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Sergiy TSYKHMISTRO*, Mykhailo CHEPTSOV, Volodymyr CHEKLOV
Donetsk Railway Transport Institute
Ukrainian State Academy of Railway Transport
Artema str. 184, 83122, Donetsk, Ukraine
Marin MARINOV
NewRail, Newcastle University
Stephenson Building, Newcastle upon Tyne, NE1 7RU, United Kingdom
**Corresponding author.* E-mail: cychmistro@mail.ru

EURO-ASIAN CO-OPERATION IN RAIL EDUCATION AND RESEARCH

Summary. In this paper, rail education and research – focused initiatives, approaches, policies and practices are presented. Needs for integrating rail education and research in EU and Asia are identified and discussed. The SWOT-analysis conducted suggested that it would be of interest to set up a Euro-Asia cluster, which shall be focused on rail education and research to promote rail transport between both continents through co-operations, training and knowledge exchange.

ЕВРО-АЗИАТСКОЕ СОТРУДНИЧЕСТВО В ОБЛАСТИ ЖЕЛЕЗНОДОРОЖНОГО ОБРАЗОВАНИЯ И НАУКИ

Аннотация. В статье представлены подходы, политические инициативы и практика развития железнодорожного образования и науки. Проведен SWOT-анализ необходимости интеграции железнодорожных научных и образовательных потенциалов Европы и Азии. Предложена модель формирования Евро-Азиатского кластера железнодорожного образования и науки с целью развития высокоскоростного железнодорожного сообщения между двумя континентами

1. INTRODUCTION

Recently, significant changes have occurred in the rail industry. It has become a more globally oriented industry featuring a large variety of complex technologies, which suggests that railway education should be modified to accommodate this shift from nationally oriented industry to a global one [1]. Future rail professionals who serve in the diverse rail industry must be able to master increasing levels of new information technologies and system complexities which differ from the historical concepts that concentrated more on local issues. Such a critical need must be addressed in the rail higher education and also suggests that university programmes offered in the field should be more globally oriented and employ interdisciplinary approaches [2].

The transition to a more global rail education and training can be facilitated by initiating a closer collaboration between higher education institutions and stakeholders.

In Europe, International Union of Railways (UIC) and European Commission (EC) has already taken first important steps in creating such a network. International networking activities among European and Asian educational and research centres are surprisingly sparse in spite of the fact that many of the challenges faced by them are international in character or common to most of them.

A modern educational programme should exploit the complementary strengths of collaborating institutions and experts, to establish unique international interdisciplinary educational components and build coordinated, integrated research capacity in the multidisciplinary and complex scientific fields of railroad productivity, engineering, management, policy, planning and operations efficiency. A framework for integrating research and education and for promoting collaborative efforts across institutions spanning the two continents may be developed. Such collaboration will bring together an extraordinarily diverse intellectual community in the field of rail transport. A key issue is to have enough commonality in research and education to promote real collaboration among partner institutions, while keeping open multiple and diverse opportunities at a variety of international sites to promote participation by graduate students with diverse interests and goals.

Participants in such collaborative educational initiatives will share:

- An explicit focus on unraveling the details of interaction among the education and research themes, and on understanding how those interactions vary at different sites, based on history, economy, geography and culture.
- A focus on the pragmatics of multi-national research and education collaborations. Participants will share experience on how to overcome challenges to multi-disciplinary, multinational collaboration in rail education.

The railroad expert nucleus existing in collaborating institutions such as those participating in the European research networks should be leveraged, to match all members' resources and abilities to address strategic, tactical and operational aspects of the regional and international rail industry in an integrated way. By forging strong partnerships among key stakeholders, the potential for success of education, training and research initiatives will be maximized, bridging theory and practice. The existence of such strong industry oriented initiatives assists in the direction of advancing a major sector of the global, regional and national economy and broadening the knowledge bases pertaining to rail transportation research and education.

Cooperation between universities and rail industry, drawing on the broad range of existing academic and research strengths and capabilities, and matching them with the needs of the industry, have the potential to enhance our ability to bring critical insights to issues related to the rail industry.

