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The Impact of Port Transport-logistics Infrastructure and LPI for Economic Growth: on the Example of Landlocked Countries

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ABSTRACT

For this study, carried out as an empirical study, 37 landlocked countries have been selected. And a broader economic impact on the national economy, on the quality of the port infrastructure and logistics efficiency has been considered as well as investments on creating a high quality port infrastructure and its contribution to the economy, often questioned by politicians, investors and general public. The Structural Equation Model (SEM) has been used for providing empirical data about a significant economic impact on the port infrastructure quality and logistics efficiency. However, some countries that do not have access to the sea are not, according to international agreements, inferior to other countries in terms of economic growth.

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1 Introduction

Nowadays, economy is not stable and the majority of countries, especially the landlocked ones, have suffered because of inflation. For Afghanistan, Central African Republic, Burundi, Kazakhstan and other countries that do not have an access to the sea, the imported oil, food and other goods are delivered at a high price and take longer time. Hence, it is hard to export domestic products. Trade is less and economic growth rates lower than in the neighboring countries that have an access to the sea. Lack of an access to the sea is one of the main reasons why 16 out of the 37 countries, surrounded on all sides by land, are among the poorest countries in the world.Road conditions are not the main reason for low efficiency and expensiveness of transportation. This means that effective infrastructure is not able to solve all issues. Many researchers claimed that effective infrastructure could solve all *problems related to the lack of an access to the sea*. However, as presented in the last studies, the key problem is the delivery of cargo to these ports. Among other issues, it is important to note delays of cargo at the border, the prevalence of cartels in the field of road transport many different customs control procedures and bribery. All these problems support transportation costs on an artificially high level.

Investigation of the economic impact has a vital value for the creation of an economic value for the large infrastructure objects. The trade-off between direct transportation costs and reliability varies depending on trade in goods and logistics in the country, which may limit the potential of developing countries to diversify from time-independent goods to value-added goods [7]. Despite of the relevance, impact of the port infrastructure quality and effectiveness of logistics to trade and economy of a country has been largely ignored in the existing literature of ports economics. Landlocked countries i.e. countries that do not have a direct access to the sea and which, accordingly, cannot participate in maritime trade, have significant and specific problems [1].

In comparison with other countries, they meet numerous difficulties in trade operations from the beginning. This kind of position almost always gets worse, if difficulties of getting access to the sea are supported with other factors as remoteness from major markets, tropical climate, great distance from the coast, underdeveloped

infrastructure or lack of appropriate political, legal or institutional conditions.

In the world of today, rivalry of a landlocked country is very weak. Development history of cities has also shown that economic growth is especially noticeable in cities with seaports (Chan et al., 2014). However, the lack of seaports has created certain problems that have not been resolved. These types of problems that landlocked countries meet have practical solutions, as well as integrated approaches to the creation of transit corridors, general activities for the development of regional integration, regulatory reforms, special international protection mechanisms, as well as an in-depth analysis of the foreign trade structure of each landlocked country and its adequacy in terms of transport difficulties [15].

The real problem is the delivery of goods without serious delays and increase in the cost because of legal, administrative, customs or technical barriers. These are the main issues for all countries, but more acutely felt by landlocked countries, and, in particular, developing or remote countries that do not have an access to the sea. A coordination of the infrastructure functioning through borders is difficult. Therefore, high transport costs, due to infrastructure deficiencies, delays, charges or procedures in the transit country, make the country, as a part of the transport of goods to landlocked countries, very expensive and force them to store large amounts of stocks. Transportation costs for these countries still remain the greatest obstacle in access to the world market and a rivalry between other countries in fair terms.

Based on this, the closer a landlocked country is located to the coast, the more it can benefit from relatively low cost of the transport by sea. However, if a landlocked country has navigable inland waterways that connect it with the coast then isolation becomes an even simpler problem for the country. If additionally to this, the country has a necessary infrastructure, i.e. roads and railways, ports, then the actuality of the problem connected with geographical remoteness gets much lower. However, on the other hand, this requires cooperation with the transit country. Therefore, for instance, in order to increase import and export to Ruanda and Uganda, it was necessary to modernize the system of the railways in Kenya. Furthermore, a coordinated approach to the infrastructure development is needed. An example of an insufficiently coordinated infrastructure development for a long time was a pool of the Parana River in Paraguay.

In the majority of cases, expenses of landlocked countries, increase not only due to the lack of proper infrastructure, but because of problems connected with capacities starting from the lack of containerization and the poor development of cargo handling facilities and ending with non-developed railway rolling stocks or ships and barges. In the end, these landlocked countries can neglect the existing opportunities, as they and their transit partners often do not show enough flexibility to the reaction on a growth in demand for goods. Such capacity problems are frequently underestimated and it is often difficult to find facilities to acquire new locomotives to build new streets.

The majority of the above mentioned problems have caused a poor economic growth in landlocked African countries, which are located far from markets and sea trade routes and which are generally not accessible for oceangoing vessels. For the exports of landlocked countries, reconstruction plays the key role. According to the East African Cooperation organizations, an intergovernmental organization created by Kenya, Uganda and Tanzania, out of the three countries joint road network, 84% require immediate action, i.e. only 16% of the roads are updated or maintained in any other way from time to time. However, it is encouraging that in Africa there are three landlocked countries (Botswana, Lesotho and Swaziland), that have one of the sustainable growth rates.

