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ACTUAL PROBLEMS OF PUBLIC-USE RAILWAY INFRASTRUCTURE DEVELOPMENT MODELLING

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Abstract. The current work is aimed at studying the actual problems in modelling Latvian public-use railway infrastructure (hereinafter – the railway infrastructure) development and targeted on defining both key variables and test indicators.

The research was based on the analysis of the statistical material and the observance of existing methodological approaches with a feedback to the Latvian specific distinctions described in the work. The output indicators of the model were adopted from the National Development plan 2020 and stated at the beginning of the study. After that externalities were segregated as an outside environment and expressed in correlated indicators. Completely available statistic data for the scoped factors was analyzed for its significance within an ample horizon and summarized in system tables.

The following conclusions were drawn:

1) methodological solution is needed for evaluation of the endogenous factors with indicators that can be fixed directly for the railway infrastructure;
2) there is no reliable data from non-European stakeholders on outside impact on the Latvian public-use railway infrastructure.

Therefore, further academic research is needed on how to create and secure the flexible and sustainable railway infrastructure development model. The survey method for further examination of purposed system of indicators is provided for discussion.

Key words: *public-use railway infrastructure, modelling, evaluation of sectoral statistics*

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Introduction

The Latvian Railway is a powerful institution and its managing entity "Latvijas dzelzceļš" (hereafter – the infrastructure manager) is one of the largest employers, taxpayers and one of the most valuable companies in Latvia. According to the condition of the section 6 of the Railway Law "the State public-use railway infrastructure shall be developed to meet the needs of the economy and its development, the interests of stable transportation, and the requirements of environmental protection". Due to these factors the Latvian railway is a grand player on the macroeconomic level and its outcomes of operations and development should be measured on the macroeconomic level despite its microeconomic legal position.

The development of the national economic interest policy cannot be experimented with because it can lead to major losses. So the railway infrastructure development model (hereafter – the model) should be worked out and applied to a current situation in order to imagine trends in the economy and affecting

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factors in logical or mathematic expression. This formalized concept has to show how input (exogenous) factors alter output (endogenous) variables and relationships between the railway infrastructure and the national economy to allow analyse short, medium and long term changes in the national economy structure caused by the changes in the technical, political, economic and financial proceedings of railway infrastructure as well as predict the national economy impact on the railway infrastructure indicators and vice versa in order to identify the necessary changes in the proceedings of the railway infrastructure so that the national economy objectives can be achieved.

It is crucially important to define in advance the base case (Job van Exel et al, 2002) whilst detecting specific characteristics of the model object. Then, relevant external and internal effects should be determined (Button, 1993; Rienstra, 1998). Finally, the key support and trouble determinants may be assumed as well as interaction between them and network effects that can appear in wider economy (e.g. changes in output of regions and employment) (James J. Laird et al, 2005). Given the sectoral meaning of rail statistics, the output macroeconomic indicators are not directly quantifiable "with and without" implementation of an railway infrastructure development strategy. Therefore this work is **aimed at** defining key variables and test indicators of both endogenous and exogenous factors of the model and target setting for methodological solution for microeconomic level criteria assessment on national economy level.

In spite of many studies have tried to establish statistical links between investments in railway infrastructure development and national economic growth (Crainic T.G., 1984; Shiftan, Y. et al, 2002; Weisbrod G., Reno A., 2009; Абрамов А., Галабурда В, 2002; Канторович Л.В., Лившиц В.Н. 1982; Мачерет Д.А., 2006; Терешина Н.П. et al, 2002), the common trend is to design specific models for each project or specific problem (Banister D., Thurstain-Goodwin M., 2011; Griskeviciene D. et al, 2012; Nair R.et al, 2008; Patļins A., Kuņicina N., 2009; Thomopoulos N. et al, 2008). The variety of the interrelated distinctive features that impact the Latvian railway causes difficulties in expressing them in terms of exogenous and endogenous factors of existing models. Therefore, it is necessary to work out a new system of possible long-term period statistic indicators that can be effective input of the model. In order not to distract from the main objectives it has been decided to examine appropriated criteria from fixed output to possible input. For this reason the endogenous factors of the model have been stated at the beginning of the study. Then signature features of the model object have been described. After that externalities have been segregated as an outside environment and expressed in correlated indicators. Completely available statistic data for the scoped factors have been analysed for its significance within an ample horizon and summarized in system tables. The survey method for further examination of purposed system of indicators is provided for discussion.

