Baimukhanbetova E.E.[1], Tazhieva K.K.[2]

[1]Candidate of economic sciences, senior lecturer, e-mail: ela.68@mail.ru
[2]candidate of economic sciences, associate professor, e-mail: samal_tj@mail.ru
al-Farabi Kazakh National University, Almaty, Kazakhstan

PROBLEMS OF «GREEN» LOGISTICS WITHIN THE CONCEPT OF SUSTAINABLE TRANSPORTATION DEVELOMPENT

The purpose of the study was to conduct a comparative cross-country analysis of indicators characterizing the problem of «green» logistics in the framework of sustainable development and to identify the main directions of its solutions for Kazakhstan on the basis of studying the experience of other countries. This problem was considered in relation to transport, as with the development of the economy and the growth of urban transport demand is growing, which entails huge gas emissions to the environment. The analysis revealed the interdependence of the various factors to the transport emissions to different countries of the world. Relation and intensity of factors was estimated by calculating the correlation and analysis of indicators. Based on the analysis and conclusions, the state approach to the implementation of the principles of sustainable development in different countries and Kazakhstan were discussed in this article.

Key words: green logistics, sustainable development of transportation, greenhouse gas emissions, public transport management.

Баймуханбетова Э.Е.[1], Тажиева С.К.[2]

[1]э.ғ.к., аға оқытушы, e-mail: ela.68@mail.ru
[2]э.ғ.к., доцент, e-mail: samal_tj@mail.ru
әл-Фараби атындағы Қазақ ұлттық университеті, Алматы қ., Қазақстан

Көлікті тұрақты дамыту тұжырымдамасы шеңберінде «Жасыл» логистикасының мәселелері

Осы зерттеудің мақсаты тұрақты даму аясында «жасыл» логистика мәселесін сипаттайтын көрсеткіштердің салыстырмалы еларалық талдауын жүргізу және басқа да елдердің тәжірибесін зерттеу негізінде Қазақстан үшін оның шешімдерінің негізгі бағыттарын анықтау болды. Бұл мәселе көлікке қатысты қарастырылды, себебі экономика дамып, қалалар өскен сайын көлік қажеттілігі артуда, ал ол қоршаған ортаға үлкен газ шығарындыларын алып келеді. Талдау барысында әлемнің түрлі елдері бойынша түрлі факторлар мен көліктен шығатын шығарындылары көрсеткіштері арасындағы өзара тәуелділігі анықталды. Факторлардың өзара байланысы мен қарқындылығы корреляция көрсеткіштерін есептеу және талдау арқылы анықталды. Жасалған талдаудың негізінде қорытындылар шығарылып, түрлі елдерде және Қазақстанда тұрақты даму қағидаларын жүзеге асырудың мемлекеттік тәсілдері қарастырылды.

Түйін сөздер: жасыл логистика, көлікті тұрақты дамыту, парниктік газдар шығарындылары, көлікті мемлекеттік басқару.

Баймуханбетова Э.Е.[1], Тажиева С.К.[2]

[1]к.э.н., старший преподаватель, e-mail: ela.68@mail.ru
[2]к.э.н., доцент, e-mail: samal_tj@mail.ru
Казахский национальный университет им. аль-Фараби, г. Алматы, Казахстан

Проблемы «зеленой» логистики в рамках концепции устойчивого развития транспорта

Цель исследования состояла в том, чтобы провести сравнительный межстрановой анализ показателей, характеризующих проблему «зеленой» логистики в рамках концепции устойчивого развития, и определить основные направления ее решения для Казахстана на основе изучения

опыта других стран. Данная проблема рассматривалась применительно к транспорту, так как по мере развития экономики и роста городов потребность в транспорте растет, что влечет огромные выбросы газов в окружающую среду. В ходе анализа выявлена взаимозависимость различных факторов с показателями выбросов от транспорта по разным странам мира. Связь и интенсивность факторов была установлена путем расчета и анализа показателей корреляции. На основе проведенного анализа сделаны выводы и рассмотрен государственный подход к реализации принципов устойчивого развития в разных странах и Казахстане.

