How Innovations Change the World? Social Aspect of Technological Development in Poland

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Introduction

21st century is abundant in continuous, dynamic technical advancement. This progress drives economy and in consequence changes lives of societies at local and global level. However, being innovative is frequently understood only as technical improvement and thus does not take human aspect into consideration while all innovation should be human-centered. Facing flourishing digitalization of products, commonness of computers, Internet of Things and their augmenting processing power and memory, as well as universal access to the Internet and algorithmization of services it is crucial to pay close attention to practical features and social influence of technology. That is why we can emphasize some research questions regarding the topic of this paper. How do innovations affect the development of countries? What are the types of innovations? Does the technological innovation have a big role in today's society? Which institutions support innovations in Poland? What is the state of Polish innovation? What are the methods and techniques of innovation management? How is their social dimension? The aim of the project will be to confirm or overthrow the research hypothesis that Polish technological innovation contributes to the development of society. This article presents the results of analyze devoted to the use of technological innovations including opportunities offered by them. Practical part with case studies, is based on best-practice examples from the domestic market review.

1. Innovation as a development factor

1.1. Concept and essence of innovation

As defined in the Encyclopedia of Management[1], the word innovation comes from Latin 'Innovatio' which means renewal. That is the series of activities leading to the implementation or creation of a new, significantly improved product, process, new method or organizational system in internal business activeness or external communications. It is believed that the term "innovation" was introduced in the literature of Joseph Schumpeter in the 1930s, while distinguishing at the same time 5 cases in which innovations occur[2]:

- New product creation,

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[1] https://mfiles.pl/pl/index.php/Innowacja (14.04.17)
[2] Marciniak, S. (2010). *Innowacyjność i konkurencyjność gospodarki*. Wydawnictwo CH Beck.

- Implementation and application of new technology, production method,
- Setting up a new sales market,
- Acquisition of unknown raw materials,
- Reorganization of a particular branch of the economy.

There are some main goals of innovations' existence. There is a possibility to mention for instance an increase of organizations' competitiveness in the market, reduce operating and administrative costs, rationalize the consumption of resources and raw materials, enrichment of the offer, the quality improvement and meeting legal requirements and standards[3][4].

In practice, the process of innovation is quite complex and time-consuming. That is because of the need to test the effectiveness of new solutions at each stage of its development. A schematic example of the innovation management process is shown in the Figure 1.

Figure 1. Process of innovation

Source: Own elaboration based onDolińska, M. (2004). Innowacje w przedsiębiorstwie, na rynku, w regionie. Ekonomika i Organizacja Przedsiębiorstwa, (9), 18-25.

1.2. Classification of innovation

Due to the numerous paradigms and research perspectives, many types of innovation stand out because of the various criteria[5][6]. Differentiation of classification is presented in Table 1.

Tabel 1. Classification of innovation

Criterion	Type of innovation	Details
According to the subject of the change	technological / technical	Based on the results of scientific research and scientific activity, they are the most expensive but most profitable
	organizational	They are based on a change in the way a company operates and the work reorganization, it is often costly, usually related to adapting to legal processes or customer requirements.

[3] Poznańska, K. (1998). *Uwarunkowania innowacji w małych i średnich przedsiębiorstwach*.
[4] Poznańska, K. (2006). Czynniki sukcesu małych przedsiębiorstw w Polsce. *Ekonomika i Organizacja Przedsiębiorstwa*, (numer specjalny), 90-94.
[5] Drucker, P. F., & Noel, J. L. (1986). Innovation and Entrepreneurship: practices and principles. *The Journal of Continuing Higher Education*, *34*(1), 22-23.
[6] http:// pi.gov.pl/Firma/chapter_95851.asp (25.05.17)

	process	Associated with the operation of various processes (mainly production or service), involves the implementation of process improvements
	social	Relates to the human and non-productive aspects of organizations
	marketing	Related to marketing mix areas, sales and distribution of the offer and products
	ecological	They have the task to reduce the emissions of pollutants into the environment, are linked to sustainable development
According to the originality of the changes	Imitating (secondary)	Based on imitation, duplication, copy of original changes, which have proven themselves in practical terms
	Original (primary)	These are independent inventions, discoveries and inventions, applied for the first time in the economy
According to the scale and scope of the changes	Radical	They are based on new, unreleased solutions
	Partial	Their essence is to streamline and modernize, their goal is to improve the specific features of the object, service or process

