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An Evaluation of the Efficiencies and Priorities for Sustainable Development in the Transportation System for the Manufacturing and Trade Industry

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Abstract: One of the most important factors in determining sustainable development of using a transport system is in its efficiency, and there are a number of indicators which can be considered to this end. The aim of this paper is to assess and evaluate such efficiencies, their indicators and the extent to which implementing sustainable development and sustainable transportation is feasible within the transportation system within the trade and manufacturing industry. To this end, the authors determine efficiency as a ratio between expenditure and resources, versus the effects of the realised transportation process. The first chapter introduces the transportation system and any specific terms discussed in this paper. The second chapter describes the source material used for the subject of sustainable development and sustainable transportation. The third chapter details the analyses of the transportation system as processed based upon the technical and economic indicators. The penultimate chapter compares existing and proposed alternative logistical solutions for profitability employing heuristically applied methods. And finally, the fifth chapter summarises the calculations and considerations from which the thesis' conclusions are drawn. The authors also propose potential aspects for the development of the areas discussed in this paper.

Keywords: sustainable development, sustainable transportation, transport system

JEL codes: Q01, L91, L99

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1. Introduction

In this paper authors present the case study of an existing transport system within the trade and manufacturing industry that refers to Eurasia (mostly selected partner relationships of Poland,

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Netherlands, Russia and China – this is precisely explained in section 3 of the paper). Authors elaborate and evaluate two variants of this transport system in the context of its efficiencies and priorities for sustainable development. The first variant concerns the transport system in its current state, that the company transport system prospers, and the second variant is to explore and offer alternatives for its organisation (this variant is believed to be suboptimal).

Development of sustainable transport requires consideration of indirect factors (arisen from acquired knowledge) as well as direct factors (usually derived from scientific analysis and expert opinion). For measurement of these impacts, authors chose certain technical and economic indicators for the research, such as: transport duration, transport cost per shipping unit, transport cost per distance units, average commercial speed, transport performance among technical indicators and efficiency of container carrying capacity, efficiency of container loading space, net present value and internal rate of return among economic indicators. The study is given in accordance to sustainable development and especially to sustainable transport. Authors' thesis is to attempt in finding answer whether it is possible to conciliate sustainable development and company policy. The research method is qualitative method, the purpose of which was to gather the fullest possible amount of information available in the scientific and popular literature.

One of aims of this paper is to assess the extent to which implementing sustainable development and sustainable transportation is feasible within the transportation system within the trade and manufacturing industry. To this end, the authors use economic and technical indicators and quantitative factors which allow to make assessment that is credible, expressed in values.

The first chapter introduces the transportation system and specific terms discussed in this paper. The main aim of the transportation system, which is currently explored, is to deliver products on time from a factory placed in Shanghai to a final customer in Vladivostok. Before delivering products to the customer, the order is collected in a warehouse in Moscow and then redistributed. The process uses the means of maritime, road and rail transport and takes about 30 days. It is precisely described in third chapter.

The second chapter describes the literature review in the subject area of sustainable development and sustainable transportation. The third chapter details and analyses the transportation system and process based upon technical and economic indicators. The fourth chapter explores alternate logistical solutions for the transportation system that is evaluated and compared (with that of the first variant of transportation system) for profitability, employing heuristically applied methods. And at last, the final chapter summarises the calculations and considerations and then the conclusions of the thesis are given. Potential aspects of the study development described in the paper are also given.

It must be mentioned here that some data considered in the paper were obtained from a successful entrepreneur, whom expressed the wish for anonymity.

2. Concise literature review

In order to gather sufficiently large research material, numerous items of foreign scientific and popular science literature were studied. Therefore, part of the paper was made with so-called qualitative method, the aim of which was to attempt to gather the most complete information available in national and foreign literature, scientific and popular literature. An extensive library query was conducted, the problem was solved using "hard" literature and numerous web resources, properly verified.

