

Theoretical and Expert Assessment of the Effect of Infrastructure on Regional Competitiveness (Lithuanian Case)

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Abstract

In the article the authors analyze and assess the impact of infrastructure on regional competitiveness. Theoretical analysis involves the development and directions of investigations on infrastructure as well as classification of infrastructure components, its specific characteristics, the significance of infrastructure to economics and regional competitiveness. In the article infrastructure is understood as physical assets that are widely used by the economic subjects, society and Government. Taking into consideration that infrastructure is analyzed through its usage by the subjects for performing their activities thus increasing their competitiveness, the effect of infrastructure is understood as the establishment of conditions for the increase in competitiveness and is analyzed in the article as an internal factor of regional competitiveness. Aiming to identify these components of infrastructure which make a complex competitive advantage for the region, but not positive preconditions for its pursuit only, an expert assessment was conducted, the results of which may be used as the basis for adopting the Government's probable strategic resolutions with regard to the increase in the Lithuanian regional competitiveness.

Keywords: infrastructure, regional competitiveness, assessment of the effect of infrastructure.

Introduction

In the conditions of the ongoing globalization, competitiveness is becoming more important when seeking to achieve a country's economic development or attraction of foreign investments. Production factors might be transferred from one country to another more easily, that is why the importance of higher evaluation of country's competitiveness arises.

Infrastructure resources in the country's economy are an important factor of competitiveness and the ability of society to satisfy its economic and social needs. The economic theory and international practice shows that activity of infrastructure industries plays an important role in economic development, competitiveness, creates a background for the survival and development of the country's economic subjects.

Every country as an economic-social system consists of subsystems, i.e. regions. The fact is that economy of the whole country is directly dependent

on an economic and social viability of regions and their ability to be competitive. If strategies of regional competitiveness, which are under realization, are not effective and factors of competitiveness are not fully used, the region will lose its competitive position among others and will make a negative influence on national competitiveness. Aiming at the avoidance of these consequences, the present competitiveness of a region should be measured and factors of complex competitive advantage should be distinguished first, but not positive presuppositions for its achievement while forming a strategy. Due to these reasons, a complex assessment of regional competitiveness and identification of the factors of competitiveness are becoming one of the most significant stages of strategic planning and precondition for the increase in regional and country's competitiveness.

Taking into consideration that infrastructure is analyzed via its usage by the subjects for doing their activities, thus increasing their competitiveness; the effect of infrastructure is understood as the establishment of conditions for the increase in competitiveness and is analyzed in the article as the internal factor of regional competitiveness. Aiming to identify the components of infrastructure which make a complex competitive advantage of the region instead of positive preconditions for pursuing it only, there is a need to analyze the effect of infrastructure on regional competitiveness.

The aim of the article is to analyse theoretical aspects of impact of infrastructure on regional competitiveness and identify the main components of infrastructure important for regional competitiveness in Lithuania.

Methods of the research are systemic, comparative and logical analysis of the concepts, methodologies and conclusions, published in scientific literature; expert evaluation; mathematical and statistical analysis with the help of specialized software (SPSS, MS Excel).

The pioneers of the infrastructure research are Hirschmann (1958), Rosenstein-Rodan (1961), Jochimsen (1966), and Yangson (1967). Among the aut-

hors who made research into the correlation between the infrastructure and economic growth are Munnell (1990), B. H. Baltagi, Pinnoi (1995), Holtz Eakin and Lovely (1996), Sanches-Robles (1998), Chin, Chou (2004), Apergis, Payne (2009). In their studies the authors focus on the features of the infrastructure, its physical installation in the country, the importance of goods or services for the country's economic subjects and citizens. The impact of infrastructure on the economy is assessed using various methods, but there is a lack of assessment of the impact of infrastructure globally: one ignores the fact that due to the country's poor infrastructure companies may move to other countries or foreign companies may refuse to invest in the country or establish their businesses there.

In Lithuania scientific research on infrastructure started in the last decade of the previous century. Atkociuniene's doctoral dissertation (2000) involved the analysis of the Lithuanian rural social infrastructure. Transport infrastructure has been analyzed by Baublys (2008), Minalga (1997). Jankauskas (1997, 2000) focused on the analysis of economic regulation of the communal enterprises as well as on restructuring of branches of infrastructure in Lithuania. Snieska and Simkunaite (2009) conducted the assessment of social and economic effect of investments on infrastructure. Cibinskiene (2010) analyzed links between infrastructure of natural monopolies and the country's competitiveness. Works of Lithuanian scientists involved little analysis (especially mathematically and statistically based) of infrastructure in general, there are only some assessments of particular branches of infrastructure; and the analysis of the significance of infrastructure for the competitiveness of the country's regions is insufficient. The assessment of the effect of infrastructure on the country's regions is complicated by the lack of statistical data by regions.

The theory of competitiveness is one of the most confused and difficult to summarize fields of research, because of complexity of the concept, numerous varieties of factors, complicated process of competitiveness. Competitiveness researches and comparisons are made by Juscius, Snieska (2008). Regional competitiveness is analyzed by Snieska, Bruneckiene (2009), Simanaviciene, Bruneckiene, Simberova (2007), importance of the competitiveness forming factors is studied by Urbonas, Maksvytiene (2003). Yet there is a lack of scientific research dealing with the effect of infrastructure on regional competitiveness. This justifies the relevance, timeliness and novelty of the problem analyzed in the article.

Development and directions of studies on infrastructure in economic literature

The earliest application of the term "infrastructure" has been observed in the military terminology at the end of the 20th century. It was used for the description of auxiliary services and systems. The notion of infrastructure is derived from the Latin language ("infra" – a sole, basis existing beneath, and "structure" – a composition, layout). Infrastructure in general is understood as the totality of economic resources pertaining to the level of an active economic functioning. It involves transport, communications, energy as well as education, health care, public services related to the laws and legal system. The emergence of the notion of "infrastructure" in the economic terminology is related by American economist Samuelson (1958) to the name of his compatriot Rosenstein-Rodan (1961), whereas the English researcher Youngson (1967) maintains that the notion "overhead capital" which is now called "infrastructure", was started to be used after year 1940, and one of its expressions in the economic literature emerged in Zinger's work.

Differences in definitions of the notion of infrastructure occur due to different level of analysis of this phenomenon. Infrastructure can be analyzed at micro, meso, and macro levels. Infrastructure can be analyzed within the general level of production, within the general economic system. In this case infrastructure is defined as the totality of social and economic services accommodating the whole process of production. It can also be analyzed by its functional aspect, at the level of a respective economic sphere (district, region, city, etc.).