Ключевые слова: зеленая логистика, устойчивое развитие транспорта, выбросы парниковых газов, государственное управление транспортом.

Introduction

In the whole world, many of the concepts and definitions of green economy are formulated within the framework of the United Nations Environment Programme, which defined it as «the economy, which leads to an increase in well-being and social equity while reducing environmental risks and ecological scarcities» (UNEP, 2011).

At this stage of development,achieving sustainable growth is a question of long-term perspective for Kazakhstan with its rich natural resources, opportunities for economic growth and a favorable geographical position. In addition, there are factors like the concentration of the country's efforts in the oil and coal energy, and the fact that the Republic of Kazakhstan produces the most intense peaks greenhouse gases among the CIS countries.

At the moment, the ecological situation in the Republic of Kazakhstan is unfavorable and requires fundamental changes. Kazakhstan is in second place in terms of total environmental pollution by organic substances among the countries of Central and Eastern Europe and Central Asia, on the 3rd place in terms of greenhouse gas emissions into the atmosphere among the CIS countries and 1st place on the same indicator among the countries of Central Asia. In light of this situation, the concept of «green economy» as relevant as ever. Transition to sustainable development that provides the harmonic coexistence of economic, environmental and social spheres requires systemic changes in public policy. The problem of energy and ecological balance, the transition to «green economy» and «green logistics» were actualized in Kazakhstan recent years.

Sustainable development with regard to transport means that the satisfaction of transport needs is not contrary to the priorities of environmental protection and health, does not lead to irreversible changes in the natural and the exhaustion of non-renewable resources. Particular attention in this aspect deserves study of the problems in «green» logistics, as it is designed to solve the problem of reducing emissions of road transport impact on air pollution. The development of «green» technologies in logistics is directly dependent on the condition of transport, so it is important to harmonize the requirements of international transport and transport infrastructure in Kazakhstan.

Literature Review

Along with all the advantages of modern types of transport, which enable fast and comfortable travel, the rapid development of transport systems is the cause of many problems. The most topical of them are: air, water, soil, noise and vibration effects, the accumulation of dust and debris, accidents and injuries, reduced physical activity. These phenomena can be dangerous currently for human health and life, and contributing to climate change have an impact on the living conditions of future generations. This is evident from the research of the consultant related to sustainable development and climate change, the World Bank NadaaTaiyab. She notes that, according to current research, transport systems belongs to 25% of carbon dioxide emissions (Taiyab N., 2008) that involves large financial costs, vulnerability due to rising fuel prices, environmental damage due to the use of non-renewable fossil fuels (95%).

According to experts, transportation accounts for about 8% of all carbon dioxide emissions on the planet, even in the warehouses 3% (Palanivelu P. et al., 2010).

In this regard, the introduction of «green» technologies in logistics activities would make a significant contribution to the preservation of the climate on the planet suitable for human life. As the authors of the textbook «Logistics: Basics – Exercises – Case Studies» claim to logistics traditionally include planning, implementation and control of movement and placement of people and / or goods within the economic system in order to achieve certain goals (Gleissner H. et al, 2013.).

«Green» logistics emerged as a scientific discipline in the mid-1980s and is the focus of logistics considering systems and approaches in

terms of minimizing damage to the environment with the use of advanced technology and equipment (Thiell M. et al., 2010). After the introduction of the EU Directive on packaging companies have increased the use of reusable containers and equipment for the production and logistics of waste processing activities implemented turnover of management of packaging (Fernier J. et al., 2011).

The main issue of logistics is a material management, information and financial flows with minimal cash cost corresponds to the problem of «green» logistics, with an emphasis on reducing the harmful effects of human activities on the environment, achieving a balance of economic and environmental efficiency. In particular, the objectives of the «green» logistics are a reduction of air pollution, water and soil pollution, noise reduction, energy consumption, minimizing traffic congestion and improving safety (Boile M., 2015).