Research results and discussion

1. The specifics in modelling Latvian public-use railway infrastructure development

The needs of national economy are vital objectives of the railway infrastructure development. Therefore the efficiency of the railway system development should be measured within it integration in national policy and output indicators for the model needs should be adopted from the national policy planning documents. The highest level of them is the National Development Plan 2020 (hereinafter - NDP 2020) issued by the Cross-Sectoral Coordination centre in 2012, then – the Transport Development program (issued by the Ministry of Transport in 2010) after that – the Strategy of the railway infrastructure development (issued by the infrastructure manager in 2009) that outflows to hundreds of individual projects.

The Latvian railway infrastructure has a number of distinctive technical, political, economic and financial qualities that should be presented by the model describing reasons of diminishing marginal productivity of the railway infrastructure. In order to find out the optimal usage of the railway capacity and investment leverage, the model should explain development of which production factor (or combination of factors) gradually decreases output of the railway infrastructure and where a margin is whereby additional investments no more increase the benefits. It is important to highlight that the productivity of the railway infrastructure service is not unique and depends on the structure of the predetermined objectives: passenger and freight shares in transportation, social and ecological policy provided and others. Therefore output of the model should be fixed with concrete test indicators before examining input. NDP2020 indicators (see Table 1) matched to the transport development have been chosen for appraisal of **endogenous factors**.

Table 1

The endogenous factors of the model

Priority	The objective of the National Policy	Indicators
National Economic Growth	Highly productive, export capable industry and internationally competitive services	*Exports of goods and services (% of GDP)* *Productivity (thousands euro per labourer)* *Productivity of natural resource use (euro per resource ton)*
	Excellent business environment	*Ranking of Trading Across Borders in Doing Business index* *Freight turnover in Latvian big seaports millions ton per year*
	Advanced research and innovation	*Investments in R&D (% of GDP)* *R&D (personnel % of labourer)*
	Energy efficiency and production	*Energy consumption (oil equivalent kg per 1000 euro of GDP)* *Intensity of greenhouse gas emission (CO2 equivalent ton per 1000 EUR of GDP)*
Individual's Securit-ability	Development of competencies	*Adult education (% per labourer)*
	Decent work	*Dynamics of salaries (% to previous year)*
Growth For Regions	Promotion of economic activity in regions – unleashing the potential of territories	*Regional developments index* *GDP per capita regional dispersion* *Income tax in municipal budgets (EUR per capita)*
	Availability of services for creating more equal work opportunities and living conditions	*Passenger turnover in public auto transport (millions passenger km par year)*
	Sustainable management of the nature and cultural capital	*Forest territories (% of total Latvian square)*

Source: author's construction based on National Development Plan 2020 (Cross-Sectoral Coordination centre, 2012)

The technical distinctions of the Latvian railway arise from a historical fact that the Latvian railway infrastructure was built not for domestic needs, but primarily in order to transport bulk and raw materials from Russia, Belarus and other former Soviet republics to Baltic seaports. Therefore most the Latvian

railway technical characteristics (1520 mm gauge, partial electrification with 3 kV voltage, axle load 23.5 t, allowable speed, length and weight) differ from the railway infrastructure prevalent in Europe and correspond to heavy transportation. This kind of usage has been preserved to this day. Therefore the origin of most important factors influencing rail operation arises from the global Eurasian traffic flow not from the Latvian economy.

The majority of the Latvian railway has been constructed as the single-track (trains can travel in only one direction at a time). This factor, as well as such technological circumstances as irregular cartage from neighbouring countries and uneven detraining in the seaports, light running in West-East direction and others causes incomplete capacity utilization which is also a distinctive condition in comparison with two-track networks or networks where several alternative routes have been developed.

