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IN THIS ISSUE

Editor's

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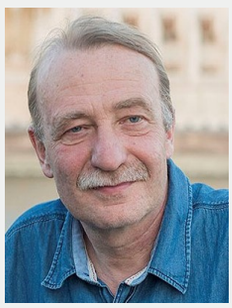

The last years have been the time of real challenge for rolling stock division in the Railway Research Institute. European Union's funding for the rolling stock purchase resulted in a significant growth of new types of vehicles to be tested by the Institute. New European legislation has been incorporated into the Polish law. The Railway Interoperability Directive, Technical Specifications for Interoperability (TSI), European standards, the accreditation requirement for testing laboratories are now in force.

The Rolling Stock Testing Laboratory and Rail Vehicles Department, which I am the head of, had to address these challenges. In order to perform tests, we have developed new research and testing procedures taking into account the latest European requirements. We have received accreditation for these procedures by the Polish Centre for Accreditation. We have exchanged and completed the research equipment and improved the personnel competence. Our employees have specialized in carrying out tests and assessment of vehicles for the needs of certification conducted by the Institute as NoBo, DeBo and AsBo. Despite such ambitious plans, we have not neglected our fundamental missions such as research, publications, technical assistance and advice for state bodies.

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A cooperation agreement between the Czech Research Institute and the Railway Research Institute

On Tuesday, 26 September 2017, a cooperation agreement between the Czech research institute - Vyzkumny Ustav Zeleznicni, a.s., represented by Director of the Institute František Bureš and Vice – director Antonin Blažek, and the Railway Research Institute, represented by Director Andrzej Żurkowski, was signed in Gdańsk at the 12th anniversary edition of the TRAKO International Railway Fair. The agreement includes mutual cooperation in the field of testing, certification, assessment, research and development.

Initiating cooperation between the Railway Research Institute and PKP Informatyka

A letter of intent, initiating cooperation between the Railway Research Institute and PKP Informatyka in the area of mutual IT solutions, R&D projects, the developing of new products and services as well as looking for the ways of their funding, was signed on 27 September 2017 by Manager of the Board, Tomasz Miszczuk on behalf of PKP Informatyka and Director Andrzej Żurkowski, in the name of the Railway Research Institute.

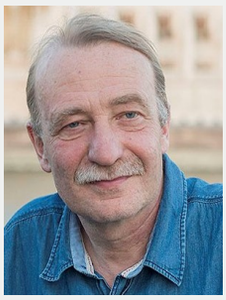
TRAKO International Railway Fair

The 12th anniversary edition of the TRAKO International Railway Fair was held on 26 – 29 September 2017. Not only was the Railway Research Institute represented by its Directors but over 80 experts as well. The stand was shared by most important railway market offices, i.e. the Ministry of Infrastructure and Construction, the Office of Railway Transport and the Centre for EU Transport Projects.
The Railway Research Institute was the coorganizer of two conferences:

- Infrastructure Manager – Contractor and Manufacturer – Notified Body. How the relations between these entities influence the implementation speed and costs, effectiveness, quality and innovation of investments. What have we achieved? What lies ahead? (PKP PLK – IGTL – IK).
- Digital Platform vs the implementation of the 4th Railway Package (UIC – IK).

Rolling Stock Testing Laboratory and Rail Vehicles Department

Sławomir Walczak
Head of Rolling Stock Testing Laboratory and Rail Vehicles Department



The Rolling Stock Testing Laboratory and Rail Vehicles Department, which I manage, are located within research structures of the Railway Research Institute.

The Rolling Stock Testing Laboratory and Rail Vehicles Department carry out tests and assessment of complete rail vehicles. We perform tests of dynamics and safety of the drive, of brakes and their elements, strength, noise, air condition, heating and lighting of vehicles. We are equipped with unique, highly specialized research stations and stands. We carry out stationary tests and also test during measurement drives on the Test Track facility at Żmigród and the PKP-PLK railway network.

