connection

with the project TRACEKA in Kazakhstan. To create prolonged corridor rail and road highway Rostov –Odessa – Kishinev is used,

– ITC № 9-б (Klaipeda (Kaliningrad) – Kiev) – Kharkov – Rostov and further on, up to Makhachkala – Baku – Teheran. This corridor connects ports of Baltic Sea with the ports of Caspian Sea, as well as ITC "North-South" with ITC № 3.

The logistics park «Melovoe – Chertkovo» may be positioned directly within international transport corridor «North – South» (Fig. 1). Situated between three regions (Lugansk region, Rostov region and Voronezh region), two railroads (NCR and SER), logistics park will effectively take part in the system of inter-modal trans-boundary trafficking, this will allow to optimize the delivery of the cargo in all destinations of Lugansk, Kharkov and Donetsk regions (Ukraine), Rostov, Voronezh, Belgorod and Volgograd regions (Russia). The logistics park «Melovoe – Chertkovo» will become logical component for the infrastructure of highways of north-eastern part of Lugansk region with the exit to the Russian highway M-04 «Don» and railroad highway «Moscow – Caucasus».

The basic methods for promoting the services of the logistics park are:

1. Organization of themed events for potential customers (presentation, conferences, exhibitions and other).

2. Written commerce propositions for potential customers.

3. Regular visits to potential customers from representatives of the logistics park.

4. Advertisement in the Internet and media.

5. Attraction of clients is planned through affordability, high quality service, efficiency, complexity of services provided and other possible preferences.

The marketing plan also envisage the system of discounts and forming on this basis, the group of permanent solvent clients.

Fig. 2. Logistics parks «Melovoe – Chertkovo» among the international corridors system

Stage 5. Production plan for implementation of investment project.

The project suggests the construction of the logistics storage terminal (Fig. 3) to the south-east from Melovoe and Chertkovo villages, creating outdoor platforms for handling, maintenance, storing the goods and parking the automobile transport.

Using the services of the logistics park, the customer will get high quality service and will optimize the expenses, with regard to specifics of each cargo and different conditions for storing the goods to choose from. The storage complexes include – warm premises, cold premises and open platforms. All the storage complexes have comfortable driveways, regardless the size and technical characteristics of the automobile transport.

For decreasing the expenses for storing the goods and cargo, we suggest responsible warehousing. Our warehouse complexes are projected to maximally match the requirements and standards for responsible warehousing. All needed loading-unloading equipment available. The professional hourly security will ensure the safety of the stored goods and materials, privacy of the information about goods and cargo is guaranteed.
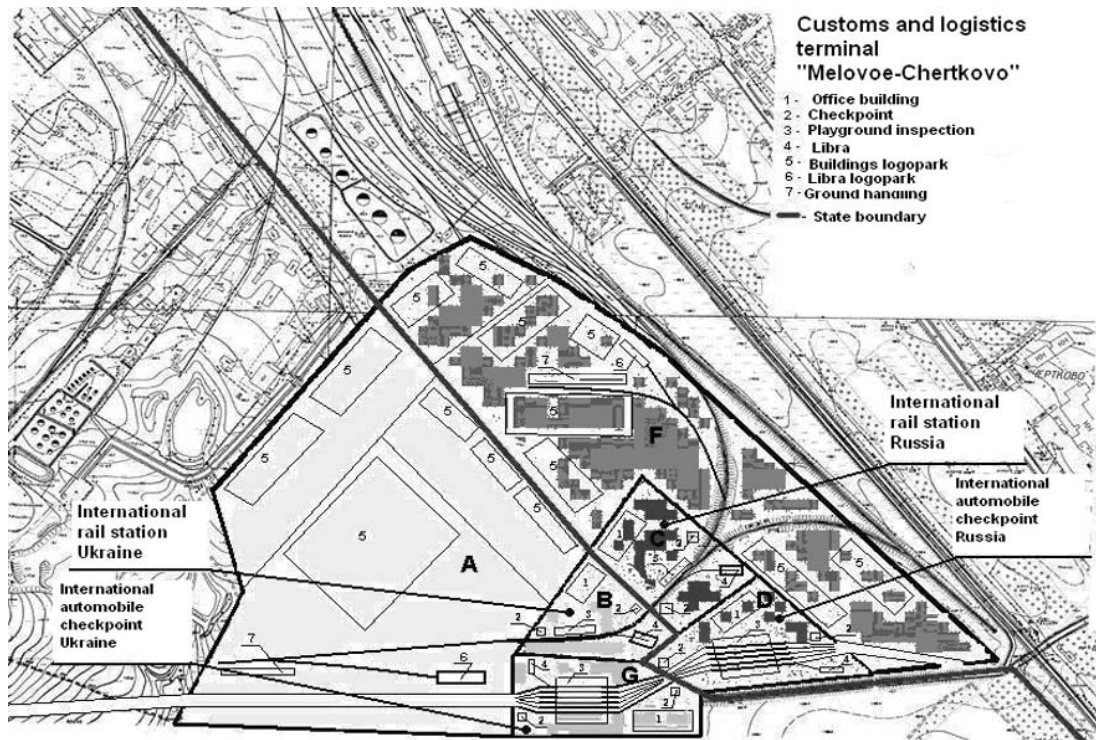