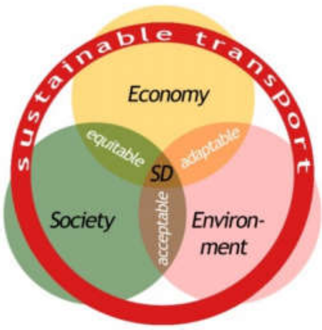
Numerous definitions of "sustainable development" are found in the relevant international literature. Most of them are based on the one given in "The Report of the Brundtland Commission", commonly called "Brundtland Report: 'Our Common Future'". It defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987: 41). Sustainable development understood in that sense contains two key-concepts: the concept of *needs* and the idea of *limitations*. The first one is truly important in all cases, however the second one seems particularly relevant in case for transport systems. Let us then focus on sustainable transport.

Eliasson and Proost (2015: 92) claim that if sustainable transport is considered in accordance to sustainable development, the most frequently mentioned policy is to reduce greenhouse gas emissions from the transport sector. Márquez-Ramos (2015) focuses on the relationship between trade and sustainable transport. At the very beginning of the paper she points out that "[i]ncreasing trade liberalisation has increased exports and imports of goods and, hence, transport emissions. It is worth noting that transport is one of the most contaminating economic activities in terms of CO_2 emissions, although levels of pollution differ from one mode of transport to the next (Zafrilla et al., 2012)", Márquez-Ramos (2015: 170). In fact, it is a much more complicated subject. Sustainable transportation is believed to be one of the aspects of global sustainability, of world sustainable development. Therefore, it involves meeting present needs of humanity without reducing the possibility of future generations to meet their needs as well. A sustainable transportation system is one that enables some basic access needs of an individual person, and social communities as a whole, to be met safely and as part of a healthy ecosystem (where "eco-" can stand both for "ecological" and nowadays for "economical"). What is more, it is believed a sustainable transportation system should be affordable, operate efficiently, offer choice of transport mode and support a vibrant economy. And last but not least, a sustainable transportation system is understood as a system that limits green-house gas emissions, minimizes consumption of non-renewable resources, reuses and recycles components that can be renewable and minimizes the production of noise and other kind of vibrations. In general, it can be said that sustainable development is a kind of coexistence of economy, society and (the natural) environment as it is given in figure 1. Sustainable development aims to improve quality of life in these three areas.

Transport has a global impact on aspects related to sustainable development. There is no doubt about it. Sustainable transportation can be described in a variety of ways. As Stephenson et al. (2017: 1) state, it refers to desirable combinations of government policies, technologies, infrastructure, and behaviours which minimise adverse social and environmental impacts while retaining or enhancing economic outcomes. Therefore, in figure 1 it is proposed to input sustainable transport as a ring that simultaneously includes sets of economy, society and (the natural) environment and is part of each of these sets. Zuidgeest et al. (2000: 1, cited in Kostrzewski and Chudzikiewicz, 2015: 59) give examples of these impacts, as follow:

- "exhaust emissions from petrol and diesel engines (primary pollutants as carbon monoxide, nitrogen oxides, sulphur oxides, hydrocarbons and particulate matter), but also secondary pollutants due to chemical reactions of primary pollutants,
- noise which mainly results from the growth of motorization which can influence mood and reduces the performance of the cardio-vascular system, as well as affects intellectual and mechanical tasks […],
- congestion, from which major cities throughout the world are suffering,
- the large area of land for the construction of roads, railways, airports and ports, as well as the land-use of developments which are derived from these constructions,
- traffic safety, with a majority of pedestrians, cyclists and motor cyclists as victims."

Figure 1. The diagram concerning sustainable transport (SD – Sustainable Development).



Source: own work, based on Borowik and Cywiński (2016) cited after Tica *et al.* (2011) and Bayulken and Huisingh (2015).