Fig. 1 Rail vehicle 21wEa - Elf II PESA

We hold PCA no AB 742 accreditation for a research laboratory to perform key research projects. The tests conducted by us are the basis for railway vehicle manufacturers to develop their innovative products, and in case of the final product – its certification. We carry out operational tests in cooperation with licenced railway undertakings so as to implement new vehicles into service. We also conduct expert reports, opinions and assessments within the certification process of railway vehicles that comply (or not) with TSIs, of sidings, underground, and of narrow gauge rail. The Rolling Stock Testing Laboratory's experts are certification teams' chairmen as well as technical auditors.

Fig. 2 Lokotraktor Zephir

In recent years we have tested a large number of new railway vehicles which are now successfully operated by various Polish and European railway undertakings starting with tests of Pendolino type ED250, during which we broke a speed record on Polish rails amounting to 293 km/h, locomotives (e.g. Newag's Gryffin, Siemens' Vectron), agglomeration trains (e.g. Newag's Impulse family, Pesa's ELF II family, Stadler's Flirt II family), freight wagons (Greenbrier's and GATX tank wagons), as well as infrastructure maintenance and repair vehicles.

Fig. 3 Locomotive Gryffin NEWAG

Our employees are heads of research projects carried out by the Institute's consortia with industry co-financed by NCBR - the National Centre for Research and Development (e.g. Project of a vehicle for transporting turnouts - IK and KZN Bieżanów consortium). We develop new research stations and stands as well as measurement methods for the needs of tests completion in order to implement changing European legislative acts (e.g. a stand for measuring temperature, couplings for impact and brake tests, for processing vehicle dynamic parameters). We organize trainings for railway undertakers and manufacturers in the scope of new European law implementation. We also provide technical support for representatives of the government and parliament in the area of law created within the Community.

Fig. 4 Rail vehicle Impuls NEWAG

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Testing and placing in service road – rail vehicles

Paweł Winciorek
Senior engineering and technical specialist

Road – rail vehicles can be placed in service in 2 modes:

- by means of attestation – pursuant to Art. 22 of the Railway Transport Act of Law of 28 March 2003 (i.e. Journal of Law 2016 item 1727 with further amendments). The scope of technical tests necessary to issue a type attestation of a railway vehicle is presented in § 14 of the Regulation of the Ministry of Infrastructure and Development of 13 May 2014 on placing in service certain kinds of constructions, equipment and railway vehicles (Journal of Laws 2014 item 720).

These provisions apply only to vehicles intended for operation on:

- railway sidings,
- private infrastructure,
- narrow gauge infrastructure,
- metro,
- railway network which is functionally distinguished from the railway system and dedicated only to provide intervoivodship (province) or local transport.

- by means of permission – as vehicles that do not comply with TSI - pursuant to Art. 23b of the Railway Transport Act of Law. It must be added that there are different paths of placing a vehicle in service:
  - the first permission to place in service a railway vehicle non compliant with TSI (Art. 23b item 6 of the Railway Transport Act of Law),
  - additional permission to place in service a railway vehicle non compliant with TSI, with prior authorization to place in service onto the European Union's territory (Art. 23g of the Railway Transport Act of Law).

Fig. 1 Road – rail vehicle Unimog U423 intended for shunting

Railway vehicles that do not comply with TSI are subject to verification including the following tests:

- of conformity with national technical specifications and standardization documents as defined in the list issued by the President of the Office of Rail Transport (UTK) of 19 September 2017,
- of conformity with railway network, especially in the area of the vehicle's technical and operational characteristics conformity with infrastructure and fixed installations,
- of the vehicle parameters to be checked in conjunction with the placing in service (the list of parameters is included in Annex 4 of the Regulation of the Minister of Infrastructure and Construction of 21 April 2017 on railway system interoperability (Journal of Laws 2017 item 934).

Fig. 2 Road – rail vehicle UniRoller-S intended for rescue and rerailing operations

These provisions apply to vehicles intended to operate on railway network on the territory of the Republic of Poland.
It needs to be added that § 14 of the Regulation on railway system interoperability that states about the limitation of parameters necessary to be checked applies to vehicles designed to drive on railway track and public roads.
The following standards are used for road – rail vehicles' assessment:
PN-EN 15746-1+A1:2012 – Railway applications - Track - Road-rail machines and associated equipment – Part 1: Technical requirements for running and working,
PN-EN 15746-2+A1:2012 – Railway applications - Track - Road-rail machines and associated equipment - Part 2: General safety requirements.
Recently the Rail Vehicle Department of IK has issued opinions relating to the following road-rail vehicles: LOK 22.520, LOK 16.300, LOK 10.170, CRAB 3100E, Unimog U423, UniRoller-S, AD 190 T 31 W, 9C160 Orion, which were granted relevant documents authorizing placing in service issued by the President of UTK in Warsaw.
Fig. 1 and 2 present exemplary road-rail vehicles that operate in Poland.