Globalization of difficult processes of the industrial production amplified the meaning of seaports in a global supply chain. The provision of logistics services in an international context has become a major part of the business. In this situation, more important aspects of logistics efficiency are expenses on logistics and reliability of the supply chain. Poor logistical assistance greatly affects the country's competitive advantages [7]. The main economic growth strategies of developing countries are intensive export production or assembly. However, importing products take a significant part of them, being connected with certain transportation costs and leads to lower profits in landlocked countries. Thus, it is real to concern that these geographically isolated countries as Mongolia, Ruanda, Burundi, Kazakhstan or Bolivia, will face serious difficulties in trying to reproduce the model of rapid economic growth based on the development of intensive export industries. If we do not take into account these landlocked countries that are located close to their markets and have facilitated access to interconnected transport networks, as, for instance, in the case of Hungary located in Europe, the development of comparative advantages in modern high-tech industries is difficult [27].

The access of the landlocked countries to the market, and their abilities to trade i.e. efficiently and economically move exports and imports are key elements of maintaining consumption levels and promoting economic growth. Trading has also an important meaning from the point of economic reconstruction of landlocked countries, which are often looking for funds for compensating the consequences of deterioration in terms of trade, civil unrest or natural disasters. Expensive and unreliable transport hampers trade and, in addition to the above, is often complicated by the problem of transit.

Ng (2013) noted that, with the current concentration of researches in ports on daily port operations (that, on port productivity and competition, port management, port and supply chain management), port-region related researches have decreased significantly since 1990. To consider the importance of the port infrastructure quality and logistics efficiency, this study addresses the following research questions: Does the quality of port infrastructure affect the efficiency of logistics? Whether positive or negative on the country's economy? Does the influence differ

between developed and developing countries? To answer the questions, a structural equation model (SEM) has been developed to analyze how the port infrastructure and logistics efficiency in a country affect a country's economy [57].

2 Literature Review

Many studies justify investments in transport funds as an economic growth stimulant of countries and regions. The majority of researches on economic consequences concerning seaborne trade were concentrated on a specific seaport or region giving an exact picture of how seaborne trade benefits the world. The economy remains elusive. Two relatively recent studies, one in context of South Korea (Jung, 2011) and other in context of China (Deng et al., 2013), claim also that ports have a declining impact on the economy [27]. Advantages of investments in transport infrastructure are not limited by time economy on a road [9]. Tabak, Ç. andYildiz, K. (2018) assume that developed countries attach great importance to the logistic sector. Accordingly, to get an understanding about countries logistic infrastructure, World Bank started publishing the Index of logistics efficiency every two years since 2017 [68]. The last study was published in 2018. In addition to providing information related to the country's logistics sector, this index also provides investment information and country opportunities. For determining a country's ranking, the index takes into account six key criteria (customs, control and monitoring, logistic competition, time limits, infrastructure and logistic competition). The authors considered the ports as the logistics areas of Turkey by Spearman's rank correlation method to determine which of the six main criteria published by the World Bank is the most influential. These logistics areas were compared with the logistics system of the Netherlands, Belgium and Germany. The countries, selected for comparison, have the best logistic zones in Europe and are among the first countries in the Logistics Performance Index published in 2014. After comparing the existing Turkish ports with the above mentioned countries, the authors have revealed gaps in the field of the logistics sector of Turkey and have prepared suggestions [59].

Jhawar A.et.al., (2014) has examined the impact of the development of qualified labor through investments in training, social security, working conditions and salary to the logistics efficiency index. They have also discussed over the impact of qualified labor on logistics costs, logistics time, reliability, flexibility and security of the logistics system [35]. Mohamed El Kallaet et al. (2017) has concluded that a competition among container ports is increasingly challenging the recent concentration of shipping lines [52]. Additionally, Filina (2015) has considered the approaches to determining the quality and efficiency of transport taking into account the transformation of the criteria for determining their connection with changes in the economic climate [26]. The competitiveness of the industry has been shown in the example of the domestic and international transport services market. Munimetal. (2018) has examined 91 countries with seaports. This is an empirical study, carried out by using the structural equalization model [56]. Economic discrepancy between rich and poor countries, as well as between developing countries with middle- and low-income persists [64]. Pritchett has claimed that once again it became acceptable to look for the causes of poor economic indicators in "natural" factors. Gallup et al. (1998) has suggested that location and climate, affecting to transportation costs, disease burden and agricultural productivity, have a significant impact on development [28], [60].

Moore (2018) has estimated the cost of access to the sea for export using the structural gravity model [53]. The empirical challenge is to estimate the variable for a particular landlocked country in the presence of the fixed effects of the exporter and importer, Raballand (2003) [65]. First, the review of the economies of the countries of Central Asia has revealed that the lack of an access to the sea implies a high burden to transportation costs. In the second stage, the impact of landlocked trade has been measured using four indicators. The first assessment has been obtained by introducing a dummy variable. The second assessment has used the shortest distance between the landlocked country and the nearest large port facility. The third measure represents the number of borders with riparian countries, and the fourth the number of crossed national borders.

MartínezZarzosoI (2009) has assessed the relative importance of various sources of trade costs, namely: freight rates, poor infrastructure and location in relation to Latin American imports from the European Union (EU) [48].

Gor S. (2010) has addressed the issues of economic growth and argues that the main problem for the development of the new millennium is the failure of the growth process in the poorest countries of the world. These countries lag behind and often fall apart. He has identified 58 countries in this group, including most African countries to the south from Sahara, as well as Bolivia, Cambodia, Haiti, Laos, Myanmar and Yemen and most landlocked Central Asia ones [30].

