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Social climate of support for innovativeness

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Abstract
The article describes a research study focused on determining the level of social support for innovative activities. Based on a questionnaire survey and in-depth interviews conducted among engineers working in the United States and in Poland, data was obtained to determine the level of social acceptance and the level of support from third parties and institutions encouraging innovative activities. Conducting a comparative analysis of innovation support in the United States and Poland made it possible to learn about the social climate strengthening and inhibiting innovative behavior in both countries. An important element in the aspect of social acceptance is the perception of innovation from the perspective of corporate social responsibility, responsibility of business leaders and engineers as well as sustainable development.

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1. Introduction

One of the most important questions regarding innovation in Poland is why, despite highly developed human capital and a large number of young relatively well-educated people, innovation is so low in Poland. This state of affairs can be seen mainly as a result of low effectiveness of public institutions and the lack of a good and effective organizational and institutional environment. According to the authors, the reason for low innovation in Poland are the shortcomings of social capital, and its deficit. This is becoming a more and more serious barrier of development and it may result in a slowdown in growth along with the depletion of other sources of development, primarily based on human capital and low labor costs (Rogers, 1962). Rogers identified the factors determining the pace and universality of innovation.

The properties of innovation affecting the climate (pace and range) of dissemination include:

- Relative advantage - to what extent is the innovation better than previously used solutions? This advantage may be of various types, economic reasons and lower costs, as well as the prestige associated with the new solution may also be important.
- Compatibility - depending on the nature of the innovation, its compliance with values, past experiences and behaviors, as well as with the needs or with the technologies already used .
- Complexity- the difficulty of using and understanding innovation.
- Trialability - is it possible to try and experiment with an innovation before deciding to adopt it?
- Observability - the visibility of innovation for other people, which is important for the speed of dissemination of information about innovation, the creation of fashion and the demand for a given innovation.
- Re-invention - the possibility of varying the application and adapting the innovation to one's own needs. Innovations are not always used in accordance with the assumptions of their creators. Sometimes innovations themselves have to be reinvented and change in order to be disseminated.

Innovation diffusion occurs between individuals in the social system and the social environment. Communication between individuals affects how quickly innovation spreads and when individuals will adopt it. This social environment is important at all stages of innovation adoption, but especially from the stage of persuasion, through decision and implementation, to confirmation (Valente, 1995). An important factor determining the pro-innovative climate is social capital. Social capital and the resources functioning in the social network facilitate the flow of information. Social relationships provide an opportunity to influence people who are important in initiating pro-innovation activities. Social relationships can also serve as social references. Social

interactions will often be in the form of social support, shared interests, belonging to the same group etc.

Support from other people around us (family, friends, co-workers) is important for the success of any task or initiative. This is especially true in the case of innovativeness and entrepreneurship because of the high amounts of internal and external resistances associated with innovativeness and entrepreneurial initiatives. Direct and indirect social support for innovativeness can encourage and enhance innovative behavior.

The concept of innovation is at the heart of the "sustainable development" approach whose main task is to ensure the future. This approach is based on taking actions aimed at meeting the present needs, while taking under consideration the limitations of the negative effects of these actions on future generations. To achieve sustainable development, the consistency of three key elements is necessary: economic growth, social inclusion and environmental protection. These key elements are interconnected, and they are all vital to the well-being of individuals and societies as a whole. The defined goals of sustainable development and tasks related to them are global in nature and can be implemented all over the world. Of course, it is necessary to adjust these measures, considering the different conditions within individual countries, their possibilities and level of development as well as the compliance with national strategies and priorities. However, an important element is a comprehensive approach to the tasks related to sustainable development and its implementation to the farthest possible extent by individual entities.

2. Aims

The main goal of this article is a comparative analysis of the social support for innovativeness in the United States and Poland. The social support for innovativeness can either enhance or hinder innovative and entrepreneurial behavior. A good understanding of the social support for innovativeness in entrepreneurship is essential for identifying the best practices enhancing an innovative mindset. This is important from the perspective of managing an innovativeness network.

The idea and tasks of sustainable development constitute the basis for searching for new innovative activities in every possible field. The motivation to support innovation in terms of social responsibility is aligned with the 2030 Agenda for Sustainable Development, defined by the United Nations.