Specialists of the Institute of Energy Research, and performance in the field of transport, environmental protection and sustainable development in North America say that the whole area of research «green» logistics can be divided between the three main, closely interacting sectors: economic, environmental and social, are so-called «triple bottom line» (Gudmundsson H., 2001).

Dr. Jean-Paul Rodrigue, Dr. Brian Slack and Dr. Claude Comtois exploring the essence of «green» logistics, explain that the word «green» has become code for a range of environmental problems and when put together the two words suggest an environmentally friendly and efficient transport and distribution system. In the book «The geography of transport systems» they offer the following definition of «green» logistics: «Green Logistics. Supply chain management practices and strategies that reduce the environmental and energy footprint of freight distribution. It focuses on material handling, waste management, packaging and transport » (Rodrigue J. et al., 2017).

The transport sector includes the movement of people and passenger loads, trucks, trains, ships, aircraft and other vehicles. The largest share of emissions of greenhouse gases from transport is a carbon dioxide (CO_2) from burning of petroleum-based products, such as gasoline, in internal combustion engines.

A European Strategy for low-emission mobility forEuropean Commission notes that transport represents almost a quarter of Europe's greenhouse gas emissions and is the main cause of air pollution in cities. Within this sector, road transport is by far the biggest emitter accounting for more than 70% of all GHG emissions from transport in 2014(European Commission, 2016).

As urban economic development and growth of transport demand is growing at an alarming rate, which leads to huge emissions into the environment. Intergovernmental Panel on Climate Change (IPCC, 2014) estimates that emissions from transport will be doubled by 2050. The largest share of emissions in the transport sector belongs to the private car. What is striking is that private vehicles account for less than one third of all trips in the cities, but they account for about 73% of all greenhouse gas emissions from urban transport.

During the time when a number of scientists believe in that the larger cities agglomeration phenomenon has a strong pronounced adverse impact on the environment, (Igwe, 2006), (Gwilliam, 2003), (Decker et al, 2002.); others believe that if it done right, this phenomenon has economic benefits due to economies of scale (Banister, 2008), (West and Bettencourt, 2010), (Dodman, 2009).

Thus, with intensive increase of large cities and the development of transport systems, the organization of sustainable transport systems is becoming a global problem.

Research Methodology

The official data of the International Organization of Motor Vehicle Manufacturers, the Organization for Economic Cooperation and Development, the World Bank, the International Panel on Climate Change and the Statistics Committee of the Republic of Kazakhstan were taken for the analysis. The study was conducted in two stages.

At the first stage, we conducted the analysis of the interdependence of the various factors to the emissions from transport based on the ranking of top 10 countries by security cars per person, in the second step, we did the same calculations based on the ranking of top 10 countries with the highest emissions from transport. Communication and intensity factors wereestimated by statistical regression analysis. It examines the relationship of economic factors, demographic development and motorization to the emissions from transport.

Results

An analysis of the relationship of economic, demographic development and automobilization factors with the emissions from transport.

Stage 1. Analysis based on the rating of top 10 countries by cars supply per person

The population of the industrial and post-industrial countries is only 20% of the world's population, but the proportion of cars, owing these countries is up to 80%. Supply with cars per person groups large countries that are not too different from each other (Table 1).