Further related studies of infrastructure were started based on the formulated theory of infrastructure. Major attention in these studies was focused on the analysis of the impact of infrastructure on the growth of economy. Since 1980 an increased interest in reforms of infrastructural entities and their privatization is observed. These two aspects of infrastructure analyses can be distinguished as the most important ones. The regulation of infrastructural activities of entities was started to be analyzed as a result of restructuring and privatization of these enterprises. These studies can be attributed to a more modern research on infrastructure. While evaluating the new tendencies of research on infrastructure, a potentially new direction of its impact on competitiveness can also be distinguished. Theories on infrastructure and directions of the development of research are generalized in Figure 1.

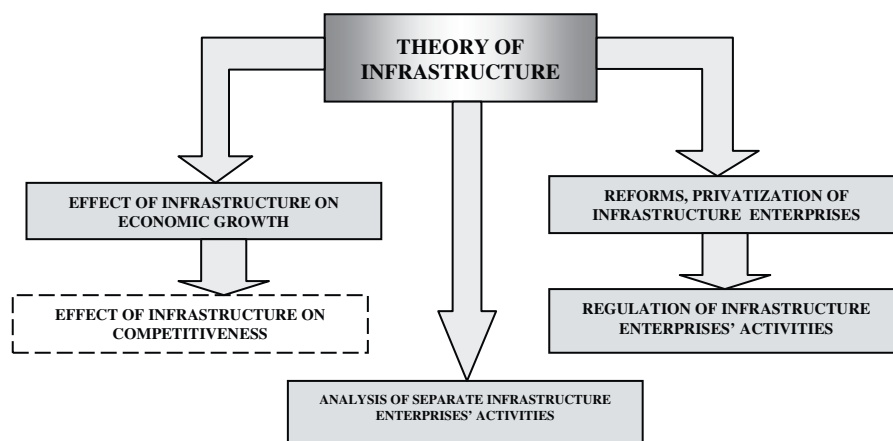


Fig. 1. Principle directions of formation and development of the theory of infrastructure

Infrastructure may be analyzed from the perspective of macroeconomic and microeconomic levels. From the microeconomic perspective, its development is indispensable for the economic growth. From the regional perspective, its development is indispensable for promoting the economics of underdeveloped regions and satisfying the needs of developed regions. From the microeconomic perspective, it is significant for all economic subjects of the country.

Specific characteristics and classification of infrastructure

Infrastructure resources in the country's economy are an important factor of its competitiveness and the society's ability to satisfy its social needs. The establishment of infrastructure itself does not generate profit. Infrastructure performs the function of integration between branches of production, regions and countries. It does not create material goods; it performs the function of provision. The better infrastructure is developed, the faster and easier investments and manpower are attracted, the economic development and quality of life are improved (Komarov, 2000). Rosenstein-Rodan (1961) maintains that economic analysis of infrastructure is especially important from the social-economic perspective because the expenses assigned to infrastructure development are not a naturally material product prepared for realization by the way of purchase and sale, but economy received by the users of infrastructure.

The studies conducted prove that economists identify characteristics of infrastructure in different ways, however the common feature remains the same – infrastructure must establish favourable conditions for the functioning of both private and public capital (Navickas, Cibinskiene, 2002). It is the essential condition for further economic development of developing countries. Within economically develo-

ped countries infrastructure may be analyzed as a supplementary source of capital accumulation or growth, factor of competitiveness, means of fighting the crisis, etc.

The studies carried out have proven the significance of the methodological step – identification of characteristics thus providing possibilities to group branches of infrastructure and distinguish them from the totality of branches of the country's economy (Navickas, Cibinskiene, 2002). This enables to conduct a systematic distribution of infrastructure, i. e. distinguish its characteristic elements, identify their inter-relationship. Summarizing the above mentioned characteristics of infrastructure, including those mentioned in the scientific literature, the following characteristics specific solely to infrastructure can be distinguished:

1. Indirect effect of branches of infrastructure on the country's economy: expenses for the payment for goods or services of infrastructure are considered the expenses of economic-commercial activities of economic subjects.
2. Public form of the infrastructure usage: the common characteristics of all branches of infrastructure involve its "generality" and "universality", i. e. it is related to all branches and spheres of the country's economy.
3. Establishment of infrastructure goes ahead of the economic assimilation of the area: no new business is started in the region unless it is properly accommodated with infrastructure.
4. Branches of infrastructure usually belong to the state or its activities are regulated by the state in one or another way.

The economic growth depends on the level of infrastructure. The collective character of usage of its

services is characteristic to infrastructure. Particularly the collective character of usage of its services gives infrastructure the specificity that requires special attention. The effectiveness of infrastructure development is observed in the basic branches of economy.

Infrastructure is classified by many different characteristics: by spheres of activities, spatial distribution, consumers of infrastructural services, etc. The studies conducted (Navickas, Cibinskiene, 2002) show that infrastructure may be sorted by the following characteristics:

1. Social-economic: planned economy, market economy.
2. Economic groups: infrastructure of economy of developed, developing and transition countries.
3. Territorial aspect: separate country's, international, global infrastructure.
4. Spheres of activities (manner of usage): economic, social infrastructure.

Pavlov and Alaev (1973) maintain that the social infrastructure involves a complex of activities that are directly related to the establishment of suitable conditions for manpower (health care, education, professional training, etc.). Here the emphasis is laid on the creation of conditions exceptionally for manpower by ignoring the country's other population who are not or cannot be considered manpower yet. Distinguishing the social and economic structure is significant only if development of elements of the first group is related to the significant number of population; so the development of elements of the second group is dependant upon the growth of production capacities. The level of the economic infrastructure development is compared with the country's general economic potential, whereas the level of social infrastructure development reflects the level of life (Pavlov, Alaev, 1973).