3. Selection of the Research Sample

The data for the comparative analysis of the social support for innovativeness was obtained from surveys of the engineering workforce in the United States and Poland. The research data were collected in Northeastern Pennsylvania (NEPA USA) and the Slask Region (Poland). Practicing engineers employed by the industry were the subject of the survey. Based on the pilot study, the questionnaires were validated. The required number of the sample was calculated to be ninety-two in each country. The number of engineers surveyed in the United States and Poland was ninety-eight and ninety-two respectively. The data related to the number of business incubator centers for one thousand residents as well as the number of STEM (Science, Technology, Engineering, Mathematics) graduates per one thousand residents per year were obtained from statistical data available in both countries (USA and Poland).

Northeastern Pennsylvania (NEPA USA) and the Slask Region (Poland) have had a similar pattern of industrial development. Since the survey was limited to only those regions, the results may not be applicable in other regions of both countries. The conducted research is a pilot study and is intended to answer whether and to what extent the climate (social relations, social capital) influences the innovative attitudes of engineers. Further research is needed in the United States and Poland to assess the degree of influence of social attitudes and individual support on engineers and their pro-innovation attitudes. In the future the research will extend to other regions and countries with a similar industrial development pattern to identify more widely accepted best practices.

4. Literature Review

The social climate of the support for innovativeness has many faces. The business incubator centers in the United States and Poland are forms of social support for innovativeness and entrepreneurship (Al-Mubaraki et al., 2017; Malecki, 2018; Hassan, 2020; Wolniak et al., 2019; Hausberg and Korreck, 2020; Torun et al., 2018). Technical education and a large number of STEM (Science, Technology, Engineering, Mathematics) graduates are affected and linked to social support for innovativeness and entrepreneurship (Niittylahti et al., 2021; Saw, 2020; Aguilar and Turmo, 2019; Garcia-Morales et al., 2021; Haviland and Robbins, 2021; Grebski and Grebski, 2016; Grebski and Grebski, 2019; Aguilar and Turmo, 2019; Garcia- Morales et al., 2021; Haviland and Robbins, 2021). A social culture of respecting and protecting intellectual property is also a another form of social support for innovative behavior (Holgersson et al., 2018; Grebski and Wolniak, 2018). Socially responsible practices employed by industry greatly enhance social support for innovativeness and entrepreneurship (Mahmud et al., 2021; Zastemowski and Cyfert, 2021; Mulej et al., 2021; Padgett and Moura-Leite, 2012; Fobel and Kuzior, 2019; Mikhnevych et al., 2020; Kuzior et al., 2021).

Although it is an undeniable fact that innovation is the basis of development for companies, the managerial approach to implementing innovative projects still has an untapped potential (Yuan and Chen, 2015). The conducted data analysis suggests that new innovative solutions (organizational or technological) are key factors in the implementation of development strategies for modern knowledge-based enterprises (Alheet et al., 2022). These activities are carried out mainly through the implementation of the concept of learning organizations, and therefore are related to the acquisition of innovative knowledge, its dissemination and use (implementation). These activities are aimed at increasing the efficiency of the processes within the organization as well

as the development of innovative products that are offered to customers (Bao et al., 2012).

The authors of this article emphasize the important role of innovation in the processes aimed at sustainable development. Innovative activities constitute the basis for the implementation of the sustainable development goals, on the enterprise scale as well on the local and global scale (Nill, Kemp, 2009; Lioutas, and Charatsari, 2018; Klewitz, Hansen, 2014; Fu, 2021). The research analysis clearly shows a direct relationship between the development of companies (introducing new products to the market, creating new internal processes) and innovation orientation. In addition, the concept of sustainable development is part of the development strategy and constitutes the basis for the determinants of the research conducted. Important elements in the field of innovation focused on sustainable development should not be omitted and concepts related to the ecologies and waste management conditions should be included in the development strategies of companies. These issues are subject to a number of obligatory legal requirements, and thus become the basis for the search for innovative solutions that will not only constitute the basis for the company's development but will also be solutions with global applications (Horodyńska, 2017; Kirikkaleli and Adebayo, 2021). All these observations clearly indicate that innovation is the main driver of economic development, but at the same time it is also becoming the main cause of environmental degradation (Hall and Vredenburg, 2003).