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IN2STEMPO project within Shift2Rail JU with the engagement of PKP SA and IK

Eliza Wawrzyn
Head of the Unit of Project Coordination and International Cooperation

Innovative Solutions in Future Stations, Energy Metering and Power Supply (IN2STEMPO) addresses the call S2R-CFMIP3- 01-2017 Smart System Energy Management Solutions and Future Station Solutions within the Shift2Rail Joint Undertaking. The project started on 1st of September 2017 and will run over 60 months under the coordination of Network Rail. There are nineteen participants including eight Linked Third Parties (LTP) (Fig. 1). The total amounts to 13.6 M€ with max. EU contribution of nearly 6 M€.

Fig. 1 IN2STEMPO Project Partners

IN2STEMPO aligns with the Shift2Rail objectives and aims to reduce lifecycle costs, improve reliability and punctuality, whilst increasing capacity, enhancing interoperability and improving the customer experience. The IN2STEMPO Smart Power Supply activities seek to contribute to the development of a railway smart grid based on the development of a unique railway power grid in an interconnected system. This new railway network will integrate smart metering, innovative power electronic components, energy management and energy storage systems. This new concept will lead to improved and optimised train traffic, energy costs, and energy supply security for the railway system. In parallel it will allow for optimised solutions to be developed through optimising investment, operation costs and maintenance. The IN2STEMPO Smart Metering research activities will introduce a non-intrusive smart metering sensor network at a railway system level. It will demonstrate an open system and interface for data collection, aggregation and analysis at an open source Operational Data Management level. The applications will exploit the energy analysis process with the aim of enhancing energy decision-making and line operation patterns. Other possible applications include preventative maintenance plans, asset management and Life Cycle Cost dashboards.

The IN2STEMPO Future Stations activities are aimed at improving the customer experience and safety at stations, resulting in a better passenger experience for customers using the railway. Research will be focused on improving crowd management in high capacity stations, station design and components, accessibility to trains and new ticketing technologies.

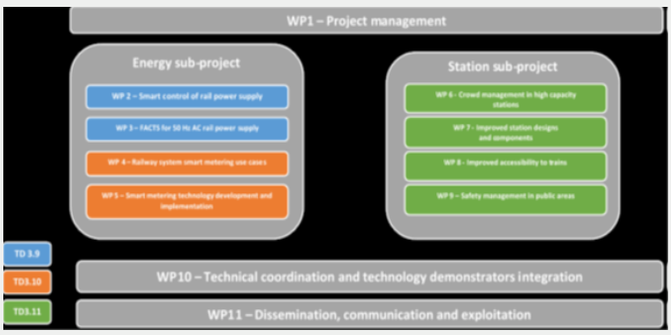

Fig. 2 Scope of the IN2STEMPO project

PKP S.A. together with IK (LTP) contribute to the Station sub-project in the three work packages (WP): WP 6, WP 7 and WP8 (Fig. 2).

The overall objective of WP6 is to significantly improve customer experience and security in large & high capacity stations (especially large interconnect stations and multimodal hubs) both during standard operations and in emergency cases by using tools allowing to represent crowd simultaneously as a flow or a large group of persons with individual motivations.

The aim of this WP 7 is to deliver significant improvement in the design of low capacity stations and optimize the design process from concept to construction by developing standardized solutions and modules available for implementation. This will enable the reduction of construction and operational costs at railway station facilities which add to the life cycle cost of a railway station. Design will also take into account evolving needs of passengers, the opportunities for low-energy usage and use of autonomous smart solutions supporting digital and web-based services.