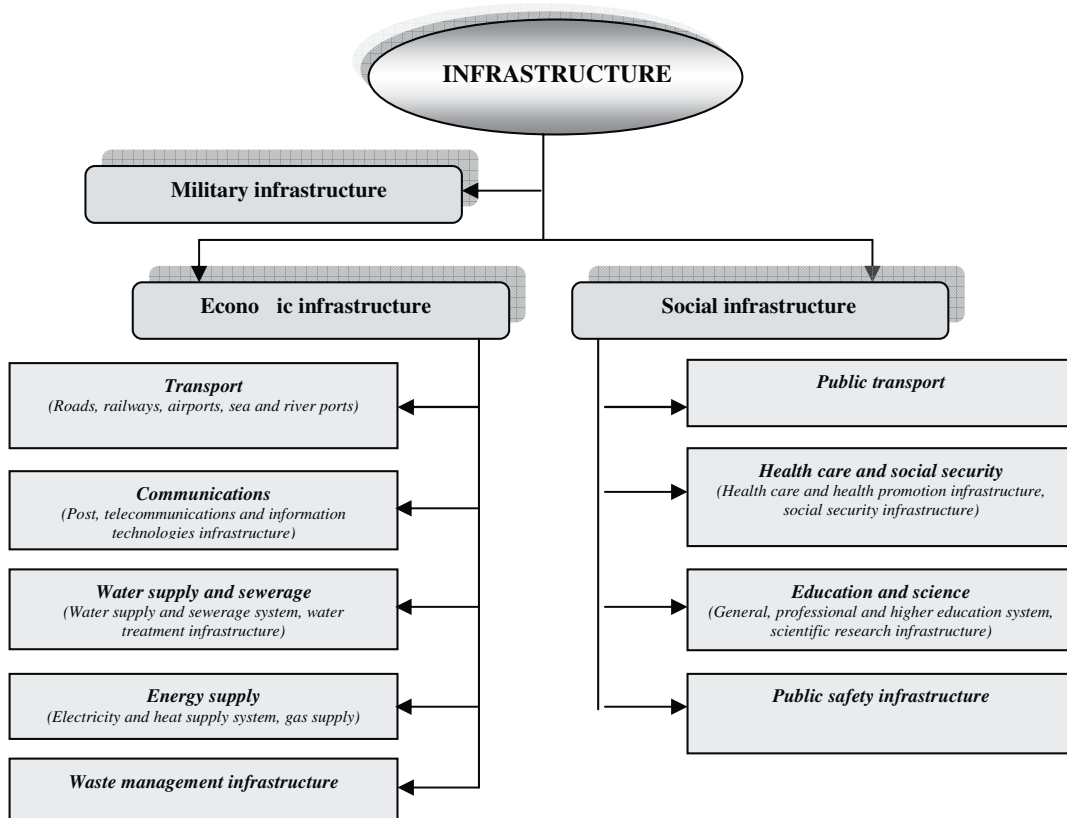


Fig. 2. Classification of infrastructure by consumers of goods and services

Analyses on the systems of classification of infrastructure conducted by various authors (Navickas, Cibinskiene, 2002) allow to distinguish two major types of infrastructure by consumers of their goods and services: economic and social infrastructure, by attaching all branches supplying activities of the economic (economy-commercial) process to the economic infrastructure, whereas different services the function

of which involves satisfying the population's social needs – to the social infrastructure.

Considering the fact that infrastructure establishes conditions not only for satisfying the population's needs, but also for ensuring their safety, the military infrastructure may be distinguished as well, which might be described as the totality of special systems aimed at provision of military forces' daily routine activities du-

ring the period of peace as well as provision of military activities during the wartime. Classification of this infrastructure is reflected in Figure 2.

Significance of infrastructure to economy and regional competitiveness

Taking into account limitations on the volume of the article, objective of analysis as well as the fact that much consideration has been attached to the problems of regional competitiveness in articles by other authors (Bruneckiene, 2010, Snieska, Bruneckiene, 2009, Bruneckiene, Cincikaite, 2009), in this article regional competitiveness is defined as an ability to use factors of competitiveness in order to make a competitive position and maintain it among other regions. Such viewpoint allows treating the competitiveness as a self reinforcing process, where present factors of competitiveness (inputs) create future factors of competitiveness (outputs) and after that outputs become inputs for a new cycle of competitiveness process. Taking into account that infrastructure in this article is understood as physical assets widely used by the economic subjects, public, and government, infrastructure is analyzed through the subjects' usage of it for implementation of their own activities, thus improving their competitiveness. Therefore in the article the effect of infrastructure on the regional competitiveness is understood as the establishment of conditions for increasing competitiveness, and is analyzed in this article as the inner factor of regional competitiveness. Besides, regional competitiveness is analyzed from the sustainable development perspective; thus, when assessing the effect of infrastructure on competitiveness, the effect of infrastructure components on economic, social and environmental competitiveness is considered.

The effect of infrastructure on economic development, competitiveness and investment attraction is not novel, however recently it is an especially relevant sphere of research due to huge investments and their effectiveness.

Works of researchers (OECD, 2005, Jurkauskas et al., 2005, EC, 2004 a, 1999, Fleisher, 2003, Vickerman, 2001, Canada Urban Institute, 1999, Blakely, 1989) have proven that infrastructure, as one of the advantages of economic environment establishing conditions for gaining the competitive advantages of enterprises, correlates with GDP, labour productivity and feedback of attracted investments. Fleisher (2003) emphasized that the regional competitiveness itself is related to dimension of the future, though expressed by economic-social indexes of the current period related to GDP (e. g. labour productivity, employment, export, etc.). Thus the current period investments in physical infrastructure will establish conditions for the region's gaining of a long-term

competitive advantage. Although the studies conducted are not sufficient for a generalized assessment of the precisely calculated and expressed by mathematical indexes effect of physical infrastructure on competitiveness, researchers confirmed the existence of a direct link between the analyzed categories. For example, via implementation of the Trans European Network (TEN) project the European Commission forecasts the following increase caused by transport projects in the period of 2005-2025: the EU GDP – by 0.25%, employment – by 0.11%, the establishment of 800 000 work places (OECD, 2005).

Frequently a positive effect of infrastructure on both economic growth and regional competitiveness is distinguished in scientific literature. The obtained results depend upon different infrastructure components, methods of assessment identified in the analyses. Besides, many researchers face the problem of the lack of statistical data (Snieska, Simkunaitė, 2009), which complicates the reliability of calculations and possibilities of interpretation of results.

The studies revealed that infrastructure affects the economic growth by increasing productivity of the production factors, and provides goods and services which ensure the country's economic functioning. Authors (Agenor and Moreno-Dodson, 2006, Fourie, 2006) argue that infrastructure impacts economic growth in several primary ways:

- Infrastructure lowers the cost of input factors in production process. This effect is called the direct productivity effect.
- Infrastructure improves the productivity of workers, and this effect is known as the indirect effect.
- Impact of infrastructure on growth is obtained through the initial building and construction period: working places are created in construction and related industries. As infrastructure investments require maintenance, it further boosts the long-term creation of jobs.
- Infrastructure also has positive effect on education and health outcomes: good health and high education of labour force stimulate economic growth.