5. Environment of Innovation

The model of the production system environment according to Durlik (Durlik, 1995) was adopted as the starting point for the analysis of the innovation environment. This model assumes a two-stage production system environment. The same division was also adopted for the innovation environment, assuming the hypothesis that the enterprise/place of business activity is the central element for initiating innovation. The environment of the first level (internal) of innovation, was assume to be the area directly related to the place of work within the enterprise/organization. The group of climate determinants for first level pro-innovation activities includes: organizational creativity, leadership style, culture of innovation, quality of human resources, motivation system, type of strategy, structural connections and training system.

A very important factor influencing innovation in the workplace is the mutual relations between employees inside the organization as well as relations with the external environment. In the case of the second level (external factors) of the environment, we can distinguish factors directly influencing pro-innovative activities through the tax relief system (tax system) or the availability of financial support for innovative projects. Adequately prepared research facilities, including well-educated employees, are also a very important pro-innovation factor.

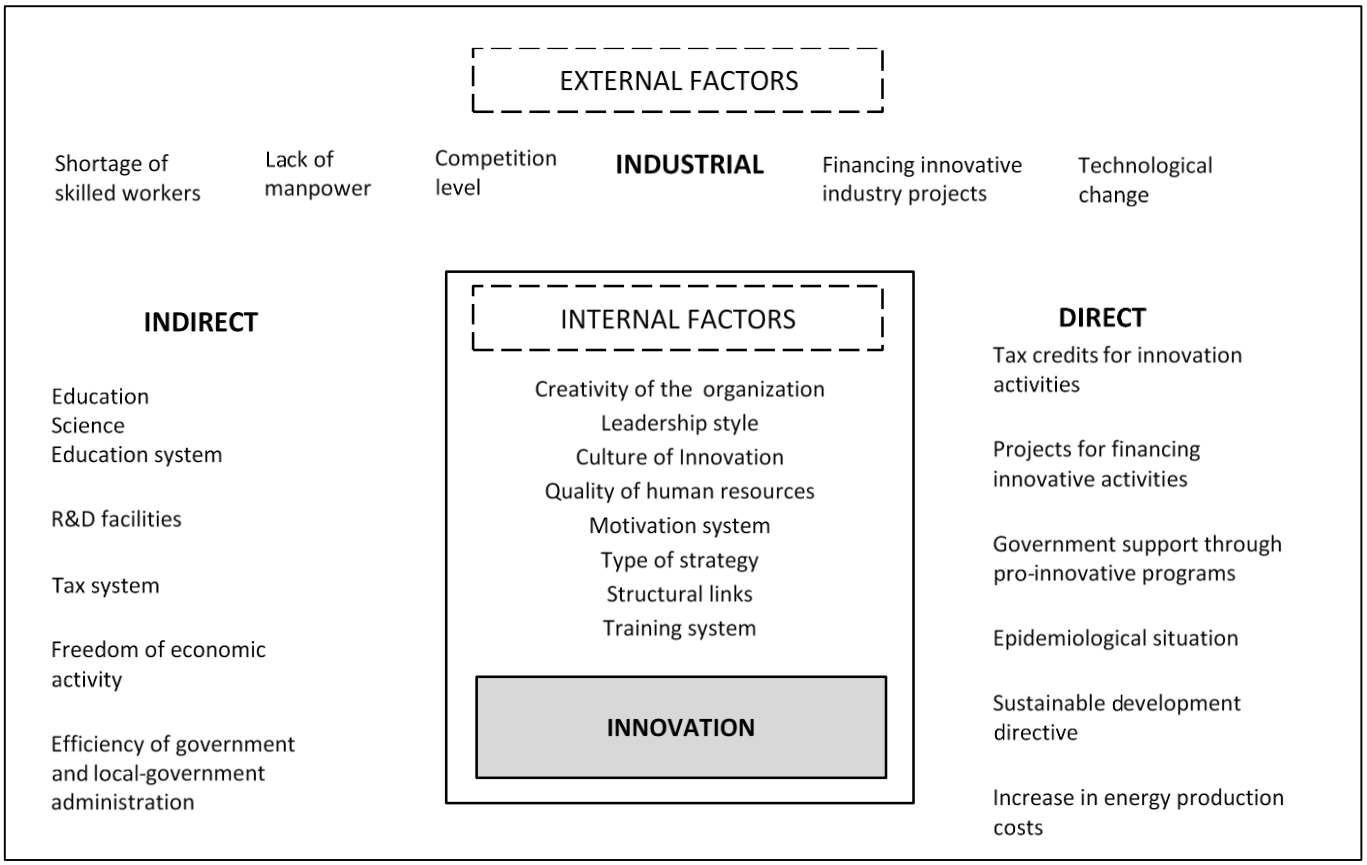

Fig. 1. Two-stage model of the innovation environment

We can also distinguish the importance of a properly developed system of science education, available RandD facilities, support of research centers and scientific organizations. It is also important to involve the central and local government administration in supporting innovative activities and the people initiating such activities. We can also include there all the factors that stimulate the workforce in the so-called the external environment of the organization. We also have a group of factors applying to a specific industry or the entire sector of the economy. Such factors may include: the level of competitiveness in a given industry, the availability of financing for innovative sectoral or industry projects as well as the availability of new technologies (BAT).