Bottasso et al. (2014) has claimed that increasing port throughput by every 10% could lead to an increase in the regions' GDP by 6% to 20% and influence the neighboring regions in the range of 5% to 18%. In the context of China, Shan et al. (2014) has found that an increase in cargo turnover in the port by 1% could increase the growth of per capita GDP by 7.6%, and the capacity of the port in the country has a positive effect on the economies of the neighboring countries [13].

ArnoldJ. (2009) has focused on the impact of the quality of the transport infrastructure and logistics services on the level of trade between East and South Asia being less significant than before. This is due to the fact that, over the past three decades, there have been significant improvements in both the infrastructure and the services [6]. Sea transport remains the dominant type of freight traffic between these two regions, and it is expected that this situa-

tion will continue in the near future. Land transport, both road and rail, will play an increasingly important role in bilateral trade in Asia. It may also facilitate trade between non-contiguous countries within South and East Asia, but it will require significant improvements in the border crossing procedures [55]. Air transport is becoming increasingly important as the value of goods sold between the two regions grows. However, the growth in air transport is behind the growth in shipping and is expected to continue to grow.

Das R.U., (2017) has claimed that the role of infrastructure in the economic growth is twofold. First, the infrastructure facilitates the development of other sectors, contributing to the production process of other sectors. Secondly, having a good infrastructure reduces operational and other costs, thereby increasing the overall performance of the factors and allowing for a more efficient use of the existing resources. The existing infrastructure networks in South Asia have also been considered. He has explained the flaws in these existing networks and has suggested policy measures to improve the state of the infrastructure in South Asia and to overcome the deficit, emphasizing the essence of the problem - financing infrastructure. In the light of building the infrastructure, collective initiatives are being discussed — public, private, and governmental-private partnerships of South Asian countries. Some examples of a successful infrastructure development that need to be addressed have also been discusses [20].

Bonfatti, R.A., et al., (2017) has substantiated the importance of the transport infrastructure in bilateral trade flows. It has been estimated that the increase in the standard deviation of the minimum number, as compared to the average, shifts the structure of the country's trade flows in favor of foreign trade, since these mining countries import is 56% less than in the neighboring countries (relative to foreign countries). However, this effect is reversed for landlocked mining countries that import relatively more from their neighbors, as well as the implications of their results for development, welfare and links them to the recent increase in Chinese infrastructure investments in Africa [12].

Kashiha, M.Abandets (2017) have explored how geography and transportation costs affect shippers' decisions, which port of export to use. Using a large sample of disaggregated items from several European countries, they have shown that European logistic networks show a low level of international integration, which affects the choice of a delivery route. In addition, they have found significant differences in the shipping behavior in landlocked countries and in coastal countries: shippers in landlocked countries avoid lengthy land transport, easily cross borders and add great value to the transport infrastructure. These findings are relevant in the design of port competitiveness strategies and economic development policies in landlocked countries [36].

Moura et.al., (2018) has analyzed the role of the transport infrastructure in the economic development and competitiveness of regions. However, little attention has been paid in the literature to the impact of changing international trade patterns on the use of infrastructure. The hypothesis of this study is that the evolution of the geographical structure of the countries foreign trade affects the internal distribution of maritime transport and, consequently, the use of the infrastructure [54].

Kolar, P and Rodrigue, J.-P (2018) have said that the strategy of containerization and regionalization of ports has now affected the level of competition between ports in disputed inland areas. The nature of this indicator of competition usually includes a single maritime range and well-defined transport corridors. The European has context emphasized the complex dynamics of competition in two ranges, especially with the Northern Ridge and the Mediterranean. Much less attention has been paid to how this dynamic unfolds in Central and Eastern Europe, but this will affect the growth prospects of the ports in both ranges. This study has assessed the importance of port selection factors for freight forwarders in the landlocked Czech Republic. It has been based on a survey of key participants, in particular on how specific carriers and ports are selected and which transport chains are used. The importance and stability of factors have been analyzed within the four levels of restrictions - the level of location, infrastructure level, transport level and logistics level. Also discussed have been the key factors supporting the dominance of the port of Hamburg with the Czech Republic, as well as the potential of the Northern Adriatic port serving this disputed inner territory [38].

Akhavan, M. (2017) has explored the evolutionary process of major port cities in the eastern world turning from cargo transportation hubs into global logistics centers. Through a comparative case study and descriptive statistics, Dubai's competitiveness as a logistics center has been compared with Singapore in terms of: location, port container and air freight respectively for the periods from 1975 to 2015 and from 2001 to 2015, main socio-economic indicators (population, GDP, GDP per capita and the share of main sectors of the economy for the period from 1990 to 2015), infrastructure and vehicles, ease of doing business, and, more importantly, the Logistics Performance Index (LPI) for the period from 2007 to 2016 [2].

Anam, P. (2017) has considered the infrastructure sector as a key factor for the Indian economy. The sector has a great responsibility to stimulate the overall development of the country on the example of India [4].

3 Hypothesis Development

The approaches to assessing the economic impact of the quality of the port infrastructure have been used based on the neoclassical economic perspective of the transport infrastructure proposed by Lakshmanan (2011). We have assumed that infrastructure investments are exogenous, which is the best quality port infrastructure (QPI). Modern technologies and equipment will help to improve the logistics of the country, that is, greater reliability, less dam-

age, the ability to track and track shipments, timeliness of delivery. Improving QPI and LP will increase the country's global availability, including opportunities to expand markets around the world [41].