Fig. 3. The scheme of positioning for objects of logistics park

Temporary Storage Warehouse (TSW). Temporary Storage Warehouse – it is a special premise with temporary storage for various goods and transport under customs control from the moment of passing through checkpoint and up to finishing all needed customs procedures.

The comfortable transport position of TSW and it's own railroad branch line will allow, without any extra expenses and wasting the time, to primary place the cargo and the delivery to it's destination.

We may propose these for our clients:

– responsible warehousing for the goods,

– loading-unloading service,

– acceptance and issuance of the goods with the control of quality and quantity,

– regular shipping of the complex cargo through rail and road transport,

– full complex of warehouse operation of the logistics terminal: assortment of goods in groups, packing, labeling, forming sets (packs), possibility to track serial numbers, lots, storage life by request of the client, stocktaking and reports about merchandizing, remote access to information about the goods fro client,

– work with return of goods,

– monitoring the cargo flow,

– road trafficking of the cargo by logistics park's transport,

– delivery of complex cargo after receiving customs clearance to any place in Ukraine and Russia,

– help with the customs clearance and consulting about paperwork,

– logistics control during all stages of the cargo trafficking,

– insurance, escort, security and tracking of the cargo,

– consolidation and payment of the bills for cargo trafficking.

The purpose of the warehouse terminal (10000 m^2) – to accept the cargo and combining them according to destinations (completion), warehouse storing itself, loading-unloading services and other.

The general characteristics of warehouse terminal building:

Building length	100 m.
Building width	100 m.
Building height	13 m.
Building area	10 000 m^2.
Building perimeter	400 m.
Wall area	5 730 m^2.
Roof area	10 201 m^2.
Total area	15 931 m^2.
Floor thickness	100 mm.

The cost for construction is 442 USD for 1 m^2, total of: $10000 \times 442 = 4\ 420\ 000$ USD.

The general characteristics for auxiliary building (Fig. 4):

The purpose of the auxiliary building (2500 m^2) – accommodation for staff, office space, garage for loading-unloading mechanisms and other.

Building length	50 m.
Building width	50 m.
Building height	13 m.
Building area	2500 m^2.
Building perimeter	200 m.
Wall area	2740 m^2.
Roof area	2601 m^2.
Total area	5341 m^2.
Floor thickness	100 mm.

Fig. 4. Auxiliary building

The cost for construction of this object is 500 USD for 1 m^2, total of: $2500 \times 500 = 1\ 250\ 000$ USD.

Two auxiliary buildings for logistics terminal with total area of 12 500 m^2, with total cost of 5 670 000 c.u. (Fig. 5).

Fig. 5. Logistics terminal building

Besides, it is planned to construct other objects of infrastructure:

Total area of land – 30 ha.

Total area for construction – 287 500 m^2, those are:

container platform – 40 000 m^2,

outdoor platform for storing the goods and parking lot for automobiles – 247 500 m^2.

The total cost of infrastructure is 5 700 000 USD. **The total sum of investment is 11 370 000 USD.**

In calculation of initial data for the project the types of services will be defined, which will be provided to trafficking operators, volume of their service and price characteristics (Table 2)

According to calculations made of initial data for the project, we can define yearly income from turnover in the sum of 7 758 760 USD.

The initial data for the project provide us (Table 3).