Kadłubek (2015: 495) states that according to Borowiecki and Rójek (2011: 23), Modrak et al. (2011: 158) as well as Grabara and Kot (2009) "sustainable development of business entities and management areas is, apart from corporate governance and value and development management, one of the most crucial modern management concepts." Does it really apply in all the requisite areas for consideration: economy, society and (the natural) environment and its coordination and coexistence? Are those business entities challenges? In the paper, authors express their doubt of the legitimacy of certain theoretical considerations on sustainable development at the same time asking the question "is the shortest route really the cheapest and/or best in the transport system?" What is hidden under the question, will be explored later in this paper.

3. Transportation system

The manufacturing and trade industry – which the paper concerns – produce products in a factory placed in Shanghai, yet the sales market is placed in Europe and Asia. The different locations of production and sales create a need for logistical management of transportation organizing.

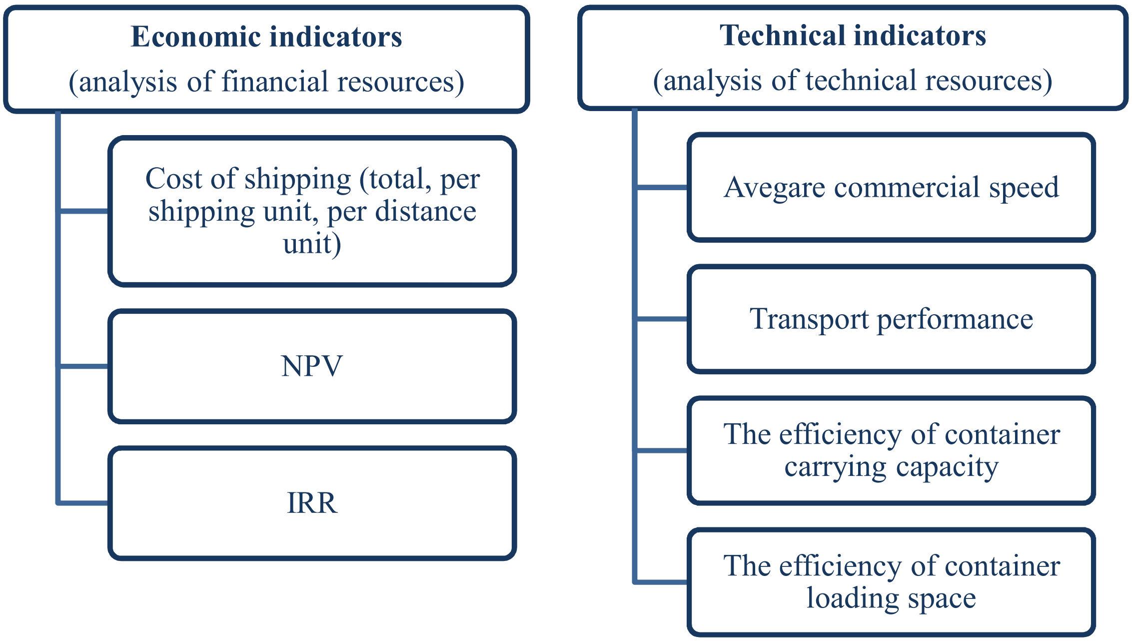
Figure 2. The outline of the shipping route from Shanghai to Vladivostok, variant No. 1. (RUDC – Moscow Central Warehouse, CEDC – Central Europe Central Warehouse).

Source: own work, based on www.googlemaps.com.

The shipping process is executed in a few stages. First, products are loaded into containers and shipped by a container ship to Rotterdam. The containers cover distance of 19 500 km in 14 days. Certain reloading operations take place in Rotterdam and the containers are then shipped to Petersburg via applied maritime transportation. Next, the containers are loaded on trucks and delivered to a warehouse in Moscow by means of road-transportation. Once in the warehouse, every order is collected and freight is sent by rail to the final customer. The whole process takes about 30 days and covers about 32 000 km. Graphical outline of the processes connected to freight transportation taken into consideration in the presented case study is given in the figure 2.