The reliability hypothesis about the positive relationship between transport infrastructure and development in the context of less developed countries has been studied. The region of West and Central Africa, comprising 24 contiguous countries, has been an empirical reference. Two main forms of generalized linear model have been used, including the zero order and multiple regressions, including natural logarithms and assuming the classical Cobb-Douglas production function [31]. Development, the dependent variable, functions in terms of the human development index (HDI) and the growth of national income per capita (GNI/capitalization). Independent variables include various basic types of transport infrastructure (road, rail, airports, seaports, waterways, and pipelines). The results have shown a strong positive relationship between transport infrastructure and development. This revelation does not only correspond to the results of the previous studies in more developed countries but also suggests that the relationship between transport infrastructure and development may in fact be stronger in less developed countries than in the more developed ones. Liu et al., (2018) has explored that logistics efficiency plays an important role in green supply chain management, which leads to environmental sustainability. An analysis has been made of the relationship between logistics efficiency and environmental degradation using data from 42 Asian countries between 2007 and 2016. Estimates have shown that logistics efficiency is largely related to environmental degradation [45]. The International Shipping Index (LPI) significantly reduces CO_2 emissions. Antoni et.al., (2015) has considered that the timelines of logistics significantly increases CO_2 emissions in the Asian countries. Other subcategories in LPI, such as tracking and tracing, the quality and competence of services, the quality of infrastructure and the efficiency of customs, have also a significant impact on the environment in various sub regions of Asia. Industrialization and urbanization increases CO_2 emissions in the Asian countries, and trade openness reduces CO_2 emissions. The results have pointed to a significant link between logistics efficiency and the environment, which emphasizes the priorities of environmental sustainability and green supply chain management in the Asian countries [3].

Competition between countries is long lasting. Gaining competitive advantages presents an access to resources and new markets. Governments around the world are making intensive investments in various development projects. Such projects include the development of new ports or the expansion of the existing ones. "Logistics efficiency refers to the cost, time and complexity of import and export operations" (Hausman et al., 2013) [69]. Modern technology contributes to improved logistics through reengineering transport routes [33]. Along with technology and quality of service, Song and Panayides (2008) have emphasized the importance of value-added port functions through a variety of logistics services to achieve a competitive advantage [67]. The quality of infrastructure is an important determinant of transportation costs (i.e., a component of logistic indicators), especially for landlocked countries [43]. In addition, innovations in containers and intermodal transport have been part of the major changes in global logistics over the past 20 years [49]. Thus, it can be assumed that:

H1 (a): The quality of port infrastructure has a positive effect on the efficiency of logistics.

H1 (b): The quality of port infrastructure has a positive effect on the global competitiveness index

H1 (c): The quality of port infrastructure has a positive effect on the national economy.

Lakshmanan (2011) has suggested that vehicle investments improve logistic capabilities and reduce transportation costs. Infrastructure quality and transportation costs are important for export-driven growth (Limao and Venables, 2001), [41], [44]. It can be concluded that efficient ports have better infrastructure and logistics effi-

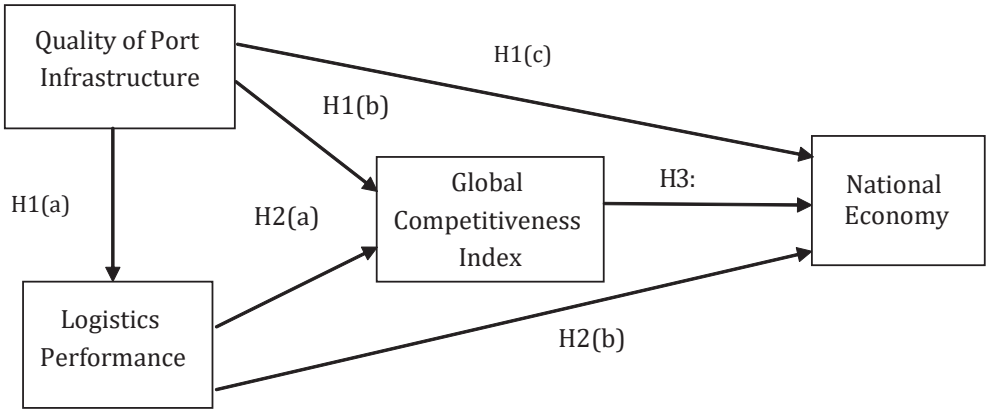

Figure 1 Model of the quality of port infrastructure on the quality of logistics and on the national economy
Source: Authors

ciency than inefficient ones. At the same time, an efficient port system with enhanced logistics capabilities is a key factor determining foreign direct investment in the country [61]. Conversely, inefficient ports reduce national and international trade and adversely affect economic growth (Clark et al., 2004) [17]. These findings have helped to put forward the following hypotheses:

H2 (a): Logistics efficiency positively affects the Global Competitiveness Index

H2 (b): Logistics efficiency has a positive effect on the national economy.

H3: Global Competitiveness Index has a positive effect on the national economy.