Contrary to European dominant passenger transportation share in railway usage, this kind of railway consumption is not so widely used in Latvia and has a negative dynamic. Reasons for this situation are not only the impact of the distinctive **demographic factors** (reduction of the population and its spending capacity, the centralization of the population around the capital and others), but also the technological features (low platforms, lack of locomotives and wagons, inefficient station services development).

The political distinctions of the Latvian railway sector are harmonized with the European Union legislation that provides liberalization, vertical separation (i.e. separation of infrastructure managers from railway undertakers), prevention of congestion, territorial cohesion, elimination of technical barriers. Currently, railways and their' integration into the overall transport system is summarized in large programming (White Paper, Rail and Public Transport for a low carbon future, Interoperability of the rail system, Action Plan on Urban Mobility, etc.) and regulatory (Fourth Railway Package, Passenger Rights Regulation and other) documents where the key trends are: significant greenhouse gas (GHG) emissions reduction by 2050; shifting freights to railways or waterways; high-speed and conventional rail passenger transport; technological innovations; prevention of accidents; congestion and noise reduction.

The development of railway infrastructure conditions is affected by the Organization of Transport Ministry Cooperation (hereinafter – OSJD) as well. OSJD main objectives are development of common rail space within the Eurasian region (mostly on 1520 gauge territory), railway competitiveness in transcontinental direction, as well as scientific and technical cooperation in promotion of the rail transport. Major OSJD activities initiate development and improvement of international railway transportation mainly in Asia direction and cooperation on the solution of the problems connected mostly with technological aspects of railway transport (wagons turnover, border crossing, statement of accompanying papers etc.)

As a result of the great impact of external policies, the internal level of the policy planning documents (Latvijas dzelzceļš, 2009 and Ministry of Transport, 2010) does not always adopt general guidelines of NDP2020. Worse still internal national policies can interfere with each other in order to achieve limited funding or other advantages. There is no any common policy coordinator at transport sector so that financial leverage can be secured. In this context, the relationships among microeconomic, sectoral, multisectoral, national economy and global transport network development perspective should be analysed in modelling the economic processes of the Latvian railway. This mixed approach allows a deeper understanding of the railway infrastructure requirements and capabilities.

The heavy pollution of the Baltic Sea due to the increasing oil transport in the Baltic Sea poses a particular risk to the **eco**system and therefore environmentally friendly transport policy was adopted by the European Commission. That includes a proposal, summed up as a "polluter pays" principle that will remove the existing differences between various modes of transport.

The Latvian railway primarily **economic distinctions** are in organization form, meaning that public administration process is entrusted to a commercial undertaking. Even in the 18th century, A. Smith wrote that every single entrepreneur is used to enhance their own capital, without respect to general well-being. Also the Latvian railway's Strategy shows that the infrastructure management is targeted on microeconomic behaviour.

Supply of a railway infrastructure services is inelastic. On one hand sustainable investments and maintenance activities should be made to provide secure infrastructure service, on the other hand the obtained potential technical capacity of the service cannot be accumulated and should be used at a particular time in accordance with the work schedule. The demand for infrastructure services has dual properties: at the domestic market it has monopole qualification but at the external market there is a strong competition among various transit corridors. The potential buyers of infrastructure services do not pay attention to the transport cost components and are interested in the total price of moving goods from loading to unloading points. Therefore the demand for infrastructure service depends on the price level throughout the supply chain as well as non-price factors that are included the so-called World Bank Logistics Performance Index (World Bank, 2012): customs, quality of infrastructure services, international policy, competence, tracking and reliability.

The Latvian Railway has such **a financing distinction** like lack of investments. Till 2004 the Railway Law provided that 50% of the excise tax on diesel fuel used in rail transport was a source of infrastructure funding. Later a decision on the withdrawing of special public budgets was adopted. As a result there is a situation where road infrastructure undertakers use infrastructure relatively free, but operators of the railway infrastructure pay access charges where wear and tear is included. The average track access charges in Latvia are one of the highest in Europe (IRG-rail, 2013).