The stimulating factors are also economic factors such as increases in labor costs, the lack of availability of professionals, the reduction of costs of automation and robotization of production systems (Ulewicz and Mazur, 2019). The other stimulating factors can be increase in energy costs and financial support for activities intended for the use of renewable energy (Ulewicz et al., 2021) or improving transport as part of a smart city (Deja et al., 2021; Dzhuguryan et al., 2021). Fig. 1 shows the two levels of an innovation environment, considering individual groups of factors determining and influencing innovation. It should be noted that in the available literature there is very little information on the analysis of factors directly influencing the innovative attitude of a person/employee. The conducted research is an attempt to initially assess the extent to which the social climate influences innovative attitudes.

It seems that an essential element of innovation is an extensive network of contacts, both geographic and disciplinary. Going beyond the circle of narrow topics allows for innovative use of known development/investigation methods in new research areas, including biotechnology (Skrzypczak-Pietraszek et al., 2019), management (Pacana and Ulewicz, 2020; Ulewicz et al., 2020), machining (Marković et al., 2021) or even designing comfortable interiors in buildings (Majewski et al., 2020; Sikora, 2021) or water resources management (Dobrzański, 2021; Wójcicka, 2021). These problems are also noticed in the analytical and design research of Industry 4.0 environments (Pietraszek et al., 2020).

6. Experiment and Data Collection

Social support for innovativeness and entrepreneurship can be broad and difficult to measure and assess. In the research described in this article, the social support was measured by the following:

1. Perception of innovative individuals on the support that they are receiving from other people while pursuing innovative and entrepreneurial ventures.
2. Perception of innovative individuals on their own innovativeness skills and attributes.
3. Perception of innovative individuals on the development of innovative skills and attributes.
4. Number of business incubator centers per one thousand residents.
   (This describes the level of support available to innovative and entrepreneurial people.)
5. Number of STEM graduates per one thousand residents per year.
   (The number of STEM graduates is affected by the social support for innovativeness and entrepreneurship.)

The bar graph shown in Fig. 2 describes the educational level of the engineering professionals in Poland and the United States.

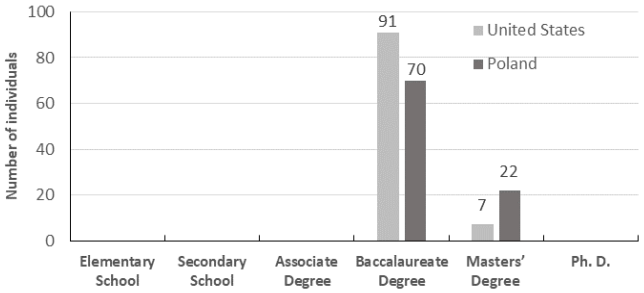

Fig. 2. Educational level of surveyed engineering professionals

All the individuals have at least a Baccalaureate degree with some of them having a Masters' degree. (22 in Poland and 7 in the United States). The data presented in Fig. 3 contains the employment background of the engineering professionals surveyed.