The following objectives will be handled in WP8: Improved accessibility to trains for all passenger groups by addressing issues related to the platform-train-interface (PTI). This will result in an improvement in the ease-of-transfer as well as an improvement of the customer experience. The majority of existing platforms cater for a variety of rolling stock with varying floor heights. Curvature of existing platforms creates gaps between train and platform. Reconstruction of existing platforms is very expensive and cannot be justified where rolling stock is variable. On the basis of this state-of-the-art description the ambitions are to develop solutions that will allow safe and inclusive access to the train, will not be too demanding on maintenance and should not increase the dwell time of the train significantly.

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Railway Research Institute's new equipment for monitoring rail defects

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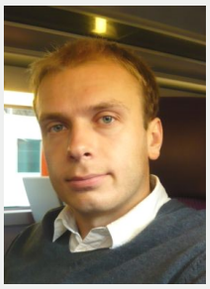

This year the Railway Research Institute has extended its research possibilities in diagnosis of railway track. The new device is based on eddy current nondestructive method to detect and measure head checks on rails.

1. Problems with head checks

Head checks are developing mainly in curves with a radius of 600-1000 meters. The curves of smaller radii development of these defects usually inhibit the wear of rails. The factors contributing to the development of the head checks include a higher internal load resulting from a low cant deficiency, which results in the load relief of the vehicle wheels in the external course of the arc. The scratches on the surface over time propagate inward, causing cracks and broken rails [1].
Head checks can be prevented by frequent diagnostics and observation of track sections that are vulnerable to defects. Measurement of defects is the most effective with eddy current devices. The new IK device is one of the first of its kind in Poland.

Fig. 1 GF04 measurement device
Source: the author' own materials

2. New device

The GF04 device is suitable for rolling contact fatigue crack measurement. The four probes (with changeable stands) of the device - working on eddy current principle – scan the rail surface to be examined.
The measuring results are displayed continuously on the computer of the device. The measured data are represented in real time in time diagram and in vector plan as well. During the operation the operator can sign certain specific areas in the measuring results with markers.
The evaluation of the damage depth is executed with different colours according to the error range determined by the railway company that utilizes the data.

The meaning of colours is as follows:
– green – depth 0÷0,5 mm,
– yellow – depth 0,5÷1,5 mm,
– orange – depth 1,5÷2,7 mm,
– red – depth 2,7÷5 mm,
– brown – depth above 5 mm.

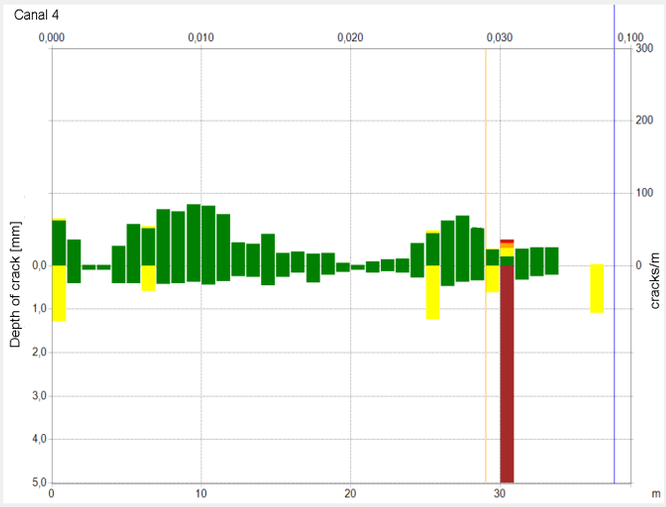

Fig. 2 Example of the results
Source: the author' own materials

Graph on Figure 2 shows an example of the results from a railway turnout. On the top of the graph presented on Figure 2 we can see the numbers of defects per 1 m, on the bottom we see maximum depth of defects. There are a lot of defects with depth below 0,5 mm. Defects are deeper at the end of the switch (10. m).

3. Research opportunities

The new device allows performing measurements of head checks as part of evaluating the effectiveness of profiling rails, as well as for diagnostic purposes.
The second application is particularly interesting as the problem of defects on the running surface has not yet been thoroughly diagnosed in Poland. No elaboration has been made, which would identify the scale of the problem on the Polish railway network. There are many foreign publications on these issues, but due to the nature of the technical railway tracks and vehicles, which are used in Poland, few applications of foreign authors can be adapted to the conditions of the Polish railway network.