Choosing the right process of shipping depends not only on its simplicity, but also should be based on chosen technical and economic parameters. The convenient way to present data as understandable and comparable information can be realised by using adequate indicators. Below, there is a list featuring selected indicators that can be used. The partition between economic and technical indicators is based on the input data. Economic indicators are based only on financial data, whereas source of technical indicators is coming from technical resources (the partition of chosen economic and technical indicators is given in the figure 3 and as such is used in following calculation presented and discussed in the paper). Efficiency of human resources is not taken into consideration as no significant changes are assumed.

Figure 3. The partition of chosen economic and technical indicators.



Source: own work.

The cost of the shipping is calculated basing on fixed and variable capital spending. The fixed cost does not depend on the size of the shipment (i.e. number of shipping units) and covers actions such as documents processing and administration. The more shipping units transported, the higher the variable costs are. This dependency is presented as the formula (1).

$$C_t = C_f + v \cdot C_v \tag{1}$$

where:

C_t – total cost, [USD],

C_f – fixed cost, [USD],

C_v – variable cost, [USD],

v – quantity of units, [pcs].

Expressing the total cost per shipping unit or distance unit can be also helpful while comparing transportation systems.

Producing goods and delivering them to the customer is a form of investment from the company owner's point of view. That is the reason why the Net Present Value (NPV) indicator also can be calculated. The NVP is a profitability of the investment. In the considered case it is a long-term investment, the discount rate also takes this into consideration. The way the NPV parameter was calculated is given as the formula (2).

$$NPV = \sum_{t=1}^{n} \frac{NCF_t}{(1+r)^t} \tag{2}$$

where:

NPV – Net Present Value, [USD],

r – discount rate,

n – investment duration in years,

NCF_t – cash surplus in t-period (year), [USD].

The Internal Rate of Return (IRR) allows to gain information about the rate of return and this is a percentage value. The IRR is a measure comparing expenditures and profits from the investment. The way the IRR parameter was calculated is given as formula (3).

$$IRR = \frac{CF}{I_o} \tag{3}$$

where:

IRR – Internal Rate of Return,

CF – cash flow, [USD]

I_0 – investment expenditure at the beginning, [USD].

The average commercial speed of transportation is the ratio between the distance and the total duration. The way the average commercial speed of transportation parameter was calculated is given as formula (4).

$$P_t = \frac{S}{t} \tag{4}$$

where:

P_t – commercial speed of transportation, [km/h],

S – distance, [km],

t – total time of transport, [h].

Traffic capacity is the product of the distance and the weight of cargo. The way the traffic capacity parameter was calculated is given as formula (5).

$$T_p = S \cdot M \tag{5}$$

where:

T_p – traffic capacity, [tkm]

S – distance, [km],

M – net cargo weight, [t].

The way the efficiency of container carrying capacity parameter was calculated is given as formula (6).

$$w_l = \frac{M}{l_{poj}} \tag{6}$$

where:

w_l – efficiency of container carrying capacity,

M – net cargo weight, [t],

l_{poj} – total carrying capacity of container, [t].

The way the efficiency of container loading space parameter was calculated is given as formula (7).

$$w_{VP} = \frac{v_l}{v_{poj}} \tag{7}$$

where:

w_{VP} – efficiency of container loading space,

v_l – cargo volume, [m^3],

v_{poj} – total capacity of container, [m^3].

It is worth mentioning that conclusions based on economic and technical requirements for transportation systems are in most cases, contradictory and mutually exclusive, in that every transportation system tries to lower costs and improve quality and commercial speed. However, these two objectives cannot be achieved at the same time. Lowering costs in most cases impacts quality and respectively high quality of service is not the cheapest solution, and that is one of many aspects that impact on the sustainability of transportation and transport systems.