Source: Own elaboration based onDrucker, P. F., & Noel, J. L. Innovation and Entrepreneurship: practices and principles, Poznańska, K. Uwarunkowania innowacji w małych i średnich przedsiębiorstwach oraz http:// pi.gov.pl/Firma/chapter_95851.asp (25.05.17)

1.3. Methods and techniques of innovation management

Innovation understood in the context of introducing new solutions, ideas, technologies to the market cycle requires a smooth model of management. It is to achieve the concrete success and measurable financial benefits. In 2015, Y. Taran, H. Boer and P. Lindgren made a classification of innovations' management models taking into consideration the criteria of range, radicalism, and complexity. Referring to the strategic context (proactivity/reactivity) and to the organizational architecture (openness/closeness) the following subdivision was presented[7]:

The open/proactive model is characterized by a high degree of radicalism and innovation, while its complexity is low,

The closed/proactive model - characterized by high coverage, radicalism and complexity of innovation,

The open/reactive model - has a low degree of radicalism and complexity, with a high degree of innovation,

[7] Ćwiklicki, M. (2015). Klasyfikacja modeli zarządzania innowacjami. In *Management Forum* (No. 4 (3), pp. 27-31). Publishing House of Wroclaw University of Economics.

Closed/reactive model - described by high level of complexity and low degree of reach and radicalism.

The approach to innovation management techniques has changed in the 20th and 21st centuries. Here is the description of the 3 most popular concepts of the aforementioned models found in market practice[8]:

1. H.W. Chesbrough - the concept of open innovation. Dominates in the 21st century. The innovation process is based not only on the organization's own resources. Innovation is the result of numerous complex interactions between individuals, organizations and the environment. Companies cannot rely only on their own research but they should share knowledge and acquire solutions from others. Sharing in the meanwhile their own solutions that they do not use (sale of licenses).
2. H. Etzkowitz – the concept of the Triple Helix. Innovations are the result of cooperation between science, government and private sector. Relations between sectors determine economic growth. The scientific sector is represented by private universities, state universities and by various research, development institutes and the industrial business environment.
3. E. von Hippel - the leading user concept. It is based on understanding the public and hidden needs of consumers. It consists of the clients' involvement in product development and the use of customer information. The driving force behind innovation processes can be defined as dissatisfied consumers who streamline the product. Lead users - individuals or companies who have created their own unique solutions because none of the available products meet their needs.

Innovation is inherent in the development of new technologies. A different distribution of innovation management models is provided in Table 2.

Table 2. Styles of innovations management

Typology Virtual TODI	Sample methodologies and tools
Market Intelligence Techniques	Patent analysis Business Intelligence Benchmarking CRM Technology Watch Virtual communities
Collaborative tools and networking	Groupware
HR tools	E-learning Intranet Teleworking Videoconferencing

[8] Kozioł-Nadolna, K. (2012). Modele zarządzania innowacjami w XXI wieku [w:] Historia i powstanie nauk o zarządzaniu, red. *B. Mikuła, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków*.

Techniques for creative problem-solving	Altszuler's Algorithm Brainstorming Mind map
Project management techniques	Value analysis Fast prototyping Project management

Source: http://imik.wip.pw.edu.pl/innowacje27/strona13.htm (15.04.17)

The above-mentioned forms of innovation management are very often found in startups and creative agencies, where unusual ideas are of above average value. They are most likely to be implemented through the development of new technologies that are currently operating in the common business practice. The tabular list does not constitute a closed collection and is constantly expanding, due to the dynamics of the market and its users.

1.4. Innovations as development factor

1.4.1. Organization success vs. innovations

According to the classics of management, the task of the organization is to efficiently and effectively achieve the objectives, with a variety of resources (human, material, financial and information[9]) . But the success factors of the organization are not only indicators of economic profit, which is supposed to be treated as a tool to achieve development goals. Thus, the proper use and management of specific financial gains to improve the efficiency of an enterprise and, consequently, to translate into people's lives can only prove being successful.

Creating innovations can certainly contribute to a successful market organization and build a competitive advantage. Innovations significantly increase the market value of businesses, affect their image and build greater financial independence. They allow you to set your own pricing policy and dispose of distribution rights. Efficient innovation management plays a key role and can contribute to significant economic success[10].