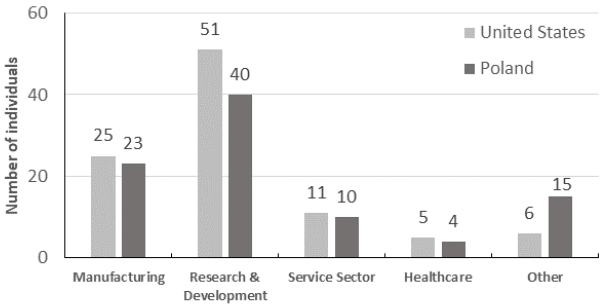

Fig. 3. Types of industry where the surveyed engineers were employed

Approximately 50% of the surveyed individuals worked for research and development companies , while 25% work for traditional manufacturing companies.

Fig. 4 contains the collected data related to the perception of engineers on their own innovativeness. Fig. 4 also contains the perception of engineers related to the support of their innovative initiatives by other people. The numbers on the top of bar graphs are the mean values from the responses. The numbers in parentheses represent variance.

Engineers in Poland have higher confidence related to innovativeness than their counterpart in the United States. (4.84 compared is 4.45 respectively)

The individuals surveyed in the United States believe stronger that their innovative behavior is supported by other people (4.50 compared to their counterparts in Poland 2.38). People in Poland do not believe that their innovative behavior is supported by other people.

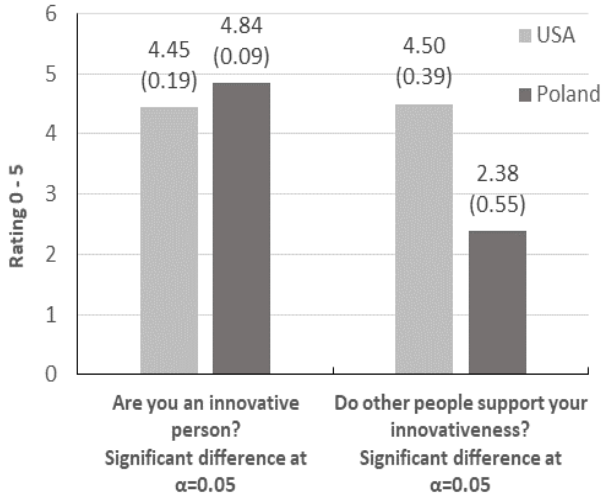

Fig. 4. Perception of engineers on their own innovativeness as well as the support that they receive from other people

Fig. 5 contains the data collected related to the perception on how innovative skills are being developed.

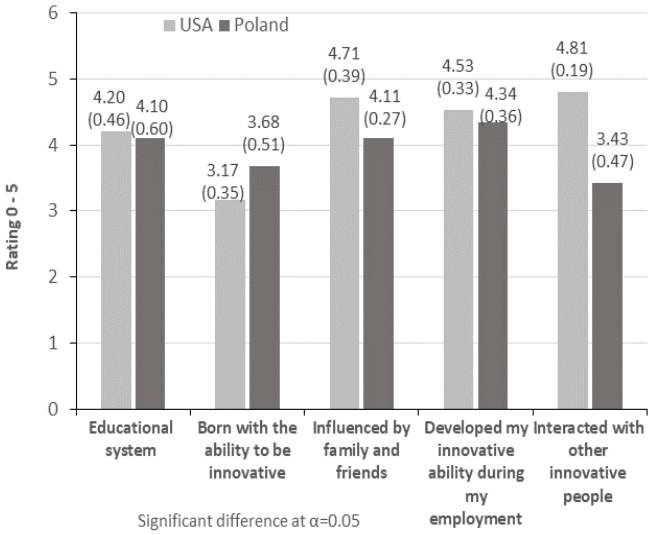

Fig. 5. Perception on the development of innovativeness skills

In the United States, the engineers who were surveyed believe that their innovativeness was developed as follows: (Scale: 0-5)

- Interaction with other innovative individuals (4.81)
- Influence of family and friends (4.71)
- Development of innovative ability during employment (4.53)
- Educational system (4.20)
- Born with an ability to innovate (3.17)

In Poland the engineers who were surveyed believe that their innovativeness was developed by the following: (Scale: 0-5)

- Developed innovative ability during employment (4.34)
- Influence by family and friends (4.11)
- Educational system (4.10)
- Born with an ability to innovate (3.68)
- Interaction with other innovative individuals (3.43)

Fig. 6. contains an indirect assessment of the social support of innovativeness by comparing the number of business incubator centers per one thousand residents. The number of business incubator centers (per one thousand residents) in the United States is over three times higher than in Poland. The availability of a business incubator center to assist innovators and entrepreneurs is a form of social support for innovative behavior.