The infrastructure manager as a state joint-stock company may attract credit resources as follows: personal loans (not used because of insignificancy and cost); leasing (minimally used because of difficulty to manage); bonds (not used because of strategic importance of the railway); issue of promissory notes (not used); bank loans. So far the infrastructure manager has used mainly the resources offered by the financial sector due to their availability, relatively low price and possibility to grant the loan without hypothecating property or shares.

The Latvian bank statistics show that about 90% of foreign direct investments (hereafter FDI) in land transport division have Russian origin.

The infrastructure manager intensive use another kind of guaranteed resources like the Cohesion Fund, the European Regional Development Fund, the Trans-European transport network, the European Commission program "Marco Polo" that means developing the railway infrastructure in accordance with the programs' priorities.

Summarizing section 1 the following can be noticed: the Latvian infrastructure rail due to the specific usage with accent on freight transit has dual dependence on cargo flows from CIS countries on the one part and European political heat on the other part. Some features like underfunding and uncoordinated policy might create state failures risks.

2. The exogenous factors of the model

The outside environment effect (factors that cannot or can be narrowly controlled by the Latvian railway development policy makers) exerts as **exogenous factors** and can be characterized using indicators of six main impact groups: technology, ecology, demography, economy, finance and policy.

The assessment of external impact is quite resource-intensive. There are also many complete models that provide integrated approaches and indicators. For example, European Commission can supply extensive technical documentation on each of the individual country HERMIN models and can facilitate the initiation of such work in the Member states (European Commission, 2012). But all observed existing models have been designed for each concrete task and project like Cohesion Policy and are not comparable with specific characteristics of the model observed above. However the establishment of a new model unit can be undertaken extracting suitable parts from existing models.

The impacts of **technological** development appear as the productivity of railway infrastructure. Ortuzar and Wilumsen (2001) offered time saving as the most significant indicator of transportation

benefits. Later Shires at el, 2002 provided an extensive meta-analysis of the value of time. Both this researches are mostly focused on passenger traffic, but this type of measure can provide sufficient information for the most significant trends like unification and standardization of technological processes for all transport modes. Given Latvian distinctions, the impact of compatibility with on-demand services like interoperability, sorting, storage and clarifying should be taken into account excessively.

Global **economy** trends predetermine traffic intensity and freight structure and provide reduction of the infrastructure service cost due to reduction of fixed costs load per transportation unit. Economic factors in the Latvian case of dominant bulk transportation depend on following: global production overall and consumption volumes; deployment and development of a regional transport corridor in connection with location of material resources and choice between different modes of transport; the level of service requested by different goods; as well as world price and demand for the row material (Adamsone L. 2000, Aleksejevska J., 2007, Caprara A. 2011, Slotins D. 2009, Zarins A. 2011).

A significant impact on international trade can be made taking into consideration global regionalization trend expressed in growing interdependent of countries with ever-increasing specialization in concrete fields. For example, the enlargement of China's industrial geography to the West leads to the development of the intermodal connection in East-West direction. These facts and growing interest in development alternate transport corridors for meeting perspective demand are not taken into account in above studies and call for additional examination.

Since 2013 when the Basel III agreement entree into force, negative trends in **financial** sector like lack of long-term resources of the European banking market and higher resource prices (due to the need to raise more capital) have been rising and providing a global framework for bank capital adequacy, stress testing, liquidity risk and market standards. A further objective of Basel III (2012) is to strengthen and promote global consistency in liquidity risk supervision using the set of indicators. These indicators provided for banks in the near future converts to bank requirements that will impact European bank investment policy. Slovik, P. and B. Cournède (2011) offered the approach of quantifying the impact of Basel III capital requirements on bank capital levels and bank lending spreads that can be used for evaluation of financial sector impact to national economy and transport sector.

The indicators and evaluation approaches of European funds are included in the declaration of relevant policy. For example, impact evaluation of Regional Policy falls into two approaches using a mix of methods: counterfactual methods to quantitatively estimate an impact, theory-based methods to understand the underlying mechanisms and the context of an intervention thus helping to modify or generalize it to other contexts. Ex-ante evaluation for each European program is available on relating agencies websites and on special European Commission Funds site.