Due to these characteristics infrastructure is often described in the economic literature as “a free factor of production” because its existence determines a bigger turnover achieved by other factors – capital and labour. Aubert (2000) formulates his hypothesis on the significance of infrastructure to economic growth in the following way: a developed infrastructure increases production capacities of enterprises, thus reducing costs of the increased production. From theoretical perspective, this is the case of infrastructure's di-

rect (as a factor of production within the enterprise's production function) or indirect effect on productivity of factors.

Traditionally physical infrastructure involves roads, highways, pipelines, airports, railways, electrical energy transfer lines, sewerage/drainage, flood control systems. During the creation of knowledge economy, communication infrastructure (networks of mobile telephone, high-speed data communications, satellite communications, fiber optics and broadband networks) previously not attached to physical infrastructure becomes a significant part of it. Elements of physical infrastructure are insufficient for the development of regional economy. Their quality (reliability, timely availability, convenient application) have become a significant criterion. For example, many technologies-related enterprises consider the quality of electrical energy transfer a significant criterion when choosing the place of activities (any disturbance in electrical energy transfer causes a big loss to the enterprise); transportation capacities via air, railway or roads (traffic jams and punctuality of rail and air transport) are very important for enterprises the activities of which depend upon a timely delivery of cargo.

The research studies have shown that the effect of different elements of physical infrastructure varies depending on the level of development of the country. Vickerman (2001), EC (1999), Blakely (1989) indicated that in poor countries major significance is attached to water supply system, whereas in the economically developing countries – to energy supply or transport infrastructure. Formation of knowledge economy raises the significance of infrastructure related to telecommunications and information technologies.

The system of transport which consists of land and water ways, airports, railway and the system of public transport, ensures the essential economic links and combines all regional production elements into the unanimous totality, thus establishing conditions for an effective economic functioning. Sepic (2005) and EC (1999) have noticed that regions with a well developed high-quality transport infrastructure distinguish themselves by a better availability of markets, lower transport-related costs and a higher GDP per person. Fleisher (2003) and EC (1999) emphasizes that the region's transport system will increase the regional competitiveness and availability when it, as a totality, is integrated into inter-regional and international transport corridors and creates conditions for inter modal transportation.

The studies prove that roads are one of the most important elements of the transport system. This is confirmed by the EU statistical data revealing that in year 2004 and 2005 more than 85% of the to-

tal passengers and around 75% of the total cargos (expressed in tones/km) were transported via roads, whereas in 1970 – only 50% of the total cargos. Besides, the developed roads ensure an effective application of other elements of the transport system, particularly air and sea ports, which ensures the increase in the region's competitiveness. However, due to the increase in the fuel prices roads give their position to railways within the cargo transportation sphere. This proves the significance of the railway infrastructure to competitiveness of regions and enterprises. Fleisher (2003), Houvari et al. (2001), Pinelli et al. (1998) attribute airports to the elements of physical infrastructure as also significantly improving the competitiveness of regions. When assessing regional competitiveness it is important to take into consideration the quality of the air transport infrastructure because fast transport increases the region's attractiveness.

The formation of knowledge economy, information society as well as the increasing importance of communication also increases the significance of ITT structures for the economic development and competitiveness. Fleisher (2003) considers infrastructure not a factor of competitiveness but a condition for gaining the competitive advantage. Other researchers (Sepic, 2005, EC, 1999) consider the application of ITT infrastructure a factor of competitiveness of enterprises, others (Auskalnyte, Belazariene, 2001, Madon, 2000, Avegrou, 1998, Mansell, Wehn, 1998, Adam, 1996) – a decisive factor determining the regional development.

The studies show that ITT that reduces distance and quickens transfer of information among people, enterprises, regions and states, increases the flexibility of operational activities of enterprises, expands the geographic area and also encourages the emergence of new activities and business forms (e. g. e-commerce, e-transport, e-health, etc.). Undoubtedly, ITT application in activities of enterprises provides them with competitive advantages within the cost reduction, information collection and transfer, management and other spheres, which strengthens both their and the region's competitiveness. Researchers (Madon, 2000, Avegrou, 1998, Mansell, Wehn 1998, Press, 1997, Adam, 1996) have emphasized the importance of the Internet for regional development and have suggested attaching the increase in the Internet application to major strategic objectives of open economies, especially for less developed regions. Press (1997) has proven the existence of a positive correlation between the number of Internet users and quality of people's living. He has emphasized that the development of the Internet communications alone does not solve problems of the less developed regions. However, he has marked the existence of interaction between the spread, application of this technology and

the economic development of regions. Sepic (2005) and EC (1999) have emphasized that ITT offers new business and cooperation possibilities, which is especially important for small open economies, less urbanized and peripheral regions.

In the opinions of Jucevicius et al. (2005), Briochi, Caasia (2005), World Bank (2003), EC (1999), in the process of building of information society the decisive role is attached to educational and scientific institutions, which were named by the authors as the most significant region's resources of knowledge, because one of the objectives of their activities, which is also emphasized in the White Book of Lithuanian science and technologies (2001), involves doing of scientific and technological works, creation of innovations and their application at industrial and business enterprises.

A close cooperation between science and business ensures application of advanced scientific theories and innovations in business, which provides enterprises with competitive advantages. Briochi, Cassia (2005) maintain that the very presence of a university, a scientific institute, centres, parks of science and technologies and other institutions functioning in the region is considered a factor of the region's competitiveness. Although their existence is significant to the whole society, its education, general and technological culture, economic and social development, it is difficult to evaluate its significance increase in the future. The authors emphasize the importance of overall strengthening of innovational links of knowledge resources with the economy and society, common scientific research, formation of spin-off companies based on new technologies. While analyzing regional competitiveness Briochi, Cassia (2005) and Houvari et al. (2001) attached a special attention to the number of technical universities or scientific institutions as well as scientists and students of technical specialties in the region. Although approving the importance of doing of scientific research and application of new technologies as one of major factors in promoting the local business in the region, Macys (2005) also emphasized a close relationship of science and technologies with the market globalization and increasing effectiveness and competitiveness of production within international markets; however, implementation of the most advanced technologies does not solve the most severe problems of the region, such as unemployment. The Shumpeter's theory holds that economic advantages of advanced technologies are more prominent in the areas where research is continued after the implementation of novelties, which requests huge efforts and carries big risks. Macys (2005) maintains that with regard to technological innovations the regions with big salaries and large enterprises go ahead the regions with lower salaries, thus increasing econo-

mic-social differences between regions.