1.4.2. Innovation's role in social development

The social dimension of innovation is characterized by great dynamics and interdisciplinarity, as its aim is to improve the quality of life and functioning of people through products, services or process solutions. Due to that fact, it is given the priority of the National Research Program "Social and Economic Development of Poland in a Globalizing Market". An important role of technological innovation is also included in the Strategy of Innovation and Efficiency in the direction of 2.4. "Creation of the innovative culture and broadening the inclusion of people in creative thinking and innovation" - it emphasizes the importance of promoting openness towards innovation in society, to improve the quality of people's lives. The role of

[9] Griffin, R. W., Rusinski, M., & Rozanska, I. (1999). Podstawy zarzadzania organizacjami; Przekl. M. Rusinski; Konsultacja nauk. B. Glinski; Red. I. Rozanska. Warszawa: Wydaw. Nauk. PWN.

[10] Baruk, J. (2013). Innowacje jako czynnik sukcesu organizacji. Zarządzanie i finanse, 4(1), 7-16.

innovation in building social capital can also be read in the document "Strategy for smart and sustainable growth supporting society: Europe 2020" in which the Innovation Union was set up. That was created to oversee the transformation of innovative ideas into products and services for economic growth and job creation. The above issues are discussed in detail in numerous documents inter alia Empowering people, driving change. Social Innovation in the European Union[11].

According to the assumptions above, the "Make Tech Human" and "Human in the center" trends are gaining in popularity in the reference to genuine need to use technology in the service of humanity. Life Quality Technologies (LQT), for example, is a modern, advanced solution for the sick, elderly and disabled, designed to improve their lives. Rapid technological development should go hand in hand with their sociological dimension, both in terms of usability and the productive process associated with human work[12].

2. National dimension of technological innovations

2.1. Measures of economic innovations

Due to the multidimensional nature of innovation, one cannot be easily measured with universal macroeconomic indicator. The quantitative description is valuable only to numerical values, which are one of the many components of the success of economics. The basic variables that are useful in measuring the level of innovation include:

- The amount of expenditures on research and development (R&D), (in cooperation with GERD - Gross Domestic Expenditure on Research and Development and national expenditure on R&D as a percentage of GDP),
- Effects of expenditures incurred on +R, that is the number of scientific publications, patent applications, patents obtained, innovative products,
- Measures of technological intensity, that is the share of high and medium sized industry and services in value added or employment and the share of high and medium-tech products in foreign trade.

In order to create a synthetic footage that makes it possible to compare data internationally, numerous indexes have been created combining partial indices. Those are:

- Innovation Union Scoreboard,
- Global Innovation Index,
- Innovation pillar globally
- Global Competitiveness Report.

It is also worth mentioning that the most important innovation survey is the Community Innovation Survey (CIS), launched in 1993, in accordance with the Oslo methodology. Due to the subject of this study, a number of quantitative data will be referred to in the next subsection, useful in the context of the project objectives.

[11] http://ingos.pl/public/userfiles/Raport_IIG_2015_SCREEN.pdf (25.05.17)
[12] http://innowacyjnafirma.info/technologia-w-sluzbie-czlowiekowi/2850 (27.05.17)

2.2. Conditions of innovation in Poland

2.2.1. Main centers and organizations supporting the development of innovation in Poland

New inventions and all forms of innovation require an appropriate strategy to place them in the market. For this reason, centers and organizations that support their development in various aspects (substantive, financial, legal, etc.) are extremely important. They are generally classified into 3 groups[13]:

1) Government and national institutions - governmental units supporting innovation and technology transfer, within the Ministry of Economy, the Polish Agency for Enterprise Development (PARP), the Industrial Development Agency (ARP) and other national institutions - the Main Technical Organization, the National Chamber of Commerce, the National Focal Point,
2) Organizational units of technology transfer within the science and technology sector: technology transfer centers within research and development (R&D) units, universities and academic entrepreneurship incubators,
3) Regional and local support institutions for innovation and technology transfer: parks of technology, science-technology and industrial-technology, technological incubators, and finally technology transfer centers.

Centers and organizations supporting the development of new technologies are crucial for the development of the national, knowledge-based economy. They have a very important role in communication between the world of science and the business world, creating a platform for the exchange of knowledge, information and technology, thereby streamlining the innovation process[14].