Many researchers (Titarenko, D. 2006, Stikuts, D. 2003) and research entities (OECD 2000, European Bank for Reconstruction and Development, 2001) have examined FDI impact. Based on these assessments, it is most likely that foreign investors (usually a multinational corporation) decide to enter into another market through FDI because of lower costs and higher productive efficiency than of its domestic competitors.

Ecology impact is much investigated matter. Weisbord et al. (2009) examined three types of impacts: environmental quality, health, and broader economic impacts on the basis of medical studies relating death rates to concentrations of various pollutants. Ortuzar and Wilumsen (2001) also take into account total pollution emissions and noise levels, the impacts of transport projects on road-accident costs. It should be taken into account that ecological trends in European Union have dual impact in the Latvian case. On the one part the benefits (or loses) of rail transport identification as a priority must be evaluated associated with additional cost on compliance of environment friendly requirements. For this purpose Boardman, Greenberg, Vining, & Weimer (2001) translated measured impacts into monetary values and calculated standard financial decision criteria such as net present value (NPV), internal rate of return (IRR), and benefit/cost ratio using CBA un MCA in practice. Shefer (1994) even generated ranking criteria for monetizing such indicators as a congestion, landscape and traffic flow and road accidents.

These methods of evaluation are recognized as not sufficient (Johansson-Stenman, 2005; Yitzhaki, 2003) because they don't require effects to be equitable in sustainable mode. So on the other part long-term advantage of commonweal must be expressed in some concrete figures.

Demography trends are easy to be analysed and predicted using common statistics. Researching the demographic factors, it is essential to respect the territorial location of the railway infrastructure and take into account cross border demography. The main components of the demographic assessment are: population, geographical distribution; family structure changes; aging et al. Different kinds of existing models offer approved demography impact assessment across European Union territory SASI, CGEurope, SCENES, TIPMAC and other. There are also many studies that have focused on evaluation of the concrete impact using different kinds of indicators with the main focuses on territorial cohesion, environment and human wellbeing. It complies with the major use of rail in 1435 rail space (from 61% in Slovenia till 94% un United Kingdom of the total train/km volume in 2010), which is passenger traffic, and cannot be fully transferred to the Latvian case because of the great difference in exploitation mode (only 38% of the total train/km volume in 2010) and the absence of crossborder connection. Several national projects (the Mobility plan of Riga, RailBaltic) have particular evaluation of demography impact, but it is done in connection with the context of the concrete project.

The implementing of transportation by using rail technology has **ecological** advantages over other modes of transport. This conclusion was made in 2012 by the State Railway Administration that in accordance with Railway Law is responsible for the development of the rail environmental policy.

Political clout should be considered irrespectively to exogenous factors. This is not a separate power but leverage that can multiply positive/negative impact of externalities or adapt strength/weaknesses of internalities. For example, Russian railway development strategy (Правительство Российской Федерации, 2007) to protect directions to national seaports has a certain influence to technological, economic and financial activities. On other hand European Cohesion policy permits an opportunity of alternate development of the infrastructure. Therefore needs to identify and to qualitatively estimate relevant policy planning documents arise.

3. Indicators of the factors

The statistics of the infrastructure service are contained on the forth level of the national accounts system (NACE 52.21) but all available indicators are given in non-pecuniary expression. Businesses related to the infrastructure service that is rail freight and passenger service are contained on the third level of the national account system (NACE 49.1. and 49.2.). Only several factors can be measured in macroeconomic rates. Availability of statistics is presented in Table 2. It may be concluded that the endogenous factors of the model presented in Table 1 don't directly quantifiable with and without implementation of development strategy or project and thus call for methodological solution for evaluation with indicators that can be fixed directly for the railway infrastructure.

All criteria presented in Table 2 can be compared with European country statistics. A number of publications and data sets are available on transport thematic as well, but rail sector in the mentioned documents is specified more for passenger not for freight. There are several additional sources like UIC (the worldwide international organization of the railway sector) that provides statistic data (length of lines worked at end of year, stock value, train performance, staff number, rail traffic) for world railways, OSJD (Organization for Co-operation between Railways) provides similar information about Eurasian region (mostly 1520 rail) and Lursoft that supplies financial data from annual reports of specific companies like EBIT, Current ratio, Equity ratio, ROA, ROE.