[1] Stencel G.: Evaluation of Running Surface of Rails by Measuring Corrugation. Railway Reports, Warsaw 2016, Issue 170, pp. 87-93.

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EMC research capabilities of Signalling and Telecommunication Laboratory

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Research and technical specialist,
EMC and Disturbances Coordinator

The Signalling and Telecommunication Laboratory, accredited in 2000, operates basing on management system compliant with PN-EN ISO/IEC 17025 standard. The aim of pursued quality policy is to provide a high level of conducted research as well as meeting the requirements and expectations of our Clients. The laboratory acts in an impartial, independent and neutral way, whereas its staff qualifications ensure professionalism of research and high level of laboratory services.

Electromagnetic compatibility tests carried out by the Laboratory could be considered in two aspects:

- immunity – defined as ability of the system, equipment to operate without degradation of performance in the presence of electromagnetic disturbances,
- emission – defined as system or equipment impact by emitted electromagnetic waves on other systems or equipment located in a close electromagnetic environment.

In the EMC research area, the Signalling and Telecommunication Laboratory develops its own research competence and capabilities. The progress in testing and measurement is particularly visible through the purchase of advanced apparatus, drawing up research procedures and activities directed to confirm its competence by maintaining and acquiring the enlargement of the accreditation scope granted by the Polish Centre of Accreditation by new research methods. The main EMC tasks of the Signalling and Telecommunication Laboratory include the following:

- carrying out emission measurements of electromagnetic radiated disturbances and conducted as well as magnetic fields levels in compliance with the requirements of PN-EN 50121-x-x and PN-EN 50500 railway standards for new and modernized railway and urban rail vehicles on the Test Track in Żmigród as illustrated in Fig.1,
- carrying out emission and immunity tests of products and electric and electronic equipment installed on the rolling stock in compliance with requirements of PN-EN 50121-3-2 standard,
- carrying out emission and immunity tests of control, command and signaling equipment in compliance with PN-EN 50121-4 standard, as well as fixed power supply installations and apparatus according to PN-EN 50121-5 standard,
- carrying out emission and immunity tests of telecommunication products used in PKP, including analogue radio systems operating in 150MHz band as well as GSM-R standard radio systems,
- carrying out emission and immunity tests of any kind of Passenger and Visual Information Systems placed on railway stations, PKP stations and halls.

Fig. 1 EMC measurement stand at the IK Test Track in Żmigród

In case of testing the equipment or systems used by PKP, most of the immunity tests are conducted in the laboratory located in the Railway Research Institute premises in Warsaw in compliance with European and national standards of PN-EN 61000-x-x series, as illustrated in Fig. 2.

In order to meet our Clients' expectations, the Signalling and Telecommunication Laboratory's research offer in the EMC testing has been expanding over several years. Currently the Laboratory holds AB 310 accreditation extended with tens of measurement methods.

Fig. 2 EMC immunity measurement stand at IK premises in Warsaw

Special attention should be drawn to accreditations connected with testing electromagnetic compatibility in the scope of:

- testing immunity against electrostatic discharge (*ESD*),
- testing immunity against electrical fast transient (*BURST*),
- testing immunity against electrical surges (*SURGE*),
- testing immunity against voltage dips, short breaks and changes of voltage supply for AC powered devices,
- testing immunity against voltage dips, short breaks and changes of voltage supply for DC powered devices,
- testing immunity against electromagnetic field in the frequency of the current in the network.
- testing immunity against pulsed magnetic field,
- measurement of radiated disturbance in the frequency range from 9 kHz to 6 GHz both for the rolling stock and devices,
- measurement of conducted emissions disturbance on overhead contact lines and onboard low voltage supply systems in the frequency range from 150 kHz to 30 MHz both for the rolling stock and devices,
- testing levels of magnetic fields generated by electrical and electronic devices in the railway environment with regard to exposure for humans.
- In 2017, the Laboratory is going to extend its EMC offer by 3 new measurement stations connected with both the rolling stock testing and railway products as well, in the following areas:
- testing immunity against trapezoidal surge wave in compliance with PN-EN 50155 standard,
- testing immunity against induced conducted disturbance by radio frequency fields in compliance with PN-EN 61000-4-6:2014 standard,
- measurement of harmonic emissions in railway rolling stock 230V AC onboard supply network in compliance with the new edition of PN-EN 50121-3-2:2017 standard.