Table 1 – Indicators of economic, demographic development, automobilization and emissions from transport in the countries of the world with the highest population of transport supplyin 2014

Country	Vehic-les per capita	Per capita emissions by transport (kilogrammes CO 2 / capita)	CO2 emissions by transport million tons of CO 2	General park of auto-mobiles, k	GDP per capita	Population, k.
USA	797	5416	1 728.8	251 497.1	1 728.7	313 874
Iceland	745	2501	0.8	243,0	51.261.9	321
Luxembourg	739	11075	6.2	389.0	111.716.3	531.0
Australia	717.0	3913.0	92.5	16 436.0.0	61.219.2	22 724.0
New Zealand	712	1746	14.0	2 884.0	43.837.3	4 433
Malta	708	1268	0.5	297.0	24.876.2	419
Italy	705.0	1733.0	105.4	42 000.0	35.823.2	59 540
Finland	612	1977	10.8	3 567,0	49,496.7	5 414
Japan	597	1640	208.4	76 126,0	36,331.7	127 561
Spain	593	1763	81.9	27 481.0	30.278.3	46 761
http://www.nationmaster.com/country-info/stats/Transport/Road/Motor-vehicles-per-1000-people						

As shown in Table 1, where indicators of the top 10 countries are considered, the leader in supply with cars per 1000 population is the United States – 793, in the second place Iceland – 745.

To identify relativity among economic, demographic development, country's automobilization and indicators of emissions from transport there was hold correlation and regression analysis Results of analysis is shown in Table 2.

Data of table shows that emission volume is less dependent on country's demographic development. The relationship between the volume of emissions from transport per capita and population is weak, dependence of characters are statistically significant. There is a weak dependence between volume of emissions and economic development of country. Correlation factor between volume of emissions from transport per capita and GDP per capita is 0.950, indicating that there is a very high dependence of these factors and its statistical significance. Relationship between general volume of emissions and general park of automobiles is higher than relationship between emissions per capita and supply with cars of population.

Stage 2. Analysis based on the rating of top 10 most polluted countries.To obtain a more accurate picture on the second stage, we made up another group of countries, which selected 10 most polluted countries in the world (Table 3).

This table shows indicators of top 10 countries that are most polluted, in these countries there is observed the largest volumes of CO2 emissions per capita. The leader is Luxembourg. It is followed by countries such as Qatar and Libya. The top ten ends with Malaysia. Using the same indicators applied in the first stage, there was calculated correlation and regression analysis. Results of analysis is shown in Table 4.

Data of table 4 shows that emission volume is less dependent on country's demographic development. The relationship between the volume of emissions from transport per capita and population is weak, dependence of characters are statistically significant. As in the first bracketing, there is a weak dependence between volume of emissions and economic development of country. Relationship between general volume of emissions and general park of automobiles is also higher than relationship between emissions per capita and supply with cars of population.

Thus, the criteria by which countries are selected for correlation and regression analysis is

not important, as the results of the first and second stage of the analysis are similar. But carrying out a stepwise analysis made it possible to prove the accuracy of the gained data. Based on regression analysis of the results we can draw conclusions about what factors have influence on increasing of emissions from transport. This is automobilization level and economic development level of countries.

Table 2 – Results of correlation and regression analysis of economic, demographic development, country's automobilization and indicators of emissions from transport of top 10 countries on car supply

Relationship indicators	Assess factors			
	Emission volume from transport (kg\100k people) and population (100k)	General volume of emissions from tranport (milliontonnes) and general park of automobiles (100k ea)	Emission volume from transport (kg\100k people) and car supply per 100k people (ea\ person)	Emission volume from transport (kg\100k people) and GDP percapita (USD)
Correlation factor	0.108	0.980	0.477	0.950
Neighboring (strength) relationship by Chaddock scale	weak	very high	middle	very high
Critical value of Student's t-test	0.307	2.306	2.306	2.306
Determination factor	0.012	0.960	0.228	0.903

Table 3 – Indicators of economic, demographic development, automobilization and emissions from transport in the countries of the world with the highest emissions from transport per capita in 2014