Indicators presented in Table 3 have been selected for further correlation and optimization (detection of margin) analysis in order to assess the endogenous factors of the model presented in Table 1. Summing indicators and appraisal methods proposed in different researches that are applicable to the Latvian case

and available in comparable sources, the set of variables has been selected for further examination as provided in Table 4. The qualitative analysis of policies on stress/protect for each externality and at each policy level should be done inter alia.

There is a huge dissonance in input factors of the model. As on the one part economy and technology trends are generally outside Europe but on the other part the development of the Latvian railway should be carried out ensuring European Union policy establishing a single European railway area.

Table 2

Available data for transport evaluation in Latvian statistics database

LR Statistics Database	**Available data with feasible specifying**		
The first available NACE level	**4th level**	**2nd level**	**Transport sector**
ECONOMY AND FINANCE			
Business Tendency		*all available*	
Consumer Prices			*all available*
Enterprise Finances		*losses/profit*	*leasing/factoring*
Government Finances			*expenditure of general government sector*
Gross Domestic Product			*GDP, GVA, deflator and output and intermediate consumption (specified region)*
Investment			*investments by corresponding countries*
Producer Prices	*all available*		
Employment and Unemployment			*all available*
Household Budget			*transport expenditure specified by regions and age groups*
Labour Costs		*all available*	
Occupied Posts and Job Vacancies		*all available*	
Social Security			*subsidy of transportation costs*
Wages and Salaries		*all available specified by regions and occupation*	
INDUSTRY, CONSTRUCTION, TRADE AND SERVICES			
Construction	*For railways – by costs indicators and regions*		
Indicators of foreign affiliates	*Construction of roads and railways, freight/passenger rail transport, support activities – by countries and costs indicators*		
Trade and Services	*Freight/passenger rail transport, support activities – by countries and costs indicators*		
TRANSPORT AND TOURISM			
Cargo traffic by mode of transport (thsd t), cargo turnover by mode of transport (mln tonne-kilometres), cargo traffic by rail (thsd tonnes), freight traffic by rail by group of goods, cargoes loaded and unloaded at Latvia's ports (thsd t), sea transport: cargoes loaded and unloaded at different ports of Riga (% of total cargo turnover), cargoes loaded and unloaded by type of commodity (thsd tonnes), passenger traffic (mln passengers), passenger turnover (mln passenger-kilometres), road traffic accidents in statistical regions, cities under state jurisdiction and districts			

Source: author's construction based on www.csp.gov.lv data.

Consequently there is no reliable data from non-European stakeholders and research instruments should be developed in order to process it. The following methodology for the identification of the political impact and out-taken variables is offered for discussion:

- developing a list of stakeholders to be interviewed for this case - rail operators, marine terminal operators, ports' authorities and transport policy-makers in corresponding states;
- consultations on three main topics: a) best-practice intermodal chain characteristics (information sharing on capacity planning, seasonal and operational irregularity and rolling stock turnover); b) partners' demand, capacity and other operational matters wherever commercial competitive considerations do not prevent this; c) investment planning among chain participants;
- case study on possible common processes and activities that link the stakeholders together in the rail logistics system and problems that interfere with development coherence;
- more detailed examination of the issues that might be obtained from an individual stakeholders industry specific or even company specific operating practices.

Table 3

Indicators for assessment of the endogenous factors of the model

Distinction	Indicators (NACE, Lursoft)
Technical	*Length of network in use, km* *Share of network in use, %* *Freight traffic volume, t km* *Passenger traffic volume, passenger km* *Electric/diesel traction share of freight traffic, %* *Electric/diesel traction share of passenger traffic, %* *Staff per track-km* *Traffic units (millions) per staff* *Traffic units (millions) per track-km Implied gross ton-km/net ton-km ratio*
Economical	*Value of Fixed assets, LVL* *Turnover, LVL* *Operating revenues, LVL* *Average track assess charge, LVL* *Average tariff, LVL* *Electricity prices, LVL per kw* *Diesel prices, LVL per t*
Financial	*Annual dividend after DSCR, LVL* *Public subsidy assumptions (operational and capital), LVL* *Outstanding amount of credits and bonds, LVL*

Source: author's construction.