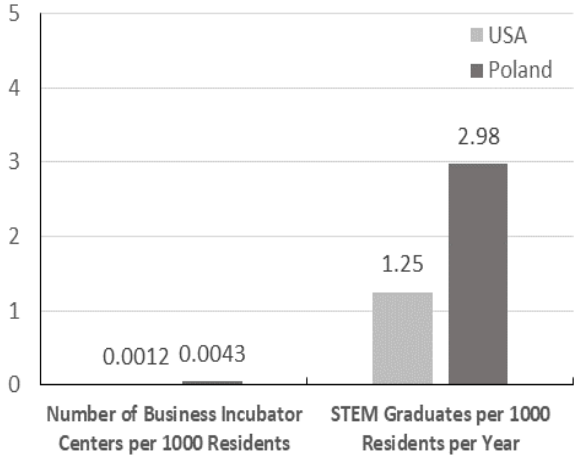

Fig. 6. Comparison of business incubator centers and STEM graduates in United States and Poland. (per one thousand residents)

Fig. 6 also shows a comparison of the number of STEM graduates (per 1000 residents/year) in the United States and Poland. The number of STEM graduates (per 1000 residents/ year) in Poland is over two times higher than the number of STEM graduates in the United States. The number of young people pursuing STEM professions is often a result of the social support towards STEM professions.

7. Results and Discussion

Based on an analysis of the collected data, it has been determined that there is a difference between the social support for innovativeness network in the United States and Poland. There is stronger support for innovativeness and entrepreneurship in the United States than in Poland. The number of business incubator centers per one thousand residents is three time higher in the United States than in Poland. Innovative individuals in the United States have better access to services provided by business incubator centers.

Innovative individuals in the United States feel stronger that their innovative behavior is supported by other people. The result of this assessment is 4.50 in the United States vs 2.38 in Poland. There is a significant difference in the assessment results (at $\alpha = 0.05$). Innovative individuals in the United States give the most credit for the development of innovative skills and attributes to other innovative individuals with whom they interact.

In the United States there are clusters of innovative people leading to the development of innovative cities. In Poland that phenomenon does not happen to that extent. In Poland the most credit for the development of innovative skills and attributes is given to activities associated with employment.

The engineers surveyed in the United States assess higher most of the individual components of the innovativeness ecosystem where most of the innovative skills and attributes are being developed. The components of the innovativeness ecosystem which are assessed higher in the United States are as follows:

- System of education
  (4.20 in the United States; 4.10 in Poland)
- Influence of family and friends
  (4.71 in the United States; 3.68 in Poland)
- Place of employment
  (4.53 in the United States; 4.34 in Poland)
- Interaction with other innovative people
  (4.81 in the United States; 3.43 in Poland)

The individuals surveyed in Poland believe stronger that their innovativeness is a natural ability with which they were born (3.68 in Poland and 3.17 in the United States).

8. Conclusions

There are significant differences in the social support for innovativeness in Poland and the United States. According to the literature analysis, social support for innovativeness increases innovative behavior. The lack of social support can hinder innovative behavior. A comparative analysis for the social support for innovativeness in the United States and Poland is important for the purpose of identifying the best practices in managing the innovativeness and entrepreneurial networks in both countries.

Research on the assessment of innovativeness levels is based on interviews and surveys, which are the main source of information on the approach of employees to pro-innovative activities. Employees understand and support the tasks and goals of pro-innovative activities. Employees also declare the goals of sustainable development as the basis for the strategy they undertake. Decisions related to pro-innovative activities are determined based on a number of external and internal factors of the organization. Those factors have influence on the success of the adopted strategy.

References

Aguilar, D., Turmo, MP., 2019. Promoting Social Creativity in Science Education with Digital Technology to Overcome Inequalities: A Scoping Review. Frontiers in Psychology, 10, ISSN: 1664-1078. https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01474/full

Al-Mubaraki, HM., Busler, M., 2017. Challenges and Opportunities of Innovation and Incubators as a Tool for Knowledge-Based Economy. Journal of Innovation and Entrepreneurship, 6 (15), https://innovationentrepreneurship.springeropen.com/articles/10.1186/s13731-017-0075-y

Alheet, A.F., Hamdan, Y., Al-Bazaiah, S.A., 2021. The impact of technology, entrepreneurship and consumer attitudes on firm performance. Polish Journal of Management Studies, 23 (1), 23-44. DOI: 10.17512/pjms.2021.23.1.02

Bao, Y., Chen, X., Zhou, KZ., 2012. External learning, market dynamics, and radical innovation: Evidence from China's high-tech firms. Journal of Business Research, 65(8), 1226-1233.

