



Varazdin Development and Entrepreneurship Agency
in cooperation with
Odessa State Academy of Civil Engineering and Architecture
University North
Faculty of Management University of Warsaw
Faculty of Law, Economics and Social Sciences Sale - Mohammed V University in Rabat



Economic and Social Development

32nd International Scientific Conference on Economic and Social Development

Editors:

Anatolij V. Kovrov, Oleg A. Popov, Anita Ceh Casni

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A REVIEW OF MANAGEMENT OF INFRASTRUCTURE ROAD ASSETS

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ABSTRACT

Purpose and research question - The destruction of infrastructure assets, including existing of the road systems, is increasing. In the process of exploitation of road assets, the excessive impact of transport vibrations, water-heat and low-temperature loads, soil washing leads to a significant reduction in the regulatory criteria for their safety, premature technical wear of surface plates, cracks, unevenness, lowering. Increasing the number of seismic fluctuations and floods violates the integrity and stability of road systems. Inadequate and untimely financing leads to increased costs for the prevention and rehabilitation of road systems. The purpose of the survey is to analyze problems and trends in the management of infrastructure road assets; correcting the content of educational programs in a new global context and principles of sustainable development.

Methods of research - Review of scientific and applied information in the public domain about the organizational mechanism of infrastructure assets management in the context of global tasks and problems. The subject of the study is knowledge management in the field of infrastructure of the road assets.

Results - This study does not have a specific grant from any funding agency in the public, commercial or non-profit sectors. It is expected that the transitional results of interdisciplinary research will contribute to the implementation of global programs aimed at improving knowledge management in the field of infrastructure asset management, including the road system.

Conclusions - In general, the trends in the implementation of the principles of global programs for transforming the economy based on digital technologies show a positive trend. For example, innovative proposals by scientists and business practitioners have helped to reduce the infrastructure gap of assets in many countries. However, factors of negative impact, including natural disasters, economic instability, slow processes of transformation of human capital and organizational culture have been revealed.

Keywords: *global challenges, knowledge management, recycling, sustainable development goals (SDGs); transdisciplinary research*

1. INTRODUCTION

In connection with the increase in the population, urbanization, natural disasters, physical depreciation of infrastructure assets, many countries need to improve them [1]. Overhaul of sidewalks, construction and subsequent maintenance of airfields requires huge public investment [2]. State initiatives are not always focused on insurance of public infrastructure, including roads and bridges [3]. Also, «globally, 2017 was a horror year for natural disasters. Hurricanes, floods and wildfires in the Americas, earthquakes in Mexico and the Middle East, and floods in Asia and Africa sadly demonstrated with heart-wrenching repetition the devastating economic and community impacts of these events. In Australia, we are particularly exposed to extreme cyclones and floods. It is inevitable that we will again face a national recovery and reconstruction bill in the billions of dollars. And science is telling us that natural disasters are increasing in intensity and likely, in frequency» (Mark Senkevics. 2018) [4]. Revealed, «that while not all EU member states exhibit signs of environmental imbalances, there still are significant differences between the EU 15 and the states that have acceded to full membership after 2004» (Kokotović, Kurecic, Cingula. 2016) [5]. Obsolete infrastructure assets and natural disasters are not the only problems. Analysts note the passive management of a certain part of production companies with regard to the transition to a circular economy and digital technologies. Perhaps, this phenomenon is due to the aging of intellectual capital or the lack of interdisciplinary knowledge. So, there are cases of insufficient level of knowledge and practical skills of graduates in the field of management, engineering, geotransport, remote sensing, management of road projects [6, 7]; Availability «dark triad» personality traits of engaged human resources can create potential for organizational crises [8].

2. STATUS OF INFRASTRUCTURAL ASSETS IN UKRAINE

The overall integral index of the dynamics of infrastructure development by regions of Ukraine for 2017 is shown in Figure 1. The information is compiled on the basis of data from a publication prepared by the Polissi a Foundation for International and Regional Studies in cooperation with the Friedrich Ebert Foundation in Ukraine.