Public sector agencies and private sector firms are experiencing several critical problems related to planning, managing and operating the rail transport system. There is a need for experts who understand the global nature of the industry, the needs and issues of key industry players, the objectives and interactions among stakeholders, the statutory, regulatory and institutional barriers, as well as issues related to operations, safety and security, and productivity-enhancing technology applications. University – industry collaborations are required to produce the proper programs to educate the next generation of railroad experts and properly train the existing workforce that will be capable of addressing these issues.

The analysis stated that neither European nor Asian rail education prepares the railway experts in compliance with the industry requirements to such experts. The main reason is not the harmonized university educational programs (rail education) with the current industry demands. The competence level of the graduates of universities usually does not correspond to the industry requirement for certain specializations because in the process of university education the student's competence level is formed at the excess of theoretical knowledge and lack of practice. The universities base their educational programs on what they can teach the student, not what they should teach.

Cooperation between universities and the rail industry may assist in maximizing the performance of the industry as a whole, with benefits accruing to all stakeholders of the industry, research and academia. Academic and research institutions should capitalize upon existing and build new collaborations with the rail industry to establish dynamic partnerships at a regional and international level.

China and Russia have extensive railway education systems, while, in the E.U. the current railway education is more limited. This somewhat reflects the overall number of employees in the industry, as China and Russia have significant workforce in the field. However, with increase in rail transportation, developed countries need to investigate whether the current level of education is sufficient enough for increased demand.

Though limited experiences in international approaches for railway education have been established, they are more of an exception today. More international cooperation between university and industry should be initiated through various innovative initiatives and approaches. One way to do so is to learn from other fields. Several initiatives have been successfully launched; several approaches have been successfully employed providing the opportunity for universities to select from some easily managed programs to some more complicated ones. When selecting between initiatives and approaches, it should be remembered that cooperation should be made not only between universities, but also between universities and industry and it is often effective to develop such activities in an early stage, starting from the less complex initiatives [1]. This paper discusses examples of innovative initiatives and approaches launched and applied to rail education and research.

2. GLOBAL PERSPECTIVE ON COOPERATION IN HIGHER EDUCATION BETWEEN EUROPE AND ASIA

Today, European and Asian countries are searching for more competitive answers in an increasingly competitive world. Educational mobility among countries, especially between Asia and Europe, is the key to unlocking the answer. To achieve the desired educational mobility requires bilingualism (English as the common medium for learning and instruction) and quality education with internationally recognized diplomas and degrees in higher education [3].

Enabling European-Asian cooperation between higher education institutions is essential for the development of a worldwide competitive European Higher Education Area. Comparing educational procedures and standards with each other contributes to a better understanding and closer co-operation.

Further impetus for strengthening relations between Europe and Asia comes from the 2020 strategy Europe that declares that the EU is to become a smart, sustainable and inclusive economy within a decade. In respect of the increasing role of Asia in the changing global and economic arena, it is vital that Asia intensifies cooperation with Europe in education. Consequently, the European Commission launched next programmes: ERASMUS Mundus, ASEMUNDUS, EU-Asia Higher Education Platform (EAHEP), Academic Cooperation Europe South-East-Asia Support (ACCESS) to expose European higher education to the wider world and vice versa [4].

3. INITIATIVES AND APPROACHES

Combining educational and scientific potential of the institutions specializing in rail educational and research will provide an opportunity to create a unified scientific and educational base for training and implementation of research for the development of the rail industry. This would make it possible to use human, research and educational resources more efficient which will push the rail industry to a whole new level. Mobility of professionals and knowledge exchange will be intensified, so that the competences of employees in the countries of the Eurasian space will be able to work up to the international requirements and standards. Suggesting that the imbalance seen in professional competences in the field of rail transport in Europe and Asia will be reduced.

3.1. EURNEX

Clustering processes in rail research sector have been started in Europe since launching European rail Research Network of Excellence (EURNEX) – the association of rail research European institutions. EURNEX has turned from a EU research project within the Sixth Framework Programme into a self standing legal entity in 2007. It comprises 47 scientific institutes in the area of transport and mobility all over Europe, represented by a standing committee. The Advisory Board, which directs research, consists of high level decision makers from the rail sector. EURNEX is the first research

cluster of excellence to underpin the European Research Area in the rail sector. With EURNEX, the integration of the excellent European rail researchers has been achieved.