2.2.2. Analysis of the state of innovation in the Polish economy

According to National Bank of Poland reports from 2014, Institute of Innovative Economy of 2015 and PARP of 2015, Poland is not a country distinguishing itself against Europe in terms of innovation. According to CIS data (2012-2014), for which in terms of Poland, Central Statistical Office (GUS) is responsible, innovative activity of Polish companies is a relatively rare phenomenon in other European Union (EU) countries. In the years 2012-2014 the percentage of active enterprises was at the level of 17.7%. That is almost the lowest one in the EU (except for Romania). Despite the results of this ranking, Polish companies spend a big amount of its income on innovation, in particular technological ones, that is 1.005 million euros, with an EU average of 1.150 million euros[15].

Such a distribution of innovativeness in Poland is conditioned by a number of factors, including the structure of Polish companies oriented towards small and micro-sized enterprises (nearly 700 thousand companies) and the existence of development barriers, inter alia high costs of conducting business in Poland, difficulties in

[13] Matusiak, K. B. (2011). Rola i miejsce instytucji wsparcia w realizacji polityki innowacyjnej. Zeszyty Naukowe Uniwersytetu Szczecińskie*go*, (654), 203-224.
[14] Matusiak, K. B. (1998). Ośrodki innowacji i przedsiębiorczości [w:] KB Matusiak, E. Stawasz (red.), Przedsiębiorczość i transfer technologii. Polska perspektywa, Łódź/Żyrardów.
[15] http://ingos.pl/public/userfiles/Raport_IIG_2015_SCREEN.pdf (25.05.17)

obtaining external financing and insufficient government support[16]. The scope of the company's activity is strongly correlated with its innovative potential and its tendency to global inclusion and export[17].

In spite of the unfavorable situation of Polish companies, the statistical data emphasize considerable innovation potential and a systematic increase in innovation expenditure[18]. Numerous scientific inventions of young Poles are becoming more and more successful internationally and have a high chance of development. Examples of good practices will be cited in the research section of this paper.

In this context, it is worth mentioning some quantitative data characterizing the Polish economy. According to data from the PARP report edited by A. Bąkowski, PhD and M. Mażewska from Poland in 2014 there were 176 active innovation centers and enterprise incubators (including 130 innovation centers) identified in Poland, which operate within 137 leading institutions. Their distribution is as follows[19]:

- 42 technology parks,
- 23 technological incubators,
- 24 academic business incubators,
- 46 business incubators,
- 41 technology transfer centers.

3. Technological innovation supporting society

3.1. Research methodology of this study

In market practice there are numerous indicators and measures of the level of development and innovation of national economies. However, having in mind the focus on the analysis of individual enterprises and micro regions for research, there was a case study method chosen, which is aimed at showing the cross-section of various types of technological innovations of Polish entrepreneurs and their current market situation[20].

Case study as a research method consists of thorough analysis of a particular phenomenon based on real examples[21]. It contains a detailed case study, its objectives, assumptions, motives, actions. It allows you to confront theory with practice and draw valuable conclusions[22]. As a consequence, the analysis is intended to overthrow or confirm the research hypothesis mentioned in the project introduction. The practical dimension of research will show the actions of Polish entrepreneurs and startups in the field of innovative inventions, which have a positive impact on people's lives, streamline them and in a broad sense are socially useful. Conclusions from case studies will lay the groundwork for the creation of an opinion on Poland's social

[16] https:// parp.gov.pl/files/74/81/806/22522.pdf (25.05.17)
[17] https:// nbp.pl/aktualnosci/wiadomosci_2016/20160530_Raport_innowacyjnosc.pdf (25.05.17)
[18] https:// parp.gov.pl/files/74/81/806/22523.pdf (25.05.17)
[19] Bąkowski, A., & Mażewska, M. (2014). Ośrodki innowacji w Polsce (z uwzględnieniem inkubatorów przedsiębiorczości). Raport z badania.
[20] http://spidersweb.pl/2016/04/polskie-innowacje.html (29.05.17)
[21] http://wikipedia.org/wiki/Case_study (15.04.17)
[22] Pietrzak M., Baran J., Podstawy zarządzania. Studia przypadku i inne ćwiczenia aktywizujące, Wydawnictwo SGGW, Warszawa 2007

innovation and can serve as a basis for further qualitative and quantitative research, depending on the research perspective.