Figure following on the next page

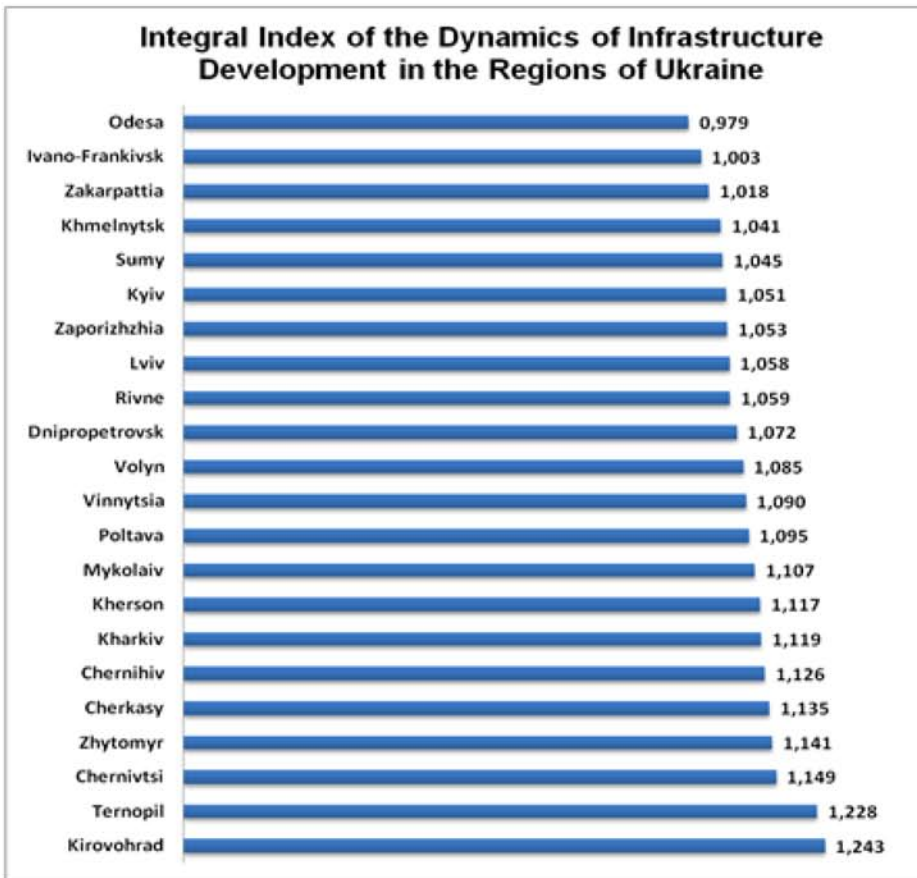


Figure 1: Integral Index of the Dynamics of Infrastructure Development in the Regions of Ukraine [24]

The integral indices of the development of the transport component by regions of Ukraine for 2017 are shown in Figure 2. The information is compiled on the basis of data from a publication prepared by the Polissi of Foundation of International and Regional Studies in cooperation with the Friedrich Ebert Foundation Representative Office in Ukraine [24].

Figure following on the next page



Figure 2. Indices of Infrastructure Development of the Transport Subsystem of the Regions of Ukraine [24]

According to the above data, it can be seen that Ukraine has a high infrastructure breakdown of assets, including road assets. In order to reduce this gap in future scientific research, a more detailed analysis of indicators and development of measures to improve the object of study is planned. Below in this article, a theoretical overview of innovative scientific proposals in the sustainable development of infrastructure assets is presented.

3. CONTRIBUTION OF SCIENCE IN THE MANAGEMENT OF INFRASTRUCTURAL ROAD ASSETS

3.1. Pavement design

A historical overview of the development of methods of the design of pavements is presented in [9]. «The introduction of French asphalt mix design to UK airfield pavements is proposed to provide a sustainable and a better whole-life cost solution. However, in order to use these materials, a detailed laboratory investigation to assess the material properties and their impact on UK pavement design, materials specification and maintenance requirements is needed. The principles of pavement design in the UK and France considering materials specification, traffic loading and environmental variations are investigated» (Hakim; Widyatmoko; Fergusson; Richardson. 2014) [10]. The effect of recycling agent in samples of asphalt mixture is studied, one of the results is the development of a technique for estimating the viscosity of asphalt and its aging tendency [11]. «Roofs are important components of buildings and can be designed and/or retrofitted with photovoltaic (PV) and green-roof (GR) systems to produce energy and to improve stormwater management. The analysis demonstrates that a GR-PV system is a low-risk investment generating lower energy and carbon-emission payback time in comparison with separate GR and PV systems» (Ali Jahanfar; Brent Sleep; Jennifer Drake. 2017) [12]. There is a trend of breakthrough innovative technologies with the use of secondary building materials