4. Alternative transportation system

The first variant of transport system concerns transportation along Asia, Europe and back again. A logical approach may assume this variant to be less reasonable and rational. The distance between the place of manufacturing and the warehouse of the customer, namely between Shanghai and Vladivostok, is about 3 050 km. On its initial appearance, it seems that direct delivery from the factory to the customer should be cheaper and faster. This is the way we consider “a distance as short as possible” in the case of an alternative variant. The fewer number of re/loading operations should also have a positive impact on number of products damaged during shipping. The risk of shipment delay is lower and the flow of information-flow is much easier thanks to working in the same time zone. Moreover, the transport network between these two cities is fully developed, so there is a possibility to use all kinds of transportation. However, the technical and organizational alignment of a warehouse next to the factory should be taken into consideration as well. The warehouse being next to the factory disallows the direct collection and processing of individual customer orders. The order-picking strategy is not possible in this case. This operation is processed in the central warehouses. As a result, in one container there can be only one type of product, so the customer has to order at least one container of each product. From the company owner point of view, adjusting the warehouse to realise orders is an enormous investment. The freight transportation in the case of second variant is given in figure 4.

5. Comparison and results

A multitude of criteria to be taken into account while decisions making, causes it difficult to take the best, optimal decision. Usually, it takes the form of a compromise dependent on the present and future situation of the company. Often policy-makers support their decision using heuristic methods, which are supposed to allow the emergence of the most suitable solution currently at the time, taking the available information into account. With regards to the situation of the analysed company’s situation, the analysis of the transport system is based on a comparison of two alternative routes of transport, taking into account the limitations imposed by the management company or investor.

Figure 4. The outline of the shipping route from Shanghai to Vladivostok, variant No. 2.

Source: own work, based on www.googlemaps.com.

To determine the most advantageous route of goods transportation in the considered transport system, the point method with assigned weights (Brzeziński, 2006 cited in Nowakowski and Werbińska-Wojciechowska, 2012: 952) is used. This method consists of determining the selection criteria, and then assigning them to appropriate weights (the method is very precisely described in Nader et al., 2017: 83-85). The final result is to choose the route with the highest assessment, which is the sum of the products of weights and granted ratings for every single criterion.

The process of choosing the right shipping route is not obvious and it mainly depends on the priorities of the company owners. The arguments that are taken into consideration should be aligned to the mission and vision of the company. One of the possible solutions on how to solve the problem is to use a heuristic method co-using the experts method. The aim of the experts method is to point out the most convenient solution based on the best knowledge of the decision-makers. First, the decision-maker is describing the criteria and their level of importance (in other words: the weights) expressed in numerical form (value). Setting the levels of importance is subjective and can differ depending on the decision-maker's opinion, therefore a decision-maker should be outstanding and independent of the organization (the company). Next, variant routes are being evaluated referring to the priorities. Whenever it is possible, the marks have a number format (a value), if not, they are converted to number with a simple rule, i.e. 0 for the worst option and 1 for the best one. Evaluation based on 0-1 can be also used when some criteria should be maximized, and other ones minimized. In the next step the importance levels and evaluation are multiplied. The evaluation for each route is summed and, based on the final numbers the proper route is chosen. As the decision criteria, calculations based on specific mathematical formulas given as (1)-(7) are taken into consideration. More precisely examination of the solutions derived are described below.

The results of the calculation for the indicators mentioned in chapter 3. are presented in table 1. It must be mentioned here that some data considered in the paper were obtained from a successful entrepreneur, whom expressed the wish for anonymity and not to publish the source data used in the calculation given in table 1. In the case of results (mentioned data) comparison point assessing method is proposed. Let us compare the obtained results.

Table 1. Comparison of the results of calculations for the two alternative routes.

Measure	**Variant No. 1: Moscow - Vladivostok**	**Variant No. 2: Shanghai - Vladivostok**
1	*2*	*3*
Transport duration	30 days	4 days
Transport cost per shipping unit	3,81 USD/pc	0,35 USD/pc
Transport cost per distance unit	0,72 USD/km	0,52 USD/km
Average commercial speed	40 km/h	35 km/h
Transport performance	217 339 tkm	71 370 tkm
The efficiency of container carrying capacity	29,21%	
The efficiency of container loading space	61,33%	
NPV	1 472 638 USD	-495 450 USD
IRR	149%	-16%

Source: Wrona (2016: 38).