Country	Per capita emissions by transport (kilo-grammes CO_2 / capita)	Motor vehicle per 1000 people	General park of automo-biles, k.	General volume of emissions from transport Million tons of CO_2	GDP percapita	Population, k.
Luxembourg	11075	739	416	6.2	111.716	536.761
Qatar	6518	532	960	14.2	93.965	2.267.916
Libya	3008	290	2260	18.8	15.878	6.253.452
Brunei	3239	510	206	1.4	36.607	423.205
Kuwait	3501	527	1810	13.1	43.103	3.479.371
United Arab Emirates	4062	313	1960	36.9	66.346	9.445.624
Oman	2938	215	920	5.5	19.002	3.926.492
Bahrain	2494.002	537.002	1040.002	3.4	28,272.002	1.344.111
Trinidad Tobago	2362.002	353.002	383.002	3.2	21.311.002	1.344.235
Malaysia	2 191	361	12228	65.5	24.500	30.187.89
http://www.oica.net/ http://statisticstimes.com/economy/world-gdp-capita-ranking.php http://statisticstimes.com/population/countries-by-population.php http://www.nationmaster.com/country-info/stats/Transport/Road/Motor-vehicles-per-1000-people						

Table 4 – The results of correlation and regression analysis of the relationship of economic factors, demographic development and automobilization with indicators of emissions from transport of top 10 most polluted countries

Relationship indicators	Assess factors			
	Emission volume from transport (kg\100k people) and population (100k)	General volume of emissions from tranport (mln.t) and general park of automobiles (100k ea)	Emission volume from transport (kg\100k people) and car supply per 100k people (ea\ person)	Emission volume from transport (kg\100k people) and GDP percapita (USD)
Correlation factor	-0.314	0.913	0.716	0.919
Neighboring (strength) relationship by Chaddock scale	middle	very high	high	very high
Critical value of Student's t-test	0.935	6.322	2.899	6.595
Determination factor	0.098	0.833	0.512	0.845

Evaluation of specific indicators of greenhouse gas emissions in the world and Kazakhstan

Other statistics and other ratings are turned out to be interesting more. Therefore, in this study we analyzed the specific indicators of emissions: in terms of per capita and per unit ofGDP.

If considered in terms of emissions per capita or per unit of GDP, the situation changes dramatically. In per capita terms, neither the US nor China and India are not leaders on harmful emissions. Leader of the list are the oil monarchies: Qatar, the United Arab Emirates and Kuwait.

Nevertheless the USA in the top ten: 23.5 tons of CO2 equivalent account for each American per year. This is almost two and a half times more than the European average indicators. In EC 10 tons of harmful emissions account for per capita per year.

EC countries are variegated. For example, German ranks 25 in this list: 12 tons of CO2 equivalent accounts for per capita. Great Britain is in the 36th place- 10.6 tons per capita. In this case France takes better place: 47th place with 9 tons of harmful emissions per capita. Its secret is simple: 80% of the electricity in France is produced by nuclear power plants, which do not emit «greenhouse» gases.

Fast growing countries, who are accused of a sharp rise in emissions, are far from leaders. For instance, China takes 72th place on emissions volume per capita. 5.5 tons of CO2 equivalent accounts for each Chinese dweller per year. It is two times less than for European and 4 times less for than USA dweller.

This rating reflects the level of industrial development and the living standards of the countries and the degree of access of the population to energy. Is clear that the in the United States, Canada or Europe, the population consumes more energy. Consequently, more power is more harmful emissions. Emissions In the poorest and undeveloped countries cannot be much. According to UN data, in 50 of these countries as much as 80% of the population have no access to electricity at all.

Fast economic growth of Kazakhstan over the past 10 years led it to the high energy of the economy. Despite the efforts of energy saving and energy efficiency measures, CO2 emissions arecontinuously increasing. Basic volume emissions in Kazakhstan's economy accounts for electricity, oil and gas, mining, and transportation systems. These current emissions exceed the limit values for Europe, and the dynamics of CO2 emissions per capita in comparison with the world's values are above these indicators in Kazakhstan on the world average emission limit is almost 2 times (A. Kasimova, 2016).

If we consider the second specific indicator – an indicator of CO2 emission rate per unit of GDP, according to the latest data, in the world in 2013 year its value equaled 0.415 kSO2, showing a decline of 1.19% relative to previous year.