Logistics development has a positive effect on economic growth in the region [16], [47]. Coto-Millan et al. (2013) have claimed that increasing the logistics efficiency index by 1% could increase the growth of the global economy by 1.1–3.4%. Therefore, we have proposed the following hypotheses:

Ports are the center and hub of networks for all types of water transport and connect countries with the rest of the world; thus, they facilitate transportation and distribution in the cheapest way. Ports are not just an infrastructure that facilitates international trade; they determine freight costs and help firms enter global markets [17]. The contribution of maritime transport is currently not significant for ordinary people. Helling (1997) has said that the cost of water transport in dollars is distributed among 10 different but interrelated business categories [32]. Sleeper (2012) has asserted that GDP is positively proportional to the number of globally recognized ports in the country [66]. In the analysis, 120 port regions out of 13 European countries have been studied. Bottassoet. al. (2014) has claimed that ports increase the GDP of the regions in which they are located, and have also a positive effect on the GDP of the neighboring regions 14].

4 Data and Methodology

Data on all observed variables of this empirical analysis have been collected annually for each country from the World Bank database (data.worldbank.org) [70]. A total of 37 countries have been reviewed for the analysis (see Table 1).

Most of the previous impact studies, discussed in section 2, have used a specific set of observable variables at empirical levels. However, when it comes to multifaceted,

Table 1 List of countries

Afghanistan	Chad	Burkina Faso
Kazakhstan	Central African Republic	Uganda
Kyrgyzstan	Burundi	South Sudan
Tajikistan	Zimbabwe	Rwanda
Turkmenistan	Zambia	Nigeria
Uzbekistan	Malawi	Mali
Hungary	Armenia	Ethiopia
Austria	Azerbaijan	Mongolia
Switzerland	Bolivia	Moldova
Slovakia	Paraguay	Luxembourg
Serbia	Lesotho	Belarus
Macedonia	Bhutan	
Czech Republic	Nepal	

*compiled by the authors

Table 2 List of observed and variables

Abbreviation	Abbreviated designation of observed indicators of latent construction	Observed indicators
QPI	Quality of port infrastructure (QPI)	Quality of port infrastructure
LPIAT	Logistics performance (LP)	Ability to track and trace consignments
LPICQ		Competence and quality of logistics services
LPIEA		Ease of arranging competitively priced shipment
LPIEC		Efficiency of customs clearance process
LPIFS		Frequency with which shipments reach the consignee within scheduled or expected time
LPIQT		Quality of trade and transport-related infrastructure
GCI	Global Competitiveness Index (GCI)	Global Competitiveness Index
PGDP	National economy (NE)	GDP per capita, PPP (Int.$)

Source: Authors

barely measurable problems, such as logistics efficiency, the essence of developing hidden structures using several observable indicators becomes relevant [23]. Therefore, we have developed a set of hidden variables consisting of several observable indicators. This motivated the choice of structural equation modeling (SEM) as a suitable method of analysis. According to Kline (2005), the sample size for the complex SEM should be greater than 100. Hence, the data were combined over three years (namely, 2010, 2012 and 2014), receiving 137 observations, except for observations with missing values. Table 2 lists all hidden constructions with observable indicators along with their codes [37].

The quality infrastructure of the port infrastructure (QPI) is formed using one observable variable, called QPI, which covers the perception of the heads of enterprises of the port facilities of their country. Data are presented on a Likert scale from 1 to 7, where 1 represents the port infrastructure, which is considered to be extremely underdeveloped, and 7 – effective in accordance with international standards (for details, see on http://data.worldbank.org/indicator/IQ.WEF .PORT.XQ.).

The design of logistics efficiency consists of six indicators listed in Table 1. Lune et al. (2016) have used the same LP dataset as the proxy for trade facilitation. The set of LP indicators is based on empirical survey data collected by the World Bank on a regular basis. The LP index measures the efficiency of logistics at the country level, asking local operators (global forwarders and courier carriers) to provide feedback on the "friendliness" of the logistics of the countries in which they operate (see http://lpi.worldbank.org/ for more details).

The Competitiveness Index assesses the ability of countries to provide a high level of welfare, using the resources that they have. In a free market, as a rule, a constant increase in labor productivity and the quality of goods / services is necessary.

The global competitiveness index is composed of 114 variables that describe in detail the competitiveness of countries of the world at different levels of economic development. A two-thirds set of variables consists of a global survey of company executives (to cover a wide range of factors affecting the business climate in the countries studied), and one-third from publicly available sources (statistical data and research results carried out on a regular basis by international organizations).

The economic literature typically uses total GDP or per capita GDP to measure the economy at the country level. Since the data used for the empirical analysis include large numbers, they are log-transformed, and their descriptive statistics are presented in Table 3.

Table 3 Descriptive variable statistics

Variables	N	Value	S.D	min	Max	Addiction	Kurtosis	Shapiro-Wilk test
QPI	107	2.68	0.13	1.0	4.9	2.02	-0.90	0.98
LPIAT	107	2.56	0.05	1.6	4.3	0.33	0.76	0.97
LPICQ	107	2.62	0.05	1.8	4.1	0.27	1.20	0.95
LPIEA	107	3.06	0.05	2.0	4.7	0.34	0.36	0.99
LPIEC	107	2.49	0.05	1.6	3.9	0.58	0.24	0.96
LPIFS	107	2.67	0.04	1.0	4.0	0.50	0.32	0.95
LPIQT	107	2.51	0.05	1.8	4.2	0.33	1.70	0.96
GCI	107	3.60	0.12	1.0	7.3	1.53	2.13	0.95
PGDP	107	2.15	0.30	1.0	15.6	1.60	2.04	0.96