Using point method begins by identifying the subjects of assessment that in this case are the transport routes. It consists of the two-pieces set $\boldsymbol{W} = \{w: w = \{1, 2\}, w \in \mathrm{N}\}$, where $w = 1$ stands for route No. 1 (Moscow – Vladivostok) and $w = 2$ stands for route No. 2 (Shanghai – Vladivostok).

The next step of point method using is to choose the proper selection criteria. Herein, it consists of the eight-pieces set $\boldsymbol{K} = \{k: k = \{1, 2, 3, 4, 5, 6, 7, 8\}, k \in \mathrm{N}\}$.

Table 2. Summary of evaluation criteria used in the point method (column 2) and summary of weights of criteria used in the point method (column 3).

K	Criteria	*p*(*k*)
1	*2*	*3*
1	Transport duration	15%
2	Transport cost per shipping unit	10%
3	Coefficient of speed / price	10%
4	NPV	50%
5	The efficiency of container carrying capacity	6%
6	Speed of information flow	4%
7	Risk of not-in-time delivery	4%
8	Influence on natural environment	1%

Source: own work.

Then to each criterion its weight is given. The weights $p(k)$ are assigned subjectively, according to the judgement of the decision-maker (criteria are given in table 2 - every criterion is numbered by numbers given in column 1 of table 2 and described in descriptive form given in column 2 of table 2; the weights proposed by paper authors are given in table 2., column 3 and they are predefined with use of experts method). It is worth noting that the sum of the weights do not exceed unity (or 100%; which is expressed in formula (8)).

$$\sum_{k=1}^{k=8} p(k) = \sum_{k=1}^{k=8} p(w,k) = 1, \qquad w = \{1,2\} \tag{8}$$

The next step is standardising assessments of route selection. Each variant route is evaluated in terms of criterion k (table 3.).

Measurable criteria obtain values that are results of the analysis given in table 1. Not all of criteria are measurable, therefore qualitative criteria bear descriptive assessment (table 3., column 1, 2: $k = \{6, 7, 8\}$). In the opinion of the decision-maker criteria $k = \{3, 4, 5\}$ should be maximized, and the criteria $k = \{1, 2\}$ should be minimized and some criteria are ambiguous in the context of their evaluation (criteria $k = \{6, 7, 8\}$). For all these reasons (minimizing or maximizing some criteria or because of ambiguous criteria), assessment of various criteria are shown in a simplified manner (table 3, columns 4, 5). Due to the comparison of just two variants, it is sufficient to introduce two-point scale $s(w,k)$, for example consisting of 0 and 1 (formula (9)). The application of this operation enables the standardization of evaluation criteria, in this case it is maximizing of rates. Each variant route is evaluated in terms of criterion *k*.

$$
\begin{array}{l}
s(w,k), \ k \in \boldsymbol{K}, \ w \in \boldsymbol{W} \\
s(w,k)=1: \ c(1,k) \leq c(2,k), \ k=\{1, \ 2\} \\
s(w,k)=0: \ c(1,k) > c(2,k), \ k=\{1, \ 2\} \\
s(w,k)=1: \ c(1,k) \geq c(2,k), \ k=\{3, \ 4, \ 5\} \\
s(w,k)=0: \ c(1,k) < c(2,k), \ k=\{3, \ 4, \ 5\} \\
s(w,k)=1: \ \underset{semantic\ meaning}{c(1,k)} \geq \underset{semantic\ meaning}{c(2,k)}, \ k=\{6, \ 7, \ 8\} \\
s(w,k)=0: \ \underset{semantic\ meaning}{c(1,k)} < \underset{semantic\ meaning}{c(2,k)}, \ k=\{6, \ 7, \ 8\}
\end{array}
\tag{9}
$$

where: $c(w,k)$ is the value of criterion for *w*-route and *k*-criterion.