While distinguishing the significance of education and science to regional competitiveness, the attention should be attached to health care and its importance to regional competitiveness. In the original formulation of his theory, Becker (1964) pointed to health as one component of the stock of human capital, but then in his early empirical work focused exclusively on education. The major contribution to our understanding of health as an integral part of human capital was provided by Grossman (1972), who was the first to construct a model of the demand for health applying human capital theory. Grossman distinguishes between health as a consumption product and health as a capital good. As a consumption product, health enters directly into the utility function of the individual, as people enjoy being healthy. As a capital good, health reduces the number of days spent ill, and therefore increases the number of days available for both market and non-market activities. Thus, the production of health affects an individual's utility not only because of the pleasure of feeling bring in good health, but also because it increases the number of healthy days available for work (and therefore income) and leisure. (EC, 2005)

Since human capital matters to economic outcomes and since health is an important component of human capital, health also matters to economic outcomes and competitiveness. At the same time, economic outcomes matter to health. Health is determined by genetic, economic, social, cultural and environmental factors. But the health of a population may also, in return, influence the economic context. In line with the scheme proposed by Bloom et al. (2001), we suggest in this study that health could contribute to economic outcomes (at both the individual and the country level) in high-income countries mainly through four channels: higher productivity, higher labour supply, higher skills as a result of greater education and training, and more savings available for investment in physical and intellectual capital.

The analyses conducted (Bruneckiene, 2010, Snieska, Bruneckiene, 2009, Bruneckiene, Cincikaitė, 2009) show that factors of regional competitiveness influence each other and affect general competitiveness differently. During the period of economic crisis, when there is lack of money for investments and investments in infrastructure require huge financial resources, it is important to identify those components of infrastructure the development of which could maximally contribute to the increase in regional competitiveness. Aiming to identify interrelationship between infrastructure and regional competitiveness, an expert assessment was conducted. Its methodology and results are provided in the next chapter.

Results of expert evaluation of impact of infrastructure on competitiveness of Lithuanian regions

Aiming to identify the significance of the effect of components of infrastructure on regional competitiveness, experimental assessment was chosen. The choice of this method was determined by the following circumstances:

- Absence and insufficiency of statistical information describing infrastructure at the regional level. The Statistics Department under the Government of the Republic of Lithuania provides very limited infrastructure-related information, e. g. the length of asphalt roads, number of fixed telephones per 100 inhabitants, etc.) The submitted indexes do not allow making a qualitative analysis of infrastructure development.
- Indexes on infrastructure provided by the Statistics Department under the Government of the Republic of Lithuania remained almost unchanged throughout the analyzed period (2004-2010), or changed insignificantly, thus not ensuring a reliable calculation of the correlation link with the regions' competitiveness (expressed by the regions' competitiveness index (Snieska, Bruneckiene, 2009), GDP per person, or other indexes).
- In Lithuania there is no unanimous methodology for the assessment of the effect of infrastructure on regional competitiveness or total economic development. There is

no methodology of assessment which is applied in the world and adapted for the case of Lithuanian regions either. The data provided by the Statistics Department under the Government of the Republic of Lithuania are not sufficient for using them as reference in the complex methods, as well as mathematical methods containing many variables, applied by scientific researchers worldwide for the assessment of the effect of infrastructure on competitiveness and economic growth.

Although Merkys (1995) has emphasized that information obtained by the expert method is subjective, related to personal opinion, the sphere of feelings and world outlook, in the opinion of Kardelis (2005) the inquiry of specially selected people possessing knowledge of a certain sphere allows to achieve the scientific objectivity. The authors of this article support the opinion that the level of conformity established by the experts' assessment allows to reduce the risk of subjectivity.

The empirical analysis of identification of the main components of infrastructure, which makes the biggest influence on regional competitiveness, was done by analysing 50 expert opinions, which were calculated by the statistical average method. All experts involved had experience in strategic planning, regional and social economic development spheres. Their qualification and practical experience allowed treating them as experts of evaluation of impact of infrastructure on regional competitiveness within Lithuania (see Table 1).

Table 1

Distribution of experts by work experience

Experts' work experience	< 1 year	1 to 3 years	3 to 5 years	5 to 10 years	> 10 years
Number of experts	0	5	18	19	8

The expert assessment involved persons representing scientific, business and authority institutions. The inquiry involved representatives of science from Lithuanian higher education institutions, authorities – representatives from the Government of the Republic of Lithuania, Lithuanian counties governors' and municipalities administrations, business – from business associations and individual enterprises. 5 experts represented both scientific and business institutions.

The basis of the questionnaire was the classification of infrastructure as presented in Figure 2. The questionnaire was prepared and the experts were interrogated by using an individual interview or by sending the questionnaire by email. The survey was done on August – September, 2010.

The reliability of the questionnaire (inner consistency of the questionnaire scale) was evaluated using the Cronbach alpha coefficient. The Cronbach alpha coefficient of the questionnaire used in the expert assessment is equal to 0.73, thus proving the acceptable reliability of the questionnaire.

The coincidence of opinions of experts participating in the inquiry was evaluated by Kendall's coefficient of concordance (Kendall's W), at the same time examining the hypothesis on its value equality to zero. The chosen level of the value $\alpha = 0.05$. The hypothesis on its value equality to zero was rejected when the observed p-meaning was less than 0.05. Based on the calculated Kendall's W test results, the experts' opinions statistically reliably coincided quite in unison (see Table 2).

Table 2

The results of Kendall W test on components of infrastructure

Comparable groups of components	W	Sign	Comments
Economic infrastructure, Social infrastructure, Military infrastructure.	0.570	0.000 (<0.05)	The opinions of the experts coincide.
Transport, Communications, Energy supply, Water supply and sewerage, Waste management.	0.444	0.002 (<0.05)	The opinions of the experts are weakly coinciding but statistically reliable.
Public transport, Health care and social security, Education and Science, Public safety infrastructure	0.557	0.000 (<0.05)	The opinions of the experts coincide.

Identification of the effect of components of infrastructure on regional competitiveness is based on the weight coefficient. It should be noted that the value of the weight coefficient does not reflect the effect of infrastructure on regional competitiveness itself. This requires comprehensive and numerous mathematical and statistical calculations. By the weight coefficients the authors of this article aimed at identifying which component has a major effect on competitiveness in comparison with other components. The weight coefficients of infrastructure components having effect on competitiveness are identified by the statistical average method according to the following formula:

$$\text{weight coefficient} = \frac{\bar{s}_i}{\sum_{i=1}^m \bar{s}} \quad (1)$$

where \bar{s}_i is statistical average,

$\sum_{i=1}^m \bar{s}$ is sum of statistical averages.