3.2. Analysis of case studies of local businesses

3.2.1. Leia Display System as technological innovation in business and education

Leia Display System is a technology that can revolutionize the way modern data is presented. In terms of technology, it is useful both in business and in education. It involves the projection of any multimedia content on a thin layer of water vapor. What is worth noticing is that it is not just a picture in itself, but a projection with which you can interact. With Leap Motion and Kinect controllers, you can control image and gesture recognition. This allows a broad adaptation of innovations, among others. It is great solution for educational purposes, business and museum presentations. The invention was invented by Daniel Skutela, patented in the international classification in 2015, and is the most stable fog screens available on the market.

Figure 2. Leia Display System

Source: http://leiadisplay.com/pl/ (25.05.17)

3.2.2. Perovskites as a new source of energy useful in ecology and construction

In 2014, Saule Technologies[23] started its startup business in the Wrocław Technology Park . Only one year later it was awarded with the Innovation of the Year Award prepared by the Marshal's Office[24]. This sturtup's founder is Olga Malinkiewicz, a Polish scientist who developed a low temperature technology for the production of flexible photovoltaic cells based on perovskite. This is connected with an innovative, flexible, translucent cell, based on PET foil, which aims to generate electricity. In the future, it will be possible to combine them with any selected products and surfaces such as facades of buildings, windows. By integrating such cells with electrical enclosures, it is possible to charge equipment without cables, also using artificial lighting. This is an innovative and pioneering approach to the use of light and ecology.

Figure 3. Saule Technologies

Source: http://sauletech.com/media/ (29.05.17)

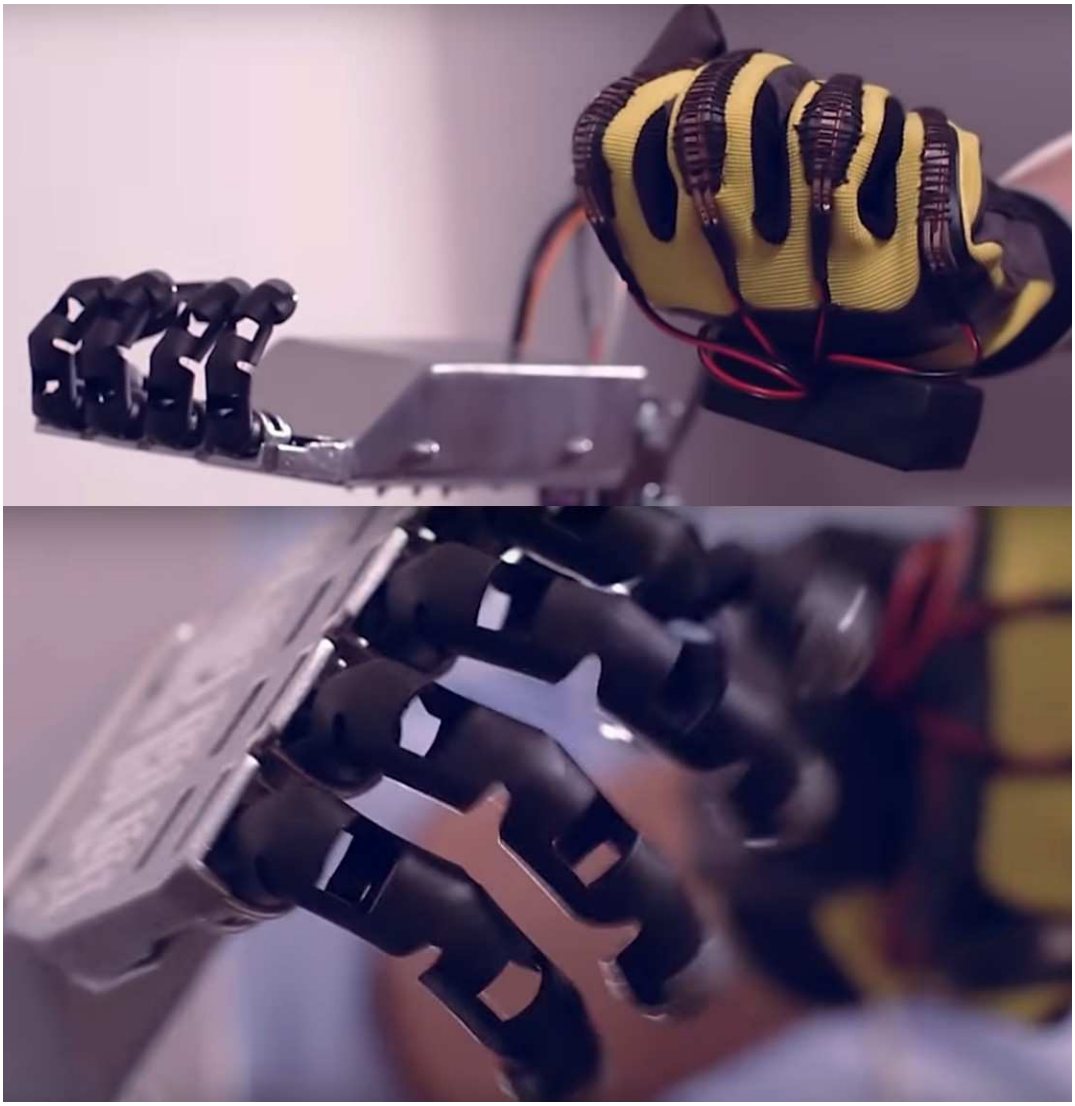
3.2.3. Innovative prosthetic breakthrough in medicine