Table 2. The planned volume of services provided

№ п/п	Name of the entry	Measure	Price	Volume per 24 h.	Sum per 24 h, USD	Sum per month, USD	Sum per year, USD
1	Loading/unloading, warehousing, grouping of the cargo	thousands tons	1 600	10	16 000	480 000	5 760 000
2	Container processing	piece	6,95	31	215	6 464	77 562
3	Outdoor parking lot service	unit	3,13	685	2 144	64 322	771 858
4	Cargo trafficking	thousands of km,	20,87	3	63	1 878	22 540
5	Maintenance services	compl.	313	10	3 130	93 900	1 126 800
	Total:				21 552	646 563	7 758 760

Table 3. The project provide

Payments and income	Time period				
	1-st period[*]	2-nd period	3-rd period	4-th period	5-th period
1. Construction of logistics park, buying and installing equipment	11 370 000				
2. Income from services provided		7 758 760	7 758 760	7 758 760	7 758 760
3. Variable expenses		120 000	120 000	120 000	120 000
4. Permanent expenses		50 000	50 000	50 000	50 000
5. Amortization		350 000	350 000	350 000	350 000
6. The income before tax		7 238 760	7 238 760	7 238 760	7 238 760
7. Taxes (VAT and tax on profits)		3 531 138	3 531 138	3 531 138	3 531 138
8. Pure income		3 707 622	3 707 622	3 707 622	3 707 622
9. Cash stream from investments	11 370 000				
10. Cash stream from operations		4 057 622	4 057 622	4 057 622	4 057 622
11. PURE CASH STREAM	-11 370 000	4 057 622	4 057 622	4 057 622	4 057 622

Stage 6. Financial plan and program for investments.

Financial results from implementation of the project. For identifying the economic effectiveness of the project, must be defined the growth of pure income from it's implementation, i.e., we are calculating the difference between pure incomes, which we will get from implementation of the project and pure incomes in case of canceling the project. In case «without project» all the indexes will be equal to zero, because the enterprise is building the new warehouse premises.

Thus, the growth of pure income is equal to value of pure income (Table 4).

Cumulative total for pure income growth is (Table 5).

According to the project, the time for construction is equal to 12 months from the start of funding the project.

If the project will be funded for 11 370 800 USD, then the index of NPV will be 13 191 270 USD.

Internal rate of return (IRR) for the project will be 35,82%.

The profitability index from investments of the project will be 54,59%, it shows quite high profitability for investments.

Payback period for the project from the start of functioning will be 2,47 time periods, i.e. 3 years (2 years and 5 months).

According to discounting, the payback period is equal to 2,73 years, i.e., the expenses from the project with regard to changing in cost of currency, will be paid back in 3rd year of implementation of the project.

Detailed method for calculating indexes of effectiveness is shown below. Calculated time period for implementation of the project is set to 5 years.

Indexes of effectiveness of the investment are shown in Tables 6-8. Basing on the calculation of economic effectiveness for the project of logistics park «Melovoe – Chertkovo», we can decide on expediency and perspective for construction of the object on the territory of Melovoe and Chertkovo regions.

Table 4. The value of pure income

Period	USD
1-st	0
2-nd	7 758 760
3-rd	7 758 760
4-th	7 758 760
5-th	7 758 760

Table 5. Cumulative total for pure income

Period	USD
1-st	0
2-nd	7 758 760
3-rd	15 517 520
4-th	23 276 280
5-th	31 035 040

Table 6. Indexes of the investment

Index			
Sum of investment, USD			11 370 000
Discount rate, %			7
Payback Period - PB, months.			36,00
Discounted Payback Period - DPB, months.			36,00
Average Rate of Return - ARR, %			54,59
Net Present Value – NPV, USD			13 191 270
Discounted Profitability Index- DPI			2,16
Internal Rate of Return – IRR, %			35,82
Period for calculating integral values			5 years
Payback Period			
Expected sum of investments, USD			11 370 000
Year	Income stream from investments		Payback from the project
	current year	cumulative total	
1-st	0	0	doesn't occurs
2-nd	7 758 760	7 758 760	doesn't occurs
3-rd	7 758 760	15 517 520	occurs
4-th	7 758 760	23 276 280	occurs
5-th	7 758 760	31 035 040	occurs
Payback period of the project is			3 years
		Precisely	2,47 years

Table 7. Discounted payback period

Expected sum of investments, USD				11 370 000
Discount rate (discount)				0,07
Year	Income stream from investments			Payback of the project
	current year	current cost	cumulative total	
1-st	0	0	0	doesn't occurs
2-nd	7 758 760	6 776 801	6 776 801	doesn't occurs
3-rd	7 758 760	6 333 459	13 110 261	occurs
4-th	7 758 760	5 919 121	19 029 382	occurs
5-th	7 758 760	5 531 889	24 561 270	occurs
Payback Period of the project is				3 years
			Precisely	2,73 years

Stage 7. Analysis of risks for the implementation of the project.
Information about possible situation of the investment project, which have risks.