The weight coefficient varies from 0 to 1. The bigger it is, the stronger is the effect of the factor determining competitiveness. The sum of coefficients of each factor of each factors group equals to 1.

The analysis of experts' opinions proved the assumption that different components of infrastructure make different impact on regional competitiveness in Lithuania (see Table 3).

Table 3

The weight coefficients of components of infrastructure, according to the expert evaluation

Components of infrastructure	Weight coefficients	Components of infrastructure	Weight coefficients
Military infrastructure	0.125	Water supply and sewerage	0.126
Economic infrastructure	0.544	Water supply and sewerage system	0.244
Transport	0.327	Water treatment infrastructure	0.756
Roads	0.273	Waste management infrastructure	0.036
Railways	0.254	Social infrastructure	0.331
Airports	0.187	Public transport	0.177
Sea ports	0.243	Health care and social security	0.206
River ports	0.043	Health care and health promotion infrastructure	0.540
Communications	0.307	Social security infrastructure	0.460
Post	0.106	Education and science	0.447
Telecommunications infrastructure (mobile, fixed telephones)	0.449	General education system	0.051
Information technologies infrastructure (Internet)	0.445	Professional education system	0.216
Energy supply	0.204	Higher education system	0.401
Electricity supply system	0.358	Scientific research infrastructure	0.332
Heat supply system	0.335	Public safety infrastructure	0.170
Gas main	0.307		

Following the expert assessment economic and social infrastructures have a major effect on the Lithuanian regional competitiveness. However military infrastructure is considered to be less significant.

The experts' opinions on the economic infrastructure statistically reliably coincided. The main components of this infrastructure are transport infrastructure (0.327 points) and communications (0.307

points). Both energy supply infrastructure and water supply and sewerage and waste management infrastructure were considered by the experts to be the essential condition of sustainable economic growth and pursuit of competitiveness; for this reason they were not considered the factors of competitiveness and were evaluated respectively by 0.204, 0.126 and 0.036 points. One of the most significant components of transport infrastructure having a major effect on regional competitiveness involves roads, railways and sea ports. In the experts' opinion, roads, railways and sea ports are less significant for regional competitiveness. Telecommunications and information technologies infrastructure received quite a similar evaluation of experts, 0.449 and 0.445 points, respectively. Post infrastructure was considered less significant for competitiveness. Electricity, heat and gas supply received rather similar experts' evaluation, which suggests that energy supply infrastructure is the essential condition of a sustainable economic growth and pursuit of competitiveness, however, these cannot be considered to be the factors of competitiveness. The system of water supply and sewerage itself received a lower evaluation from experts than water treatment infrastructure, which confirms that the qualitative development of infrastructure is more important for competitiveness than the quantitative development. The quantitative development of infrastructure is significant for the economic growth, while the qualitative development is significant for competitiveness.

The experts' opinion on social infrastructure coincided weakly but statistically reliably. Education and science infrastructure has a major effect on regional competitiveness (0.447 points). Health care and social security infrastructure have a greater effect on regional competitiveness than public transport and public safety. Health care and health promotion infrastructure received quite a similar experts' evaluation, which suggests that these components of infrastructure are the essential condition of a sustainable economic growth and pursuit of competitiveness, however, they cannot be considered the factors of competitiveness. The system of higher education (0.401 points) and scientific research infrastructure (0.332 points) are the most significant components of social infrastructure, having the biggest effect on regional competitiveness. The system of professional education received higher evaluation than the system of general education.

The expert assessment confirmed the validity of the assumption regarding different effects of components of different infrastructures on the general regional competitiveness. Although the weight coefficient value established during the expert assessment does not reflect the effect of infrastructure itself on competitiveness (this requires numerous comprehen-

sive mathematical and statistical calculations), however, according to the weight coefficients it is possible to distinguish those components that have a greater effect on competitiveness than other components have. The expert assessment conducted allowed to identify the strategic directions, the development of which would enable the achievement of the biggest effect on the increase in competitiveness. Besides, it is recommended that the results of the expert assessment were taken into account by authority strategists forecasting the increase in competitiveness strategies of regions and the whole country.

Conclusions

Infrastructure resources in the country's economy are a significant factor of its competitiveness and the society's ability to satisfy its social needs. The conducted analyses have revealed that the development of infrastructure is the result of specialization of the public production. From the macroeconomic perspective the development of infrastructure is essential for the development of economy. From the regional perspective its development is essential for promoting the economic development of the backward regions as well as satisfying the needs of the developed regions. From the microeconomic perspective it is significant for all economic subjects in the country.

The following essential characteristics describing infrastructure are distinguished:

- Indirect effect of branches of infrastructure on the country's economy: expenses for the payment for goods or services of infrastructure are considered the expenses of economic-commercial activities of economic subjects.
- Public form of the infrastructure usage: the common characteristics of all branches of infrastructure involve its "generality" and "universality", i. e. it is related to all branches and spheres of the country's economy.
- Establishment of infrastructure goes ahead of the economic assimilation of the area: no new business is started in the region unless it is properly accommodated with infrastructure.
- Branches of infrastructure usually belong to the state or its activities in one way or another are regulated by the state.

It was established that it is appropriate to divide infrastructure into social infrastructure and economic infrastructure by consumers of goods and services, also by distinguishing military infrastructure that ensures the safety of both economic activities and population.

The studies conducted prove that infrastructure affects the economic growth by increasing productivity of production factors, also provides goods or services which ensure the country's economic functioning. Infrastructure contributes to the increase in the enterprise's production capacities in the following two ways:

- Infrastructure goods and services (transport, water, electricity) are intermediate costs of production, thus, any reduction of these costs increases profitability of production.
- Infrastructure goods and services increase productivity of other production factors.

Although the studies conducted are not sufficient for a generalized evaluation of a precisely calculated and expressed in mathematical indexes effect of infrastructure development on competitiveness, the researchers maintain that there is a direct link between these two categories analyzed.

The results obtained by expert assessment did not contradict but supplemented the results of theoretical analysis. The expert assessment confirmed the validity of assumption regarding different effects of components of different infrastructures on the general regional competitiveness. Economic infrastructure is most significant to regional competitiveness. The strongest effect on regional competitiveness is made by the following components of infrastructure: transport infrastructure (roads, railways and sea ports), communications (telecommunications and information technologies infrastructure), education and science infrastructure (system of higher education and scientific research infrastructure). The energy supply infrastructure, water supply and sewerage, waste management infrastructure, health care and social security infrastructure, public transport and public safety are essential conditions for a sustainable economic growth and competitiveness; however, they cannot be considered the factors of the increase in competitiveness.