Prosthetic solutions are extremely important in the treatment of many patients with traumas or amputated limbs. Manufactured in the current technology they are often very expensive, which is a financial barrier for many patients. Polish innovation, which can contribute to the improvement of the situation of many disabled people is the invention of the engineer of the State Higher Vocational School in Kalisz - Jarosław Juszczak. He designed a bionic hand combining technology with the human body. Bionics explores the structure and functioning of the human organism, and then tries to reproduce it in the field of technology[25]. The young engineer's invention has an extraordinary social value, because its price is more than 100 times lower than the current solution. Estimated cost of the prosthesis varies within the limits of only 1000 zlotys (250 euro) and it is able to perform all human movements, not just 12 typical

[23] http://sauletech.com/about-us/ (29.05.17)
[24] http://pierwszymilion.forbes.pl/saule-technologies-start-upem-roku,artykuly,191515,1,1.html (29.05.17)
[25] https://pl.aleteia.org/2017/02/27/bioniczna-reka-spod-kalisza-mlody-inzynier-buduje-proteze-znacznie-tansza-od-innych/ (28.05.17)

gestures, as with standard prostheses. In addition, the project can also be used for industrial purposes, facilitating the production process. From a cost and utility point of view, this is a project that can bring many people the opportunity to function in a normal way[26].

Figure 4. Bionic prosthesis



Source: https:// youtube.com/watch?time_continue=89&v=GBr_Zc_0sCg (25.05.17)

3.2.4. Innovative animation of the art of painting in culture

Polish painter Dorota Kobiela contributed to innovation in the field of culture and art. and gave artistic works a new dynamic. In 2016, she hand-painted over 56 thousand of pictures telling the story of Van Gogh's life and death. Thanks to her idea and cooperation with the Polish Film Institute, more than 100 paintings of this famous artist have been revived, making art works more accessible, attractive and interactive. This innovation has enjoyed worldwide popularity and recognition, and the film has been distributed in more than 100 countries around the world.

[26] http://dziendobry.tvn.pl/wideo,2064,n/sztuczna-reka-za-1000-zlotych,227605.html (29.05.17)

Figure 5. Animated art. "Twój Vincent"