In fact EURNEX is a European cluster in rail research [5]. Driven by operators and industries and supported by the EC EURNEX provides multidisciplinary R&D organized in scientific poles of excellence, pursuing:

- integration and knowledge sharing throughout the EU-27;
- provision of local based services in the EU member states representing the summarized knowledge of the European rail research community;
- fostering innovative, practical solutions to increase competitiveness of rail transport stakeholders and overall system.

There are 10 poles of R&D:

- strategy and economics;
- operation and system performance;
- rolling stock;
- product qualification methods;
- intelligent mobility;
- safety and security;
- environment and energy efficiency;
- infrastructure;
- human factors;
- training and education.

With the poles the involved EURNEX scientists profit by:

a) internationalization through establishing new partnerships with colleagues from other countries, thus complementing their own capabilities to improve the "individual scientific competitiveness";

b) improving the knowledge about the specific challenges and future issues of the rail system in other countries in order to enhance the understanding of the European dimension for the future rail system;

c) learning more and discussing the future issues and the project approaches to cope with these challenges through the direct dialogue with industry and operator representatives in the poles;

d) initiating and developing R&D projects on European scale within the poles and with cross-pole multidisciplinary cooperation (already done with FP7 1st call, for instance);

e) Strategic Objectives.

3.2. TUNRail

Europe has also been looking at tuning transatlantic co-operations in rail higher education. TUNRail was co-funded under the ATLANTIS programme partly managed by the EC and Department for Education. The project enhanced knowledge exchange in rail education, policy and practice between EU and US and paved the way to a robust collaboration on rail academic areas by identifying transatlantic synergies. Specifically, TUNRail employed collection and comparison of rail-focused university degree programmes delivered on both sides of the Atlantic. The initiative has been considered as an innovation in itself and aimed at increasing the transparency of rail academia and industry. A deep understanding of the synergies and differences of railway systems in the EU and US has also been gained.

In the end TUNRail team produced a railway education handbook that includes a comprehensive inventory and analysis (comparison and benchmarking) of current rail-focused university programmes, policies and practices in the EU and the US. Examples of initiatives and successful approaches in railway higher education are provided followed by a list of recommendations and strategies for enhancing transatlantic knowledge sharing and further co-operations in the field [6]. The experience of TUNrail project can help to develop Euro-Asian rail cluster on education and research.

3.3. Initiatives in Asia

In Asia, international clustering processes are not developed such as in EU or in CIS. There are strong national associations and clusters (for example, Korea Railway Association or Japan Railway Engineers' Association), which might be a base for development international cooperation.

The first Asian step has been made by a group of Russian and Chinese transport universities, which launched the International Association of Transport Universities of the Asian-Pacific region (IASTU APC), which now includes 17 railway universities from Russia, China, Korea, Mongolia, Uzbekistan and other countries. The aim of the Association is to unite the scientific potential in the railway transport industry of the Asian countries.

The 6th International Symposium for Transportation Universities in Europe and Asia (Seoul, 2013) showed the increased need for the development of cooperation between transport universities in Europe and Asia [7].

4. EURO-ASIA CLUSTER ON RAIL EDUCATION AND RESEARCH

The idea of combining rail research potentials of Europe and Asia have been suggested during the NEAR2 Project (Network of European Asian Rail Research capacities) lunched by EC in 2012. The aims of the project is building a rail research network along the Trans-Eurasian land bridge and establish an efficient cooperation among the rail research centers in order to promote railway transport research and development. NEAR2 Research Network exploited the complementary strengths of the collaborating institutions and experts to build coordinated integrated research capacity to support the railway industry at a strategic, tactical and operational level. It's was the first step to join rail research and educational potentials of Europe and Asia [8].

The idea of development of Euro-Asian cluster on rail education and research is to combine Asian and European rail scientific and education potentials. With the development of the Trans-Asian railway communication and development a new Silk Road from China to Europe there is a need to integrate the sector of rail research and education.