Fig. 3 State-of-the-art measurement equipment for EMC tests purchased by the Railway Research Institute

Progressive extension of accredited EMC tests shows continuous development and competence growth of the Signalling and Telecommunication Laboratory, which systematically reacts to new railway environment's research needs and adopts a wide array of tests as illustrated in Fig. 3 the purchase of the state-of-the-art measurement equipment to test EMC emissions and immunity.

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The significance of innovativeness in the contemporary world

Renata Barcikowska
Vice Head of the Unit of Project Coordination and International Cooperation

"Innovativeness" is one of frequently used terms in the 21st century. The Europe 2020 strategy defines a new direction for the development of innovativeness and entrepreneurship. It is particularly important for Poland in the period from the moment when it joined the European Union till now.

1. The concept of innovation

The concept of innovation could be understood in many ways. There are many different definitions of the term depending on the area of science in which it functions (e.g. medicine, economics, philosophy etc.). Below the popular concepts of innovation by chosen authors are listed. The examples are presented in chronological sequence – according to the time of their formation.

Table 1. Chosen definitions of innovation

J.A. Schumpeter, *Teoria rozwoju gospodarczego (Theory of Economic Growth)*, Warszawa 1960, p. 104.	"The introduction of new products, new methods of production, finding new markets, acquiring new sources of resources and introducing a new organization".
P.F. Drucker, *Innowacja i przedsiębiorczość, praktyka I zasady*, (Innovation and Entrepreneurship), Warszawa 1992.	"Specific instrument of entrepreneurship – activity which creates new opportunities for creation of goods on the basis of the same resources".
Ph. Kotler, *Marketing, analiza, planowanie, wdrażanie I kontrola*, *(Marketing Management: Analysis, Planning, and Control)* Warszawa 2002.	"The term refers to every good that is regarded by someone as new".
W. Griffin, *Podstawy zarządzania organizacjami* (Fundamentals of Management), Warszawa 2005.	"Focused effort of an organization for the purpose of mastering new products and services, or new applications of existing product and services. Innovation is also a form of control in the sense that it helps an organization keep up with competition".

Source: author's own materials prepared on the basis of literature on the subject

The above definitions show that the perception of innovation changed along with the social-economic changes taking place over the years. In the one formulated by J.A. Schumpeter the key word is "new". The author linked innovations with the first application of particular solution and focused above all on technical innovations and their significance for the economy.
Basing on Schumpeter's deliberations it was assumed that the innovation process constitutes a sequence of events starting with the creation of an idea (invention) through the materialization of the idea (innovation) to its dissemination (diffusion). The theoretical deliberations concerning innovativeness are necessary and needed. This is the best tool for practitioners to present phenomena associated with innovation.

2. Innovativeness in the development of Knowledge –based Economy in Europe

Knowledge is the main production factor and innovation is the main competitiveness factor of a company and the whole national economy defining its development. Without them it is impossible to build a knowledge-based economy.

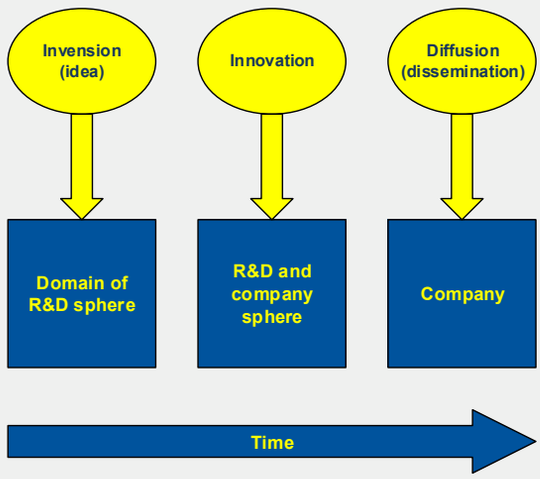

Fig. 1 Innovation process

Source: own study

It is worth concluding that the determinants of the development of knowledge-based economy are: human capital, universities, scientific research institutions, financial institutions as well as IT infrastructure. All elements are necessary for the proper functioning and development of a contemporary economy. They should influence each other during practical use. They should influence each other during utilization in practice.

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