The expert assessment confirmed greater significance of the qualitative development of infrastructure for competitiveness than that of the quantitative development. The quantitative development of infrastructure is significant for the economic growth, whereas the qualitative development – for competitiveness.

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Infrastruktūros įtakos regionų konkurencingumui teorinis ir ekspertinis vertinimas (Lietuvos atvejis)

Santrauka

Šiuolaikinėmis globalizacijos sąlygomis, plėtojant šalies ekonomiką ir siekiant pritraukti tiesiogines užsienio investicijas, konkurencingumas įgauna vis didesnės reikšmės. Gamybos veiksniai vis lengviau gali būti perkelti iš vienos šalies į kitą, iš vieno šalies regiono į kitą, todėl svarbu siekti kuo didesnio šalies (regionų) konkurencingumo.

Infrastruktūros ištekliai šalies ekonomikoje – svarbus jos konkurencingumo ir visuomenės gebėjimo patenkinti savo socialinius poreikius veiksnys. Ekonomikos teorija ir praktinė pasaulinė patirtis rodo, kad infrastruktūros šakų veikla vaidina svarbų vaidmenį ekonomikos plėtroje, sudaro pagrindą šalies ūkio subjektų gyvavimui ir plėtrai.

Kiekvieną šalį kaip ekonominę-socialinę sistemą sudaro posistemiai – regionai. Nuo regionų ekonominio-socialinio gyvybingumo bei gebėjimo būti konkurencingais tiesiogiai priklauso visos šalies ekonomika. Jei įgyvendinamos regionų konkuravimo strategijos yra neefektyvios ir nepakankamai išnaudojami konkurencingumo veiksniai, regionas praras konkurencinę poziciją prieš kitus ir darys neigiamą įtaką šalies konkurencingumui. Siekiant išvengti šių pasekmių, formuojant konkuravimo strategiją, pirmiausia reikėtų įvertinti esamą regiono konkurencingumą ir išskirti veiksnius, sukuriančius kompleksinį konkurencinį pranašumą, o ne pozityvias prielaidas jam siekti. Regiono konkurencinės pozicijos ir potencialo nustatymui tikslinga naudoti kompleksinį vertinimą, kadangi vienas ar keli ekonominiai-socialiniai rodikliai netikslingai atspindi esamą situaciją. Dėl šių priežasčių kompleksinis regionų konkurencingumo įvertinimas tampa vienu svarbiausiu strateginio planavimo etapu ir regionų bei šalies konkurencingumo didinimo prielaida.

Atsižvelgiant, kad infrastruktūra nagrinėjama per subjektų naudojimąsi ja savo veiklai įgyvendinti ir kartu savo konkurencingumui didinti, infrastruktūros įtaka regionų konkurencingumui suprantama kaip sąlygų sudarymas konkurencingumo didinimui ir šiame straipsnyje analizuojama kaip vidinis regionų konkurencingumo veiksnys. Siekiant nustatyti tuos infrastruktūros komponentus, kurie sudaro kompleksinį konkurencinį pranašumą regionui, o ne pozityvias prielaidas jam siekti, reikia nustatyti infrastruktūros įtaką regionų konkurencingumui.

Tyrimo tikslas – išanalizuoti teorinius infrastruktūros įtakos regionų konkurencingumui aspektus ir identifikuoti didžiausią įtaką darančius infrastruktūros komponentus Lietuvos regionų konkurencingumui.

Tyrimo metodai – mokslinėje literatūroje paskelbtų koncepcijų sisteminė, lyginamoji ir loginė analizė; ekspertinis vertinimas, matematinis ir statistinis apdorojimas (naudojant *SPSS* ir *Microsoft Excel*).

Infrastruktūros ištekliai šalies ekonomikoje yra svarbus jos konkurencingumo ir visuomenės gebėjimo patenkinti savo ekonominius ir socialinius poreikius veiksnys. Atlikti tyrimai parodė, kad infrastruktūros plėtra – tai visuomeninės gamybos specializacijos rezultatas. Makroekonominiu požiūriu infrastruktūros plėtra yra būtina siekiant eko-

nomikos plėtos. Vertinant regioniniu aspektu, jos plėtra būtina skatinant atsilikusių regionų ekonomiką ir tenkinant išvystytų regionų poreikius. Mikroekonominiu požiūriu ji yra svarbi visiems šalies ekonomikos subjektams. Išskiriami šie pagrindiniai infrastruktūrą apibūdinantys bruožai:

- Netiesioginė infrastruktūros įtaka šalies ekonomikai: išlaidos, skirtos infrastruktūros sukurtoms prekėms ar paslaugoms sumokėti, yra ekonomikos subjektų ūkinės-komercinės veiklos išlaidos.
- Visuomeninė infrastruktūros naudojimo forma: visų infrastruktūros šakų bendrasis bruožas yra jos „visuotinumą“ ir „universalumą“, t. y. ji yra susijusi su visomis šalies ūkio šakomis ir sferomis.
- Infrastruktūros sukūrimas aplenkia ūkinį teritorijos įsisavinimą: naujas verslas nepradedamas kurti regione, jei šis nėra tinkamai aprūpintas infrastruktūra.
- Infrastruktūros šakos paprastai priklauso valstybei arba jų veikla yra reguliuojama valstybės.

Nustatyta, kad infrastruktūrą tikslinga klasifikuoti į socialinę ir ekonominę, atsižvelgiant į infrastruktūros prekių ir paslaugų vartotojus. Karinės infrastruktūros išskyrimas leidžia nagrinėti ekonominės veiklos ir gyventojų saugumo užtikrinimo problematiką.

Atlikti tyrimai atskleidė, kad infrastruktūra veikia ekonomikos augimą, padidindama gamybos veiksnių našumą ir teikia prekes ar paslaugas, kurios užtikrina regiono ekonominę veiklą. Infrastruktūra padeda didinti regiono įmonės gamybos apimtį dviem būdais:

- Infrastruktūros prekės ir paslaugos yra tarpinės gamybos sąnaudos, todėl bet koks šių sąnaudų sumažinimas didina produkcijos pelningumą.
- Infrastruktūros prekės ir paslaugos padidina kitų gamybos veiksnių našumą.