Deja, A., Dzhuguryan, T., Dzhuguryan, L., Konradi, O., Ulewicz, R., 2021. Smart sustainable city manufacturing and logistics: A framework for city logistics node 4.0 operations. Energies, 2021, 14(24), 8380.

Dobrzański, M. 2021. The influence of water price and the number of residents on the economic efficiency of water recovery from grey water. Technical Transactions, 118, art. e2021001. DOI: 10.37705/TechTrans/ e2021001

Durlik, I., 1995. Management engineering: strategy and design of production systems. Agency. Publish. "Placet", Warsaw 1995.

Dzhuguryan, T., Deja, A., Wiśnicki, B., Jóźwiak, Z., 2020. The design of sustainable city multi-floor manufacturing processes under uncertainty in supply chains. Sustainability (Switzerland), 12(22), 1-18, 9439.

Fobel, P., Kuzior, A., 2019. The Future (Industry 4.0) Is Closer Than We Think: Will It Also Be Ethical? AIP Conference Proceedings, 2186(1). DOI: 10.1063/1.5137987.

Fu, G., 2021. Toward achieving sustainable development goal 3: Determinants, innovations, and reactions from 110 countries with different income levels. Sustainable Development, 29, 607-623.

Garcia-Morales, VJ., Garrido-Moreno, A., and Martin-Rojas, R., 2021. The Transformation of Higher Education after the COVID Disruption: Emerging Challenges in an Online Learning Scenario. Frontiers in Psychology, 11. https://www.frontiersin.org/articles/10.3389/fpsyg.2021.616059/full

Grebski, M., Grebski, W., 2019. Project-based Approach to Engineering Technology Education. Production Engineering Archives, 25(25), 56-59. DOI: 10.30657 / PEA / 2019.25.11.

Grebski, ME., Wolniak, R., 2018. Global Perspective for Protecting Intellectual Property-Patenting in the USA and Poland. Management Systems in Production Engineering, 26(2), 106-111. DOI: 10.2478 / MSPE-2018-0017

Grebski, W., Grebski, M., 2016. Keeping Technical Education Aligned to the Needs and Expectations of Industry. Management Systems in Production Engineering, 22(2), 77-80. DOI: 10.2478 / MSPE-01-02-2016

Hall, J., Vredenburg, H., 2003. The challenge of innovating for sustainable development. MIT Sloan Management Review, 45(1), 61.

Hassan, NA., 2020. University Business Incubators as a Tool for Accelerating Entrepreneurship: Theoretical Performance. Review of Economics and Political Science, 10038. ISSN: 2631-3561. DOI: 10.1108/REPS-10-2019-0142/full/html. 2020

Hausberg, JP., Korreck, S., 2020. Business Incubators and Accelerators: A Co-Citation Analysis-Based, Systematic Literature Review. The Journal of Technology Transfer, 45, 151-176. DOI: 10.1007/s10961-018-9651-y.

Haviland, S., Robbins, S., 2021. Career and Technical Education as a Conduit for Skilled Technical Careers: A Targeted Research Review and Framework for Future Research. ETS Research Report Series, DOI: 10.1002/ets2.12318

Holgersson, M., Granstrand, O., Boger, M., 2018. The Evolution of Intellectual Property Strategy in Innovation Ecosystems: Uncovering Complementary and Substitute Appropriability Regimes. Long Range Planning, 51(2), 303-319. https://www.sciencedirect.com/science/article/pii/S0024630117303527.

Horodyńska, M., 2017. Ecologistics and waste management. Publishing House of the Silesian University of Technology, Gliwice.

Kirikkaleli, D., Adebayo, TS., 2021. Do renewable energy consumption and financial development matter for environmental sustainability? New global evidence. Sustainable Development, 29, 583-594.