Source: Authors

Table 4 Summary of measurement model results

Abbreviated notation indicator	Observed indicators	Non-standard load factors	Standardized load factors	Standard error	Z-value	R 2 (confidence point)
QPI		0.23	1.00	0.01	24.62	1.00
LPI		0.17	0.93***	0.01	24.75	0.86
	LPIAT	0.18	0.97***	0.01	29.75	0.94
	LPICQ	0.12	0.85***	0.01	19.40	0.73
	LPIEA	0.20	0.95***	0.01	27.93	0.90
	LPIEC	0.13	0.87***	0.01	22.55	0.76
	LPIFS	0.22	0.97***	0.01	29.42	0.95
	LPIQT	1.46	0.98***	0.07	20.28	0.95
GCI		1.46	0.98***	0.07	20.28	0.95
PGDP		0.49	1.00***	0.04	23.16	1.00

Source: Authors

Model fit: χ^2 (31) = 81.93, CFI = 0.98, TLI = 0.97, RMSEA = 0.09, SRMR = 0.02; * p <0.05, ** p <0.01, *** p <0.001

This section presents an empirical analysis and results for research questions. First, the normality of the variables has been tested using the Shapiro-Wilk test and the QQ graphs of the residuals of the variables. After verification and validation, the resulting SEM has been presented.

Standardized load factors, quadratic multiple correlations (SMC) and model compliance indexes are considered key statistical criteria for an acceptable measurement model [40]. Table 4 shows the statistical criteria for the measurement model. R 2 represents the square of multiple correlations, and all values are above the recommended level of 0.50 [10], [11]. In addition, all standardized load factors exceed the recommended level of 0.70 and are statistically significant. In addition, a good fit to the measurement model is indicated, since the Tucker-Lewis index (TLI) and comparative matching index (CFI) are significantly higher than the recommended level of 0.90.

Reliability is determined by the value of Alpha Cronbach [19]. The values of Cronbach's Alpha (Cronbach, 1951) for the LP and ST structures are 0.97 and 0.86, respectively. Both values exceed the required level of 0.70, as suggested by Nunnally (1978) [29]. This also confirms the internal consistency of the hidden structures (Garver and Mentzer, 1999) [29]. To test for convergent reliability, we have studied the statistical significance of factor loads through their z-values (also listed as t-values, Dunn et al., 1994). As a rule, acceptable estimates should have z values greater than 2 or less than – 2 [31]. Since all p 2 values are above 0.50, the reliability of the product is also confirmed. To assess the discriminant reliability, a series of paired confirmatory factor analyzes (CFA) has been performed. In this process, unrestricted CFA of one pair of structures has been compared with limited CFA at a time to avoid the influence of pairs of structures with significant values on irrelevant ones [5]. All the results of the chi-square difference test have been statistically significant ($p < 0.001$), which indicates the reliability of the discriminant of the structures.

4 Structural Equation Model

As the measurement model and reliability tests have confirmed validity and reliability, the structural equation model continues. Parameter estimates, model conformity indices and the results of hypotheses proposed earlier are presented and discussed. SEM, including estimated standardized load factors and regression coefficients, is presented in Fig. 2 along with their respective paths. All 10 load factors are above the recommended level of 0.70 and are statistically significant. The structural model is well suited for a chi-square (χ^2) of 73.78, and the ratio of χ^2 and degree of freedom (i.e. 73.78 / 30 = 2.46 < 3) is within the required level recommended by Bollen and Long [11]. (1993). The adjusted compliance confidence index (AGFI) is 0.99, which means that the estimated model predicted 99% of the variance and covariance in the observed data. Moreover, other indicators of the compliance index, such as CFI (0.98) and TLI (0.97), significantly exceed the minimum requirements. Finally, the root-mean-square approximation error (RMSEA = 0.08), as well as the standardized root-mean-square residue (SRMR = 0.02) confirmed good SEM compliance. After confirming the suitability of the proposed SEM, we have evaluated the hypothetical relationship between the hidden constructs. Estimates of the proposed relationship and their significance are presented in Table 5. Before establishing the transmission relationship between the variables (that is, in H1 d, H1 e, H1f and H2 c), the direct relationship between the independent and dependent variables has been confirmed, as well as its relationship with the transmission variable.

Based on the statistical significance of the regression coefficients shown in Table 5, this study founds support for H1 (a), H1 (b), H2 (a), H2 (b). Other hypotheses are not supported. Thus, the quality of port infrastructure has a positive effect on the efficiency of logistics and the economy of the country. Logistics indicators have a positive effect on the national economy. The impact of the quality of port infrastructure and logistics efficiency on the national economy has been recognized as significant. At the same time, the intermediary effect of the quality of port infrastructure on the national economy through logistic indicators has been recognized as significant. There are no links between the index of global competitiveness not from the national economy and the quality of the port infrastructure.