Table 4

The exogenous variables of the model

Factors	Variables	Data source	Appraisal methods
Technology	*Clearance time, days;* *Lead time, days;* *Number of agencies;* *Logistics Performance index;* *Indicators in neighbor rail construction.*	World Bank, questionnaire survey	Quantitative and qualitative comparison of technological conditions with rival transport corridors
Ecology	*Share of renewable energy in transport, %;* *Greenhouse gas (GHG) emission index;* *Energy dependence, %;* *Implicit tax rate on energy, EUR /t of oil equivalent;* *R&D intensity in transport (% of GDP).*	Eurostat, Latvian Railway Administration	Comparison with White Paper on transport policy (2011).
Demography	*Labour costs, EUR;* *Number of households within transport corridor regions;* *Transport expenditure in household budget,%*	Eurostat, questionnaire survey	Quantitative and qualitative comparison of demography conditions with rival and corresponding transport corridors
Economy	*Mining of main product transported;* *Purchases of main product transported, EUR;* *Producer prices indices of main products transported;* *Price indices for transport by mode;* *Modal split of freight and passenger transport, %.*	Eurostat, questionnaire survey	Quantitative and qualitative comparison of economy conditions with rival and corresponding transport corridors
Finances	*Bank capital level, %* *Bank lending spreads, %* *Investments in the infrastructure, millions EUR per line km* *Investments in cooperating logistic chain, millions EUR* *Inflation, % to previous year*	Eurostat, World bank	Quantitative comparison of finance conditions with rival transport corridors and corresponding logistic chain

Conclusions, proposals, recommendations

This work performed an analysis of possible key variables and test indicators of the both endogenous and exogenous factors of the public-use railway infrastructure development model using brief analysis of common appraisal tools and analysis of statistical indicators that could be used for this purpose in the Latvian case. Based on the results of the analysis, the following conclusions can be made:

1) the Latvian public-use railway infrastructure development model should be worked out and applied to a current situation in order to imagine trends in the economy and affecting factors to allow solving of the short, medium and long term tasks;

2) the efficiency of the public-use railway system development should be measured within it integration in national policy therefore the endogenous factors and output indicators for the related model needs should be adopted from the national policy planning documents - National Development plan 2020;
3) lack of the availability of statistics does not allow direct quantifying of indicators of the endogenous factors with and without implementation of development strategy or project and thus call for methodological solution for evaluation with indicators that can be fixed directly for the railway infrastructure;
4) the Latvian railway infrastructure has a number of distinctive qualities should be presented by the related model describing reasons of over- or underfunding due to diminishing marginal productivity of the railway infrastructure and effects of dual dependence on cargo flows from CIS countries on the one part and European political heat on the other part;
5) the exogenous factors of outside environment effect have been systematized in six main impact groups: technology, ecology, demography, economy, finance and policy and the set of indicators have been selected for further correlation and optimization (detection of margin) analysis in order to assess the endogenous factors of the public-use railway infrastructure development model. The political clout have been considered irrespectively to exogenous factors as not a separate power but leverage that can multiply positive/negative impact of externalities or adapt strength/weaknesses of internalities;
6) there is no reliable data from non-European stakeholders on outside impact to the Latvian public-use railway infrastructure.

The further research of the both endogenous and exogenous factors of the public-use railway infrastructure development model will include a deeper analysis of the non-conformity seen in the results of the analysis:

1) creating of the methodological solution for evaluation of macroeconomics test indicators with indicators that can be fixed directly for the railway infrastructure;
2) developing of the research instruments in order to process reliable data from non-European stakeholders for the identification of the political impact and out-taken variables.

These conclusions only should be used with a strong link to the main ideas of the work.

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