Transnational (international) cluster is a set of networks that shares a part of R & D, using the network effect and economies of scale to promote the products to new markets. Specificity of international clusters is that the subjects of the cluster are residents of different countries, complement each other, cooperate and compete simultaneously.

The need of the development of Euro-Asian cluster on rail education and research can be analyze by SWOT analysis (Tab. 1).

The concept employed in forming a Euro-Asian rail cluster on education and research is presented on the Fig. 1. The idea is to create General Euro-Asian coordination council of representatives from European and Asian research network and associations of rail educational institutions. In addition, it should include members from the rail industry and policy. The council will help to coordinate activities of all members of cluster to achieve synergy effect.

The main activities of Euro-Asian Rail cluster on Education and Research should be organized in a way to develop international cooperation between members of the cluster (Fig. 2). It will help to create strong base for sustainable innovative development of rail industry at whole.

The main expected result from cluster activities is a formation of an effective system of research and educational support for sustainable innovative development of rail industry in Europe and Asia.

The goal of the suggested international cluster is to develop a synergistic approach to study issues relevant to the railroad industry both from an international and a regional perspective, using an international interdisciplinary approach to the problem's. Based on this approach, the aim is to develop training programmes, which will capture the specifics and dynamics of the rail industry, addressing related issues and closely studying the major trading regions of the world. The programmes will build an understanding on how the dynamics between trading regions and among the players in this industry affect the international trade and productivity of the rail transport system.

Table 1

SWOT-analysis for the development of Euro-Asian cluster of rail education and research

STRENGTHS	WEAKNESSES
- an expanded network of rail educational and research institutions in CIS and Asian countries; - active development new Silk Road from China to Europe (high-speed rail connection along Trans-Asian land bridge), that create a demand for rail specialists with international qualification; - demand for rail innovation from rail industry; - experience of E.U. in integration processes and collaboration projects (educational and research); - demand for rail specialists with international qualification (sufficient for the development of high-speed rail connection along Trans-Asian land bridge);	- geographical distances; - differences in national standards of rail educational and research activities; - the absence of a coordination center;
OPPORTUNITIES	**THREATS**
- synergistic effect from the interaction (scientific, educational, informational); - new contacts and opportunities for cooperation; - joint rail scientific and educational potentials; - transfer of knowledge and rail technologies; - increase the mobility of staff; - harmonization rail educational/scientific standards (national and international); - single information area; - common international strategy to accelerate innovation;	- the threat of hyper-specialization of the cluster; - it's possible that a single company will be more competitive compared with cluster («locked-in effect»);

5. CONCLUSIONS

For the purposes of this discussion we presented a discussion on rail education and research-focused initiatives, approaches, policies and practices. Specifically we looked at: EURNEX, TUNRail and NEAR2. Our studies suggest that there is a need for joint ventures in rail education and research between Europe and Asia. Therefore we propose to set up and run a Euro-Asia cluster on rail education and research, which will promote the rail transport between Europe and Asia through international co-operations and training programmes.

The key findings include:

- a possible integration of Asian and European rail education/research potentials could give a new impetus to the development of this sector.
- an effective type of interaction can be secured through a Euro-Asian rail cluster on education and research;
- it is imperative to collaborate with key actors in rail education and research in Europe, CIS and Asia;
- clearly identified roles in combining Euro-Asian rail education/research potentials are crucial for the success of the initiative.

Further work will focus on developing an effective mechanism for co-operation to reach a synergy effect and create a roadmap for the cluster activities. Another direction of interest shall employ studies to identify critical issues and concepts for European/International standards in rail education and research, which would help uniform and harmonize rail education and research-focused policy and practice in the world.