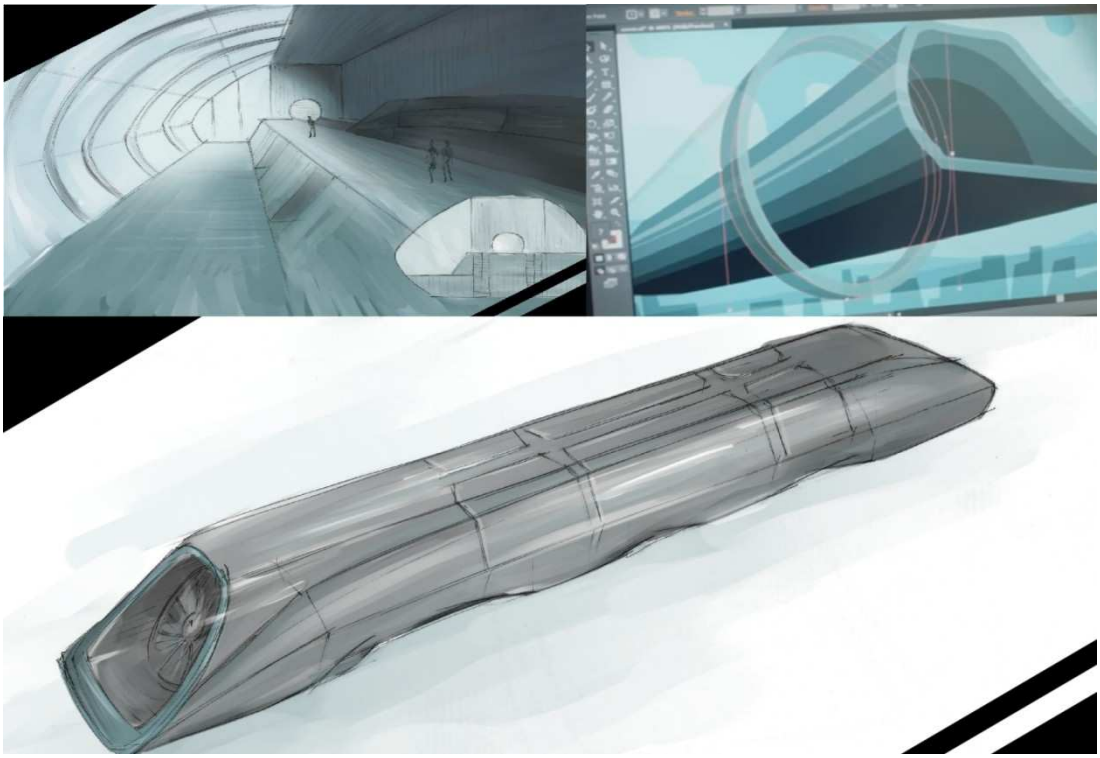
Source: http://vangoghalive.pl/foto/ (25.05.2017)

3.2.5. Hyperloop as an ultra fast innovation in transport

Communication problems in agglomerations and metropolis are a great hindrance for many people daily. For this reason, SpaceX (a space industry company) announced in 2013 a competition for a detailed plan and design of an innovative transport system. The concept was to create a passenger capsule, moving in a special tube at a speed close to the speed of sound[27]. 13 students from the Technical University of Łódź made it to the finals in Texas, as one of the 11 teams and the only one from Poland, and created a project of ultra-fast ways of transport (from construction, drive, aerodynamics to complex safety systems). What is important, the success of the students has also been achieved by their crowdfunding campaign, where they managed to raise nearly 32,000 for the simple prototype. Such technological innovation could significantly affect the way vehicles operate, especially over long distances[28].

[27] http://hyperlodz.pl/?lang=pl (29.05.17)
[28] http://kwantowo.pl/2016/11/17/polski-hyperloop-rozmowa-z-amadeuszem-batheltem/ (28.05.17)

Figure. 6. Polish Hyperloop



Source: https://polakpotrafi.pl/projekt/budujemy-ultraszybki-pojazd-na-konkurs-w-texasie/hyperlodz.wordpress.com (30.05.17)

3.3. Summary and conclusions from qualitative research

On the basis of the case study of qualitative research, numerous features of innovations on the Polish domestic market can be observed. These examples cover different industries and solve other social problems. However, all of them are characterized by the use of new technologies in the service of humanity and the improvement of the conditions and quality of life in society. Those are good practices for introducing innovative ideas, they can inspire young inventors, innovators and researchers.

Conclusion

Based on the data, analyzes, reports and case studies contained in this paper, it is possible to present the state of Polish technological innovations. Case studies clearly emphasized the role of human factor in innovation and the fundamental function of solving some sociological problems. This project outlines the types of innovations, their methods and techniques, their role in the success of the organization, and the importance of the social factor. Despite the fact that Poland is not classified as a country with a high level of innovation, which is caused by its market structure and numerous financial barriers, Polish innovators are awe-inspiring and internationally successful. On the basis of all the above-mentioned materials and data, the hypothesis in the foreword of this project may be confirmed. We can assume that "Polish technological innovation contributes to the development of society". The study clearly emphasizes that the human factor and the role of the human being is significant in the

process of designing innovation, especially in technology. Moreover, it can deliver the positive impact to society. With adequate funding, Polish innovators can make better use of their potential and create innovations that help people improve their lives in the whole world.