Nors dar nepakanka atliktų tyrimų, kad būtų galima apibendrintai kalbėti apie tiksliai apskaičiuotą ir matematiniais rodikliais išreikštą infrastruktūros plėtos poveikį regionų konkurencingumui, tačiau mokslininkai teigia, kad tarp abiejų nagrinėjamų kategorijų yra tiesioginis grįžtamasis ryšys. Siekiant nustatyti infrastruktūros komponentų daromos įtakos regionų konkurencingumui svarbą pasirinktas ekspertinis vertinimas. Šio metodo pasirinkimą lėmė:

- Statistinės informacijos, apibūdinančios infrastruktūrą regioniniu lygmeniu, nepakankamumas. Statistikos departamentas prie Lietuvos Respublikos Vyriausybės pateikia labiau ribotą informaciją, susijusią su infrastruktūra, pvz., asfaltuotų kelių ilgis, fiksuoto ryšio telefonų, tenkančius 100 gyventojų, skaičius ir pan. Šių pateiktų rodiklių nepakankama siekiant apibūdinti infrastruktūros plėtrą kokybiniu aspektu.
- Statistikos departamento prie Lietuvos Respublikos Vyriausybės pateikiami su infra-

struktūra susiję rodikliai beveik nekinta per visą analizuojamą laikotarpį (2004–2010 m.) arba kinta tiek, kad statistikai patikimai nebūtų galima apskaičiuoti koreliacinio ryšio su regionų konkurencingumu (išreiktų regionų konkurencingumo indeksu, bendruoju vidaus produktu, tenkančiu vienam gyventojui ar kitu rodikliu).

- Lietuvoje nėra sukurta vieninga infrastruktūros poveikio regionų konkurencingumui ar visai ekonomikos plėtrai vertinimo metodologija. Be to, nėra adaptuotos Lietuvos regionų atvejui pasaulyje taikomos vertinimo metodologijos. Statistikos departamento prie Lietuvos Respublikos Vyriausybės pateikiami duomenys yra nepakankami, kad galėtų būti panaudoti pasaulyje taikomiems sudėtingiems ir daug kintamųjų apimantiems matematiniais metodams, kuriais mokslininkai vertina infrastruktūros poveikį konkurencingumui ir ekonomikos augimui.

Siekiant nustatyti infrastruktūros komponentų daromos įtakos Lietuvos regionų konkurencingumui svarbą, pasirinktas ekspertinis vertinimas apklausiant 50 respondentų. Remiantis ekspertiniu vertinimu, didžiausią įtaką Lietuvos regionų konkurencingumui turi ekonominė ir socialinė infrastruktūra. Ekspertų vertinimu, ne tiek svarbi yra karinė infrastruktūra. Ekspertų nuomonė dėl ekonominės infrastruktūros statistiškai patikimai sutapo. Svarbiausias infrastruktūros komponentas – transporto infrastruktūra (0,327 balo) ir ryšiai (0,307 balo). Tiek energijos tiekimo infrastruktūrą, tiek vandentiekį ir kanalizaciją bei atliekų šalinimo infrastruktūrą ekspertai laikė būtina sąlyga darniam ekonomikos augimui ir konkurencingumui siekti, todėl juos nelaikė konkurencingumo veiksniais ir įvertino atitinkamai 0,204, 0,126 ir 0,036 balo. Vienas svarbiausių transporto infrastruktūros komponentų, darančių didžiausią įtaką regionų konkurencingumui – keliai, geležinkeliai ir jūrų uostai. Ekspertų nuomone, oro ir upių uostai yra mažiau svarbūs regionų konkurencingumui. Telekomunikacijų ir informacinių technologijų infrastruktūrą ekspertai vertino gana vienodai – atitinkamai 0,449 ir 0,445 balo. Pašto infrastruktūrą laikė mažiau svarbia konkurencingumui. Elek-

tros, šilumos tiekimą ir dujotiekį ekspertai vertino gana vienodai, todėl galima daryti išvadą, kad energijos tiekimo infrastruktūra yra būtina sąlyga darniam ekonomikos augimui ir konkurencingumui siekti, tačiau tai nėra konkurencingumo veiksniai. Vandens tiekimo ir kanalizacijos sistemą ekspertai vertino mažesniu balu nei vandens valymo infrastruktūrą, vadinasi, infrastruktūros kokybinė plėtra svarbesnė konkurencingumui nei kiekybinė. Infrastruktūros kiekybinė plėtra svarbi ekonominiam augimui, o kokybinė – konkurencingumui.

Ekspertų nuomonė dėl socialinės infrastruktūros silpnai, tačiau statistiškai patikimai sutapo. Didžiausią įtaką regionų konkurencingumui daro švietimo ir mokslo infrastruktūra (0,447 balo). Sveikatos ir socialinės apsaugos infrastruktūra daro didesnę įtaką regionų konkurencingumui nei viešasis transportas ir viešasis saugumas. Sveikatos priežiūros ir sveikatinimo infrastruktūrą ir socialinės apsaugos infrastruktūrą ekspertai vertino gana vienodai, todėl galima daryti išvadą, kad šie infrastruktūros komponentai yra būtina sąlyga darniam ekonomikos augimui ir konkurencingumui siekti, tačiau tai nėra konkurencingumo veiksniai. Aukštojo mokslo sistema (0,401 balo) ir mokslinių tyrimų infrastruktūra (0,332 balo) yra svarbiausi socialinės infrastruktūros komponentai, darantys didžiausią įtaką regionų konkurencingumui. Profesinio lavinimo sistema vertinta didesniu balu nei bendrojo lavinimo sistema.

Ekspertinis vertinimas patvirtino skirtingos infrastruktūros komponentų skirtingos įtakos bendram regiono konkurencingumui prielaidos pagrįstumą. Nors ekspertinio vertinimo metu nustatytas svorio koeficiento dydis neparodo pačio infrastruktūros poveikio konkurencingumui, tam reikalingi išsamūs ir gausūs matematiniai bei statistiniai skaičiavimai, tačiau pagal svorio koeficientus galima išskirti tuos komponentus, kurie daro didesnę įtaką konkurencingumui nei kiti komponentai. Atliktas ekspertinis vertinimas leido identifikuoti strategines kryptis, plėtra leistų pasiekti didžiausią įtaką konkurencingumo didinimui. Be to, į gautus ekspertinio vertinimo rezultatus rekomenduotina atsižvelgti valdžios institucijų strategams, formuojantiems regionų ar visos šalies konkurencingumo didinimo strategijas.

Pagrindiniai žodžiai: infrastruktūra, regioninis konkurencingumas, infrastruktūros poveikio vertinimas.

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