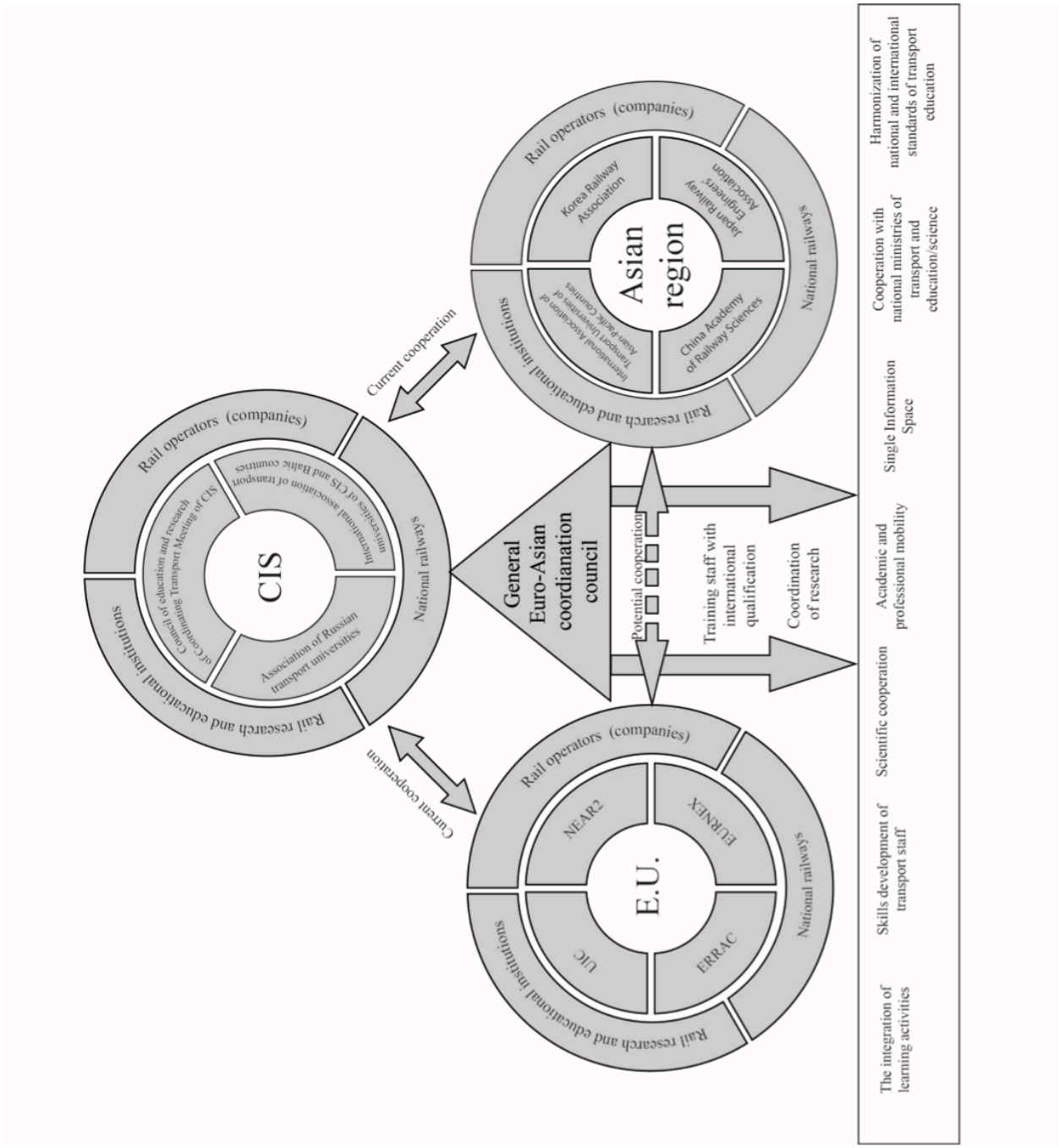

Fig. 1. A schematic presentation of the concept employed in forming a common Euro-Asian rail cluster on education and research

Рис. 1. Концепция создания Евро-Азиатского кластера железнодорожного образования и науки