for road systems. It is shown that such technologies increase their stability and financial savings in repair and restoration works, but their longevity has not been proved in time [13]. The strength of rejuvenated asphalt coatings depends on the amount of the recycling agent [14]. As anti-aging composites of the asphalt mixture, scientists propose to introduce Pongamia oil and Composite castor oil [15]. Among recycling technologies, a concrete mix based on electronic waste, which allows reducing dumping emissions into the environment, is of practical interest [16]. The hypothesis of the correlation of the roughness of rural road surfaces and their safety in operation, in particular, emergency situations, is investigated. The results confirmed this relationship [17]. Laboratory tests of studying the aging behavior of mixed asphalts in various cycles of heating, cooling and watering showed that «the ageing of energy reduced pavement concepts is not very critical and that the application of such pavements therefore pro CO₂ a good solution for saving CO₂ emissions and prolonging the installation season» (Raab, C., Camargo, I., Partl, M.N. 2017) [18].

3.2 Review of methods for assessing and monitoring infrastructure road assets

The number of scientific studies on the assessment and monitoring of infrastructure road systems, including the effects of natural disasters on their condition, has increased. For example, scientific monitoring studies are under way to develop optimal solutions for long-term monitoring of road systems in order to develop optimal solutions to increase their longevity in conditions of frequent flooding [19]. The technologies of digital insurance of risks affecting the change of infrastructure assets are actively discussed [20]. The practical value of innovative ideas is given in [21]. «The focus of this document is to provide a wide range of ideas and options to improve the inclusion of environmental sustainability throughout the road transportation project cycle (system planning, project planning and design, construction, and operation and maintenance) based on environmental sustainability indicators and highlighting environmentally sustainable products and materials for road construction. Sustainable economic growth in low- and middle-income countries is a key to poverty reduction and shared prosperity, which in part is dependent on reliable and safe transportation systems. Road and highway systems provide a critical function in creating and maintaining a desirable quality of life» (Montgomery, Robert; Schirmer, Howard Jr.; Hirsch, Art. 2015). In developing countries, the method of preventive maintenance and rehabilitation (M & R) activity profiles has been proposed as an alternative tool for assessing and monitoring aerodrome pavements. With this method of management, the life cycle of the aerodrome pavements [2]. «The use of remote sensing techniques offers new potential for pavement managers to assess large areas, often in little time. Although remote sensing techniques can never entirely replace traditional geotechnical methods, they do provide an opportunity to reduce the number or size of areas requiring site visits or manual methods» (Schnebele, E. 2015) [7]. For accelerated testing of road systems mobile simulators have been developed [22]. Innovative software is offered, «using the software, both the present condition of the pavement can be examined and future performance based on expected traffic values can be predicted» (Morova, Terzi, Gökova, Kardeşim. 2016) [23].

4. CONCLUSION

We can draw such conclusions:

1. At the stage of the digital scientific-oriented era, knowledge management is entering a new level of university and business partnerships in global sustainable development programs, including infrastructure assets. This requires activation of benchmarking of intellectual capital, thinking and practical skills.
2. In the management of infrastructure assets required to ensure high-effective sustainable development need to consider such strategies: a correct reform management of global

challenges; development institutional and individual capacities; the ensuring stable and sufficient funding; a simplified investment process.

3. The high probability of natural cataclysms and increased costs for insurance are becoming a significant driver in the improvement of infrastructure assets.
4. The speed of developing digital technologies, such as remote sensing, advanced analytics, autonomous operations, integrated planning and control, requires a qualitative upgrade of university educational programs and intellectual capital of teaching staff, raises the requirements for the results of training students in engineering, management and other specialties related to management of infrastructure assets, in particular, in Ukraine.

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