Bibliography

Literature

1. Baruk, J. (2013). Innowacje jako czynnik sukcesu organizacji. Zarządzanie i finanse, 4(1), 7-16.
2. Bąkowski, A., & Mażewska, M. (2014). Ośrodki innowacji w Polsce (z uwzględnieniem inkubatorów przedsiębiorczości). Raport z badania.
3. Ćwiklicki, M. (2015). Klasyfikacja modeli zarządzania innowacjami. In Management Forum (No. 4 (3), pp. 27-31). Publishing House of Wroclaw University of Economics.
4. Dolińska, M. (2004). Innowacje w przedsiębiorstwie, na rynku, w regionie. Ekonomika i Organizacja Przedsiębiorstwa, (9), 18-25.
5. Drucker, P. F., & Noel, J. L. (1986). Innovation and Entrepreneurship: practices and principles. The Journal of Continuing Higher Education, 34(1), 22-23.
6. Griffin, R. W., Rusinski, M., & Rozanska, I. (1999). Podstawy zarzadzania organizacjami; Przekl. M. Rusinski; Konsultacja nauk. B. Glinski; Red. I. Rozanska. Warszawa: Wydaw. Nauk. PWN.
7. Kozioł-Nadolna, K. (2012). Modele zarządzania innowacjami w XXI wieku [w:] Historia i powstanie nauk o zarządzaniu, red. B. Mikuła, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków.
8. Marciniak, S. (2010). Innowacyjność i konkurencyjność gospodarki. Wydawnictwo CH Beck.
9. Matusiak, K. B. (1998). Ośrodki innowacji i przedsiębiorczości [w:] KB Matusiak, E. Stawasz (red.), Przedsiębiorczość i transfer technologii. Polska perspektywa, Łódź/Żyrardów.
10. Matusiak, K. B. (2011). Rola i miejsce instytucji wsparcia w realizacji polityki innowacyjnej. Zeszyty Naukowe Uniwersytetu Szczecińskiego, (654), 203-224.
11. Pietrzak M., Baran J., Podstawy zarządzania. Studia przypadku i inne ćwiczenia aktywizujące, Wydawnictwo SGGW, Warszawa 2007
12. Poznańska, K. (1998). Uwarunkowania innowacji w małych i średnich przedsiębiorstwach.
13. Poznańska, K. (2006). Czynniki sukcesu małych przedsiębiorstw w Polsce. Ekonomika i Organizacja Przedsiębiorstwa, (numer specjalny), 90-94.

Internet sources

1. http://imik.wip.pw.edu.pl/innowacje27/strona13.htm (15.04.17)
2. http://ingos.pl/public/userfiles/Raport_IIG_2015_SCREEN.pdf (25.05.17)
3. http://ingos.pl/public/userfiles/Raport_IIG_2015_SCREEN.pdf (25.05.17)
4. http://innowacyjnafirma.info/technologia-w-sluzbie-czlowiekowi/2850 (27.05.17)

5. http://kwantowo.pl/2016/11/17/polski-hyperloop-rozmowa-z-amadeuszem-batheltem (28.05.17)
6. http://leiadisplay.com/pl/ (25.05.17)
7. https://mfiles.pl/pl/index.php/Innowacja (25.05.17)
8. https://nbp.pl/aktualnosci/wiadomosci_2016/20160530_Raport_innowacyjnosc.pdf (25.05.17)
9. https://parp.gov.pl/files/74/81/806/22523.pdf (25.05.17)
10. http://pi.gov.pl/Firma/chapter_95851.asp (25.05.17)
11. http://pierwszymilion.forbes.pl/saule-technologies-start-upem-roku,artykuly,191515,1,1.html (29.05.17)
12. https://pl.aleteia.org/2017/02/27/bioniczna-reka-spod-kalisza-mlody-inzynier-buduje-proteze-znacznie-tansza-od-innych (28.05.17)
13. https://polakpotrafi.pl/projekt/budujemy-ultraszybki-pojazd-na-konkurs-w-texasie/hyperlodz.wordpress.com (30.05.17)
14. http://sauletech.com/about-us (29.05.17)
15. http://sauletech.com/media/ (29.05.17)
16. http://spidersweb.pl/2016/04/polskie-innowacje.html (29.05.17)
17. https://wikipedia.org/wiki/Case_study (15.04.17)
18. http://vangoghalive.pl/foto (25.05.2017)
19. https://youtube.com/watch?time_continue=89&v=GBr_Zc_0sCg (25.05.17)

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