Table 5 Results of structural equation modeling

Hypotheses	Regression paths	Regression paths	SE	CR	Remarks
H1(a)	QPI→LPI	0.66***	0.04	12.93	Supported
H1(b)	QPI→NE	0.17**	0.25	2.80	Supported
H1(c)	QPI→GIC	-0.04	0.10	-1.83	Not supported
H2(a)	LP→GIC	0.66***	0.65	8.99	Supported
H2(b)	LP→NE	0.67***	0.38	10.53	Supported
H3	GIC→NE	-0.06	0.21	-1.81	Not supported

Source: Authors

*Std. Evaluation of standardized estimates, standard error SE, critical CR * p <0.05, ** p <0.01, *** p <0.001*

5 Discussion

The geographical location of 25 countries with transition economies varies significantly; however, 13 (Azerbaijan, Armenia, Belarus, Hungary, Kazakhstan, Kyrgyzstan, Moldova, Slovakia, Tajikistan, Turkmenistan, Uzbekistan, the Czech Republic and the former Yugoslav Republic of Macedonia) out of 25 countries with transit economy do not have an access to the sea. While 15 countries with transit economy are located in the distance more than 1,000 km from the major markets of Western Europe, Hungary, Slovakia and the Czech Republic are located in the center of Europe and, accordingly, are conveniently located for trade in goods and services. Komoračeć (2016) has made a research into the connection between quality of port infrastructure, logistics indicators and their impact on national economy [22]. Quality improvement of port infrastructure and logistics efficiency could bring the greatest benefit to the countries economy. A large number of studies have showed that quality of port infrastructure has a significant positive effect on national economy, as has been assumed by Ferrari et al. (2010), Bottasso et al. (2014), Park and Seo (2016) and others who have observed the positive impact of seaports on the economy [52]. However, quality of the port infrastructure significantly affects the logistics of the country. Hausman et al.(2013), Nevertheless, Helling and Poister (2000) have mentioned that ports, which retain direct employment associated with ports, lose their ability to compete for cargo, which in the long run leads to a reduction in the number of jobs [14],[25]. Economic development in many cases has been related to long-term capability of port to attract more clients while creating and maintaining jobs and incomes [5]. Hence, if quality of the port infrastructure is not improving continuously, it can have a significant negative impact on a country's economy [32].

Landlocked countries and donor countries have joined forces in an effort to reduce barriers to trade, economic growth and development faced by the least developed landlocked countries. Goods intended for delivery to Uganda, Rwanda and Burundi are located in the Tanzanian port of Dar Es Salaam for five days longer (25 instead of 20 days) than goods to be delivered to destinations in Tanzania. The same thing happens with goods delivered to the port of Mombasa in Kenya. Low efficiency of procedures in the Cameroonian port of Douala is the cause of delays and high costs for the transport of goods to the capital city of Chad N'Djamena. In Africa and Central Asia, goods intended for delivery to landlocked countries go through at least three "customs clearance" procedures, while goods delivered to destinations in a coastal country are subject to only one such a procedure [24]. The first delay occurs in the port and the second one at the border. The border crossing between Kenya and Uganda usually takes more than 24 hours. In the southern part of the African continent, delays at the border reached six days in 2003. In Central Asia, trucks stand on the border with Uzbekistan for 3 days. This delay is associated with the issuance of a final permit for the transport of goods in the capital of a landlocked country. *Transit goods have to go through three or four customs clearance procedures.* Delays increase the cost of shipping goods and make the situation less predictable. Trade Efficiency Index (LPI), on the basis of information, received from carriers from different countries of the world, for trade stability and predictability of supplies is not less important than how quickly goods are delivered to their destination. Simplification and rationalization of import-export procedures can reduce the cost of transporting goods, and hence consumer prices, contributing to the development of trade, economic growth of countries and the inflow of investments. Landlocked countries have indicated that uncertainty forces companies to use more reliable, but more expensive types of transport, such as air transport, or to create significant stocks of goods [63].

Jonker and Robinson(2018) have said that, while economic growth and diversification can be considered as "fuel" for development, infrastructure is the "engine" that provides growth [34]. China's contribution to Africa in this regard is phenomenal, and this paper aims to describe a wide range of infrastructure projects that have reduced bottlenecks in infrastructure development. One of the ways of financing it was the adoption of framework agreements in the "Angolan regime", in fact, an exchange agreement for the provision of infrastructure to China. The Chinese initiative "One Belt - One Road" has been described, which includes an extensive network of roads and railways in Africa, with a particular attention to China's participation in developing an integrated transport infrastructure in Ethiopia, which includes the only urban tram system in Africa and a new railway line connecting Addis Ababa with the port of Djibouti. In addition, a new road network passing through the mountain kingdom of Lesotho, and the impact it has had on the well-being of rural communities, has been considered.

However, reasons for the lack of any significant link between maritime trade and national economies for developed countries may be GDP growth per capita, compared with maritime trade in developed countries is lower than in developing countries as a whole. Additionally, the economy of developed countries service based economies and the role of maritime trade is often one-way (import), while developing countries are usually more oriented on industry and trade plays a bilateral role (import as well as export).

In general, the results of the study are consistent with the existing literature on the transport economy, which emphasizes the fundamental contribution of the quality of port infrastructure and logistics efficiency to the country's economic growth. However, association between port infrastructure quality, logistics indexes and maritime trade, as well as their contribution to annual increases of country's economy should be further explored using latent growth models. It has been proposed to the countries to increase the transparency of the regulation of transit traffic and border regime, improve administrative procedures and simplify border control procedures. It also at-

taches great importance to cooperation at the regional and subregional levels in the area of creating efficient transit transport systems and import duties, which could possibly simplify the system. However, this is not easy, since in landlocked countries these taxes constitute a significant proportion of the government revenue. Another option is to minimize the time and make the procedures as predictable as possible.

One of the main economic growth strategies adopted for one reason or another in Eastern Europe is to achieve growth based on exports with a large share of assembly operations or the supply of products for processing abroad. Since intermediate products are imported and finished products are exported to Western Europe, preference while choosing the location of production will be given to countries such as Poland, Hungary, Slovakia and the Czech Republic, since geographically they are closer to the main markets and carry more open trade policies [39].