As we can see from the analysis, Kazakhstan is ranked first in the world in terms of carbon dioxide emission intensity per unit of GDP at year end2013. The CO2 emissions rate per unit of GDP in Kazakhstan decreased by -2.74% to 1.17 kSO2, in comparison with the previous year. And from 2008 to 2013 year, the decrease was 15,14% (Kursiv Research, 2015).

It is followed by Uzbekistan; here at the end of 2013 the carbon dioxide emissions rate per unit of

GDP was 1.085 kSO2, which is less than for 9.05% compared with 2012. In the six years the emissions decreased by 35.72%.

The top three on harmful emissions finished with Ukraine, at the end of 2013 the CO2 emissions rate per unit of GDP was 0.905 kSO2, which is 4.54% less than in comparison with the previous year. The decrease from 2008 to 2013 was only 4.84%.

Fourth place is occupied by Saudi Arabia; here the carbon dioxide emissions rate per unit of GDP was 0.82 kSO2, which is 3.75% higher with respect to 2013. In the six years harmful emissions increased by 13.92%.

In fifth place is Russia, the CO2 emissions rate per unit of GDP in 2013 decreased by 2.77% to 0.737 kSO2 in comparison with 2012. In the six years Russia has managed to reduce the carbon dioxide emissions rate per unit of GDP by 3.41%.

Canada rounds out the top 20, here the CO2 emissions rate per unit of GDP was 0.406 kSO2, which is less for 1.22% compared with 2012. In the six years the emissions decreased by 0.05%. The least of all carbon dioxide emissions per unit of GDP are in countries such as Sweden, Norway, Colombia, France, Spain (IEA / OECD, 2016).

Conclusion

Greenhouse gas emissions in transport sector are growing faster than in other end-use sectors, so transport is a crucial part of emission reduction strategies

The policy owns a main role in decreasing emissions from the transport. A well-planned policies (fuel standards, taxes, emissions trading, urban planning, information) play a crucial role in the implementation of efficient technologies in transport, the use of fuel with low carbon content, replacement of transport types, decrease in demand and etc.

Policy measures such as the establishment of CO2 emission standards, fuel standards, standards for tires, etc. can stimulate fuel savings. Competent information policy aimed at improving consumer awareness, can improve their attitude towards fuel-efficient solutions. Some countries have already started to introduce instruments aimed at stimulating a more efficient behavior of car drivers (Delgado O., 2016).

Analysis of the environmental problems of the development of automobilization has shown that the theoretical and practical basis for the decision to decrease the adverse impacts of road transport is the creation of technological, environmentally friendly transport cycle. The present stage of the interaction of man and nature is characterized by two features – the global scale of environmental change and the need for effective measures to restore the natural environment.

We believe that the transition to sustainable development in the public transport management provides the following key areas:

Tightening of technical standards, the introduction of more secure and environmentally friendly vehicles and fuels. An example is the system of «Euro» standards developed by ECE POM for control ecological parameters of cars. The requirements of this system is constantly being tightened: from Euro-1 level (1992) to Euro-6.

All-round promotion of reswitching from environmentally problematic automobile mode of transport to other modes of transport. This trend manifests itself, in particular the full support at the national and international level of the development of intermodal transport;

Application of the system of transport taxes and charges on principle of «the polluter pays». For example, under the application of this principle, the motor carrier must fully compensate the damage caused to the environment. This damage is now compensated, mainly from the budgets of different levels. From the point of view of sustainable development, the concept of budgetary compensation creates unjustified market advantages for motor vehicles.

State approach to the implementation of principles of sustainable development based on a combination of mandatory requirements and constraints and incentives that give market participants a choice, and certain advantages in choosing «green» solutions. Thus, the transition to the production and operation of vehicles of higher environmental classes can be carried out in two ways: through a phased bringing into use relevant standards, and based on expansionary action. As such measures could be preferential taxation or providing other preferences for operators, who operate the ecofriendly vehicle.

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