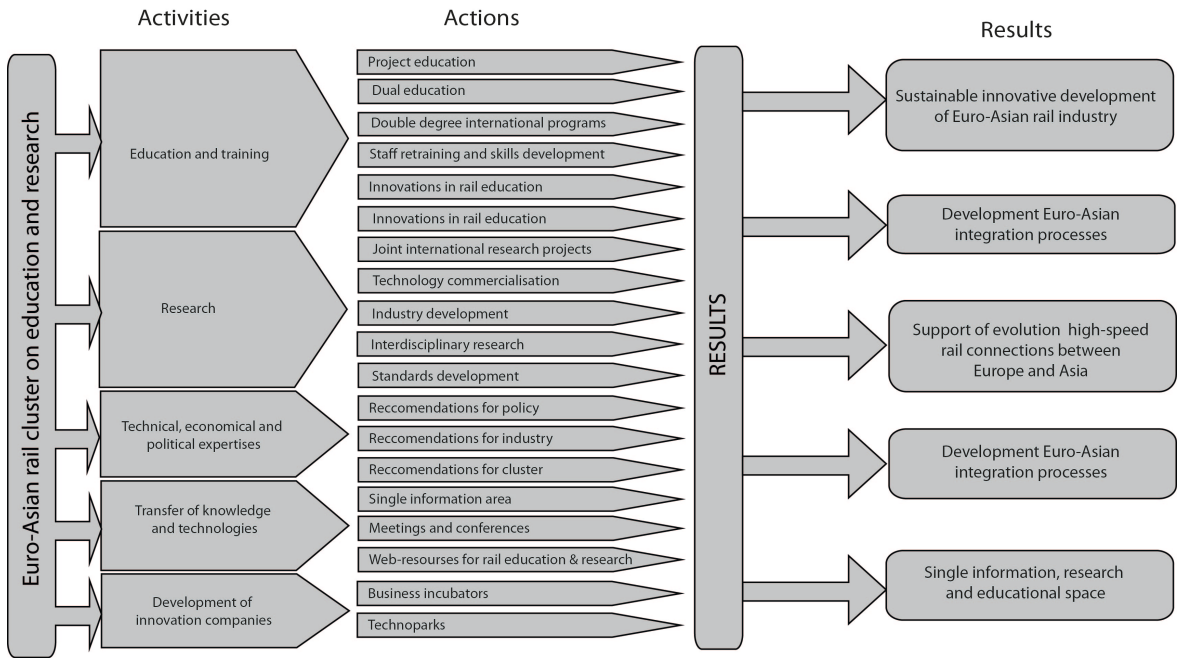

Fig. 2. Envisaged activities for Euro-Asian Rail Cluster on Education and Research
Рис. 2. Задачи Евро-Азиатского кластера железнодорожного образования и науки

Bibliography

1. Chao, Ma & Pasi, T. & Lautala, P. Railway education today and steps toward global education. *Proceedings of Joint Rail Conference 2011*.Pueblo, Calorado. 16-18 march 2011. P. 1-10.
2. Marinov, M. & Pachl, J & Lautala, P. & Macario, R. & Reis, V. & Edwards, R. Policy-Oriented Measures for Tuning and Intensifying Rail Higher Education on both Sides of the Atlantic. In: *4th International Seminar on Railway Operations Modelling and Analysis (IAROR)*. Rome, Italy. 2011.
3. Mongkhonvanit, P. & Emery, S. Asian Perspectives on European Higher Education. *Higher Education in Europe*. 2003. Vol. 28. No. 1. P. 51-56.
4. *Succeeding in European-Asian Higher Education Cooperation. ASEMUNDUS – Good Practice Report.* Available at: http://www.asem-education-secretariat.org/en/12184 http://www.asem-education-secretariat.org/en/12184/.
5. *Transport Research & Innovation Portal. European rail Research Network of Excellence*. Available at: http://www.transport-research.info/web/programmes/programme_details.cfm?ID=38584.
6. Marinov, M. & Lautala, P. & Pachl, J. & Edwards, R. & Reis, V. & Macario, M. & Sproule, W. & Barkan, C. *Transatlantic Cooperation in Railway Higher Education (TUNRAIL)*. Handbook for Railway Higher Education. 2011. Available at: http://www.ncl.ac.uk.
7. *The proceedings of the 6th International Symposium for Transportation Universities in Europe and Asia*. Korea National University of Transportation. Seoul. 2013. P. 150.
8. NEAR2 project. Available at: http://near2-project.eu/.
9. *Proceedings of the 6th International Symposium for Transportation Universities in Europe and Asia*. Seoul. 2013. Available at: http://dropmefiles.com/mAZWX.

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