Project risks. The most significant risks for the project are due to the general situation in Ukraine, lied with political instability, perspective of economic in general and financial instability.

Table 8. Discounted profitability index

Expected sum of investments, USD	11 370 000	
Discount rate (discount)	0,07	
Year	Income stream from investments	
	current year	current cost
1-st	0	0
2-nd	7 758 760	6 776 801
3-rd	7 758 760	6 333 459
4-th	7 758 760	5 919 121
5-th	7 758 760	5 531 889
Net Present Value – NPV	13 191 270	
Discounted Profitability Index – DPI	2,16	

Political instability in Ukraine. The stability of the project with regard to this factor is due to it's attachment to foreground activity for Ukraine economy – intensification of international economic collaboration and development of transport infrastructure. Since, all the territory of Melovoe region is considered to be agricultural land, implementation of the project is directed on solving one more foreground activity – integrated development of agricultural territories.

Financial instability. The influence of this factor can be partially decreased through stabilization fund and financial appeal of the project in general.

Other types of risks and their possible negative influence on the stage of preparation, investment and implementation of the products are shown in the next chart.

The most significant (quantity defined) risks for the project will be minimized due to insurance of stored cargo, as well as various measures for decreasing the risks.

Measures for decreasing the risks. There is no analogs for this project in Ukraine, this why, risks with the significant competition from other projects, on the preparation stage is set as insignificant.

The risks on the stage of functioning can be significant. However, due to effective management, those can be minimized.

The calculations for the project were based on real-life scenario for development in the market. Significant deviations to decreased economic effectiveness are unlikely.

The general level of risk for the project is acceptable for investment.

Stage 8. Social-economic aspects of the business plan.

The practical implementation of the project, with the increasing volume of transit cargo (which according to some forecast, already in 2020 year will be more than 1 trillion of UAH worth), will allow to use transport-logistics infrastructure of Lugansk region. This will provide jobs for the

thousands of the local population, as well as additionally will increase state budget income on 30-35%.

Administration center – Melovoe village and significant part of the territory of local region, are situated near the Ukraine-Russia state border, on the «crossroad» of international strategic highways, near the one of the most intense Euro-Asia transport-logistics system «North – South – West – East».

In the process of solving this question, we must consider the fact that on the territory of Melovoe region, distant from the industrial and highly populated regions, trafficking is always intense and highly active movement of rail and road transport. Russian Federation has strategy up to 2030 year to organize the fast movement of the passenger trains in direction Center -South (Moscow – Adler). This implies movement of large quantity of passengers, people of various age, characters and interests. All that will stimulate development of their activity and will positively influence local and state budget, the creation of new jobs, and will allow to exclude in the future their social-economic downturn and depression.

The creation of logistics park «Melovoe – Chertkovo» will allow to increase transit transport flow through Lugansk region, and that will increase tax income, customs duties on the checkpoints of north-eastern region, and will contribute to development of infrastructure near the highway P-07 (additional gas stations, supermarkets, hotels, maintenance centers and other).

CONCLUSIONS

1. The algorithm and method for creating the inter-modal logistics park, for processing transit and local cargo, with the regard to position, production and economic characteristics of potential customers, was designed.

2. This method provides record for all comprehensive features for all participants of the project, investment idea, evaluation of the market environment. The marketing plan and plan of implementation for the investment project allows us to define the sum for all needed investments.

3. The method for evaluating the effectiveness of the investment project, based on financial plan, with the regard to risks and social-economic aspects, in the process of the plan implementation, was suggested.

4. The example for implementation of the project, for creating logistics park on the Russia-Ukraine border, near the villages Melovoe and Chertkovo, was suggested.

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МЕТОДИКА И АЛГОРИТМ СОЗДАНИЯ ИНТЕРМОДАЛЬНОГО ЛОГИСТИЧЕСКОГО ПАРКА

Максим Слободянюк, Григорий Нечаев, Александр Кислицин

А н н о т а ц и я . В статье рассмотрено состояние и развитие инфраструктуры транспортных систем приграничных территорий Украины. Отмечено, что создание логистических парков на этих территориях повысит привлекательность международных транспортных коридоров, проходящих через Украину, увеличит объёмы, скорость прохождения грузопотоков и доходы. Предложена методика и алгоритм создания логистического парка. Рассмотрена реализация методики на примере создания пилотного проекта логистического интермодального парка на Украино-Российской границе в районе Меловского и Чертковского районов.

К л ю ч е в ы е   с л о в а :   международный транспортный коридор, логистический парк, проект, методика и алгоритм, эффективность инвестиций.