It is also interesting to note that 15 countries with transit economy are located at the distance more than 1000 km far from large markets of Western Europe. But Hungary, Slovakia and the Czech Republic are located in the center of Europe and, relatively, conveniently located for trading goods and services. The geographical location of countries with transit economy will impact on trades, investments and on making appropriate decisions. Some countries have made great strides both in implementing economic and institutional reform, and in attracting investment and trade flows. Two factors can be distinguished here: those countries that have achieved great success are coastal countries or/and are located close to their main markets. Therefore, lack of access to the sea seems to be a problem only if the country is also located far or isolated from its main markets. It can be concluded that the closer a country is — landlocked or coastal — to Western Europe, the earlier the reform process begins and the faster they are implemented. For example, the electronic engineering giant based in Singapore uses up to 50% of local materials at its assembly plant in Hungary.

These examples have shown that geographical isolation can become a burden for potential investors. However, problems associated with lack of solutions can be overcome. For Hungary, Slovakia and the Czech Republic the lack of access to the sea does not matter, because these countries bordering on Western Europe are connected by a network of good roads, railways, navigable waterways and are located relatively close to them. Due to the accession of these countries to the EU, they force them not only to invest large money in the modernization of their infrastructure and potential, but also to fundamentally revise their transport policies, institutional framework and structure of customs authorities [18], [50].

In contrast with the central European countries, Central Asia is landlocked and located far from the markets, and this is a very serious factor in its economic activity, especially after the beginning of economic transformations. Locating along the ancient Silk Road, they actively participated in trade with both the East and the West. Today, transit routes in the region are unstable, security remains a major concern, and finding alternative land and sea trade routes is not easy.

Central Asia could create and negotiate a number of transit routes, including such important pipelines for the export of energy through Russian for 10 years. Moreover, for transit transportation by rail and road, they can use the territory of China and the Islamic Republic Iran. Ferry crossings across the Caspian Sea allow transit by rail and road, and to the south through China to Pakistan and India by road. These main transport corridors have already created good opportunities for the development of trade for landlocked Central Asian countries, although much remains to be done, especially in terms of maintaining, modernizing and restoring infrastructure, which is a top priority for numerous transport assistance projects in transport development implemented by the support of international agencies. In addition, an important place, among the tasks of many of the above-mentioned international institutions in the field of infrastructure development, is determined to the efforts to restore the former Silk Road [42].

World organizations and banks have approved a large loan for further planning of the routes linking landlocked Central Asian countries with China and ultimately with other markets. The geographical location, i.e. lack of access to the sea, cannot fully explain the whole current economical situation in which Central Asia is now. Additionally, other factors, such as stability and political climate in particular, have a greater impact.

Switzerland is undoubtedly the country that has achieved the greatest success among all landlocked countries, and which, as evidenced by the success of its economy and especially Swiss export industries, does not suffer from the lack of access to the sea and does not experience any consequences. Constituent elements of this kind of success are specifically “Swiss” and can never be reproduced in any other regions or other countries. Nevertheless, they deserve a closer look, since they can certainly suggest useful ideas to other landlocked countries. Actually, the geographical position of Switzerland is regarded as a positive experience and incentive for finding creative solutions within the framework of transport, economic and trade policies. Switzerland is not only landlocked, but is, however, considered as one of the most important transit countries in Europe. Switzerland has so far managed to develop export industries of great international importance, despite the lack of access to the sea, as well as mineral reserves, coal or other raw materials needed for the chemical industry.

6 Conclusion

The problems of landlocked countries in long term perspective can be solved via the right combination of specific measures which are often related to a particular country or region. One of the important tools are proper policy “compensation” and relative investments that can

reduce psychological barriers, which often seems to impede identification and the use of some measures. Thus, for landlocked countries it is especially important to develop appropriate macroeconomic foundation and trade policy, reduce formalities associated with freight traffic and speed up customs clearance procedures. Since landlocked countries are often transit countries for their neighbor countries, the paramount importance for them is to establish a clear balance between environmental objectives and requirements for the organization of traffic and transport. The status of a transit country creates new potential opportunities for landlocked countries. The development of a modern, up-to-date service infrastructure for transit cars, trucks, trains, airliners or ships makes the transit process more expensive, leads to job creation and forms an entirely new logistics sector with distribution centers, storage facilities, technical and manufacturing facilities. Despite of this, the consequences of a geographical isolation of the countries, which are located in the center of Europe, naturally differentiate from the situation of the landlocked countries that are located in the center of Africa, in Central Asia or in Southern America. The lack of access to the sea is very closely interrelated with a number of complex tasks and problems. The most important work in this field is to simplify trade and customs procedures, develop infrastructure in border areas or coordinate and implement regional or sub-regional approaches.

The development of a modern logistic industry, which could serve transit operators will probably also help to increase the cost of transit operations and will cooperate to a successful development of new sectors. Economic growth should be fair and should have a broad base, and if export development takes place parallel with the development of infrastructure, the obstacles to growth can be easily removed.

The infrastructure development is still the top priority question for landlocked countries as well as for transit countries [46]. However, this means not only the construction of new roads or railway lines but also a regular work on their maintenance, expansion of opportunities in terms of the supply of transport services, a strengthening of object management systems through information technologies in ports or on railways and conducting a consistent transport policy. It is necessary to pay attention to the capacity i.e. to the replacement of obsolete equipments, including rolling stocks, ships, trucks, port facilities and cargo handling facilities as well [51].

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