Then the values $q(w, k)$ are generated. Those are products of multiplying weights of criteria and their assessments (table 3, columns 6, 7). It is expressed in formula (10).

$$q(w,k)=p(w,k)\cdot s(w,k), \ k \in \boldsymbol{K}, \ w \in \boldsymbol{W} \tag{10}$$

Based on table 3 (column 6, 7) aggregated indicators for the evaluation of each option are designated according to formula (11). The result in the case of variant $w = 1$ is given as formula (12) and the result in the case of variant $w = 2$ is given as formula (13).

$$f(w)=\sum_{k=1}^{k=8} q(w,k), \ k \in \boldsymbol{K}, \ w \in \boldsymbol{W} \tag{11}$$

$$f(1)=0{,}61 \tag{12}$$

$$f(2)=0{,}46 \tag{13}$$

Based on the results of the assessments the first route was chosen as favourable at the moment for the company, because:

$$f(1)>f(2) \tag{14}$$

Table 3. Rating of routes according to the criteria, its standardising (columns 4, 5) and its multiplying product of ratings and weights (columns 6, 7).

k \ w	$c(w,k)$		$s(w,k)$		$q(w, k)$	
	1	**2**	**1**	**2**	**1**	**2**
1	*2*	*3*	*4*	*5*	*6*	*7*
1	30	4	0	1	0	0,15
2	3,81	0,35	0	1	0	0,10
3	0,15	1,56	0	1	0	0,10
4	149%	-16%	1	0	0,50	0
5	29,21%	29,21%	1	1	0,06	0,06
6	good	difficult	0	1	0,04	0
7	large	Small	0	1	0	0,04
8	moderate	moderate	1	1	0,01	0,01

Source: own work.

The Moscow – Vladivostok route (variant 1) is characterised by longer durations of transport of containers and a higher cost of unit transportation. The implementation of the transport process is also connected to limits of the information-flow (much complicated in the case of variant 1). Despite these disadvantages, transportation organized on this route does not require additional investment, as it uses existing infrastructure and resources held by the investor. At the same time this is the most important criterion in the mind of the investor, which is why variant 1 itinerary is preferably evaluated.

It is worth noting that the difference in the designated assessments variants is small and is 15 percentage points. In the rapidly changing environment of organization, it is not excluded that the investor considers the second option (variant 2) to be more profitable. This can be due to changes in economic policy, which will be reflected in the change in exchange rates or changes in the way of policy-making transport through changing tax incentives. Another likely scenario is to change the weights of individual criteria used in determining the assessment of variants, for example due to changes in the mission and vision of the company or its long-distance goals. This ultimately means the evaluation is unequivocal.

6. Conclusion

The aim of the paper was to elaborate and evaluate two variants of transportation system used by particular manufacturing and trade industry in the context of sustainable development.

As it was mentioned, in general, it can be said that sustainable development is a kind of coexistence of economy, society and (natural) environment as it is given in figure 1. Sustainable development is intended to improve quality of life in these three areas. The question is then why variant 2 is not better? This question leads a reference to the subject of proving the sustainable development is not necessarily being right in every aspect of business activity in a company. Regarding environmental aspects, it can be said that, the movement of goods utilizes modes of transport appropriate to the size and distance of shipment and to the minimization of resulting emissions. In this point of view variant 1 is less indulgent to the environment. International Maritime Organization (IMO) estimates that world shipping is responsible for about 3% of global CO_2 emissions. Of the total emissions from the transportation sector, shipping accounts for 10%, road transport 73% and air traffic 12%. Losses from pipelines contribute 3%, and rail transport 2% (after Márquez-Ramos, 2015: 170). In variant 2 mostly rail transport would be used. In the policy of the decision-makers in the considered case it seems that the environmental aspects are treated equally for both variant 1 and variant 2. On the other hand, "[o]ver the last three decades, China has become the greatest energy consumer and pollution emitter in the world. As a major contributor to that energy consumption and pollution emission, China's transportation system is worthy of intense study and measuring its performance has become an important topic. Unfortunately, little research has paid close attention to China's transportation system, and there is a particular lack of research on energy and environmental efficiency evaluation", Wu (2015: 11-12). Might it mean that less goods transportation in the area would be better in environmental aspects of sustainable development?

However, shippers and carriers include environmental as well as financial goals in selecting the timing and mode of shipping. The key to taking the decision may be the economic aspect, that is as it follows. Regarding that when $NPV > 0$, the investment would add value to the company and the decision would be that the variant 1 may be accepted is supported by calculations $NPV\ (w = 1) = 1\ 472\ 638$ USD. At the same, it should be noted that when $NPV < 0$, the investment would subtract value from the company and the decision would be that the variant 2 may be rejected ($NPV\ (w = 2) = -\ 495\ 450$ USD).

Evaluation of described transport system is controllable. It is only need to change the weight of some criteria to get another variant as the best one, but it is important to make reference to the actual conditions, therefore it must not be done.

Finally, the questions betoken in the second chapter need to be answered. Are those legitimate questions to apply in all the requisite areas for coordination: economy, society and the natural environment and their coordination and coexistence? Are those business entities challenges? In the paper, authors expressed their doubt in the legitimacy of some theoretical considerations on sustainable development. The assessment/evaluation is controllable. It is easy to change values assigned to criteria to prove that variant 2 would be much better. However, would it be better in the case of company policy? This needs additional studies. Authors also asked the question "is the shortest route really the cheapest and/or the best in the transport system?" It is only when transport cost are taken under consideration. It is not while other aspects of functionality of the company are considered, e.g. costs of production, capital investment for high-bay warehouse in China and many more. As a conclusion, it might be stated that consideration of sustainable development in any company and its evaluation are not unequivocal and can be controllable.

According to What'sNext (2016) empathy might extinct in years 2020-2025. Authors' point of view proclaims that sustainable development is based on empathic approach towards people and the environment, therefore the two components of sustainable development, with the exception of economics. At the very end of the paper authors put the open-question whether sustainable development survives as an idea when the empathy would extinct?

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Ocena efektywności i priorytetów systemu transportowego przedsiębiorstwa produkcyjno-handlowego w zakresie zrównoważonego rozwoju

Streszczenie

Jednym z istotniejszych czynników rozważanych w kwestiach dotyczących wdrażania zrównoważonego rozwoju w systemie transportowym jest jego efektywność. Istnieje wiele wskaźników wspomagających jej ocenę. Celem artykułu jest dokonanie oceny efektywności, z wykorzystaniem charakteryzujących ją wskaźników i próba odpowiedzi na pytanie czy zrównoważony rozwój oraz zrównoważony transport są możliwe do zaimplementowania w przedsiębiorstwie produkcyjno-handlowym. Efektywność jest tu rozumiana jako stosunek nakładów finansowych oraz zasobów organizacyjnych przedsiębiorstwa do efektów realizacji zadania transportowego. Pierwszy rozdział artykułu jest wprowadzeniem i omówione zostają w nim wybrane aspekty systemu transportowego stosowanego przez przedsiębiorstwo. W drugim rozdziale omówiono pokrótce literaturę dotyczącą zrównoważonego rozwoju i zrównoważonego transportu. W trzecim rozdziale zawarta została analiza funkcjonującego systemu transportowego. Została ona dokonana w oparciu o wskaźniki techniczne oraz ekonomiczne. W czwartym rozdziale przeanalizowano alternatywną trasę przewozu w ramach systemu transportowego, a w piątym dokonano porównania dwóch tras przewozu: stosowaną obecnie oraz alternatywną. Dodatkowo, w podsumowaniu autorzy pracy proponują rozważenie pewnych aspektów dotyczących zrównoważonego rozwoju.

Słowa kluczowe*:* zrównoważony rozwój, zrównoważony transport, system transportowy.