Klewitz, J., Hansen, EG., 2014. Sustainability-oriented innovation of SMEs: A systematic review. Journal of Cleaner Production, 65(4), 57-75.

Kuzior, A., Ober, J., Karwot, J., 2021. Stakeholder Expectation of Corporate Social Responsibility Practices: A Case Study of PWiK Rybnik, Poland. Energies, 14(11), 3337. DOI: 10.3390/en1413337

Lioutas, ED, Charatsari, C., 2018. Green innovativeness in farm enterprises: What makes farmers think green? Sustainable Development, 26, 337-349.

Mahmud, MM., Al-Sultan, K., De Massis, A., 2021. Corporate Social Responsibility in Family Firms: A Systematic Literature Review. Journal of Small Business Management, 2021. DOI: 10.1080 / 000472778.2021.1955122.

Majewski, G., Orman, Ł.J., Telejko, M., Radek, N., Pietraszek, J. and Dudek, A., 2020. Assessment of thermal comfort in the intelligent buildings in view of providing high quality indoor environment. Energies, 13(8), art. 1973. DOI: 10.3390/en13081973

Malecki, EJ., 2018. Entrepreneurship and Entrepreneurial Ecosystems. Geography Compass, 12(3), e12359. DOI: 10.1111/gec3.12359.

Marković, S., Arsić, D., Nikolić, R.R., Lazić, V., Hadzima, B., Milovanović, V.P., Dwornicka, R. and Ulewicz, R., 2021. Exploitation characteristics of teeth flanks of gears regenerated by three hard-facing procedures. Materials, 14(15), art. 4203. DOI: 10.3390/ma14154203

Mikhnevych, L., Marchenko, V., Hristov, P. Kuzior, A., 2020. Conceptual

Relationships between Country Image and Economic Security. Marketing and Management Innovations, 1, 285-293. DOI: 10.21272/mmi.2020.1-24.
Mulej, M., O'Sullivan, G., Strukelj, T., 2021. Social Responsibility and Corporate Governance (Volume 2: Policy and Practice). Palgrave Studies in Governance, Leadership and Responsibility..Springer International Publishing. ISBN: 978-3-030-46094-5.e-ISBN: 978-3-030-46095-2.
Niittylahti, S., Annala, J., Makinen M., 2021. Student Engagement Profiles in Vocational Education and Training: A Longitudinal Study. Journal of Vocational Education & Training. DOI: 10.1080/13636820.2021.1879902
Nill, J., Kemp, R., 2009. Evolutionary approaches for sustainable innovation policies: From niche to paradigm? Research Policy, 38(4), 668-680.
Pacana, A. and Ulewicz, R., 2020. Analysis of causes and effects of implementation of the quality management system compliant with iso 9001. Polish Journal of Management Studies, 21(1), 283-296. DOI: 10.17512/pjms.2020.21.1.21
Padgett, RT, Moura-Leite, RC., 2012. Innovation with High Social Benefits and Corporate Financial Performance. Journal of Technology Management & Innovation, 7(4) e-ISSN 0718-2724.https://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0718-27242012000400005
Pietraszek, J., Radek, N. and Goroshko, A.V., 2020. Challenges for the DOE methodology related to the introduction of Industry 4.0. Production Engineering Archives, 26(4), 190-194. DOI: 10.30657/pea.2020.26.33
Rogers EM., 1962. Diffusion of innovations, The Free Press of Glencoe, New York 1962.
Saw, Guan K., 2020. Leveraging Social Capital to Broaden Participation in STEM. Psychology and Counseling, https://journals.sagepub.com/doi/full/10.1177/2372732219895997.
Skrzypczak-Pietraszek, E., Urbańska, A., Żmudzki, P. Pietraszek, J., 2019. Elicitation with methyl jasmonate combined with cultivation in the Plantform™ temporary immersion bioreactor highly increases the accumulation of selected centellosides and phenolics in Centella asiatica (L.) Urban shoot culture. Engineering in Life Sciences, 19(12), 931-943. DOI: 10.1002/elsc.201900051
Torun, M., Peconick, L., Sobreiro, V., Kimura, H. and Pique, J., 2018. Assessing Business Incubation: A Review on Benchmarking. International Journal of Innovation Studies, 2(3), 91-100. https://www.sciencedirect.com/science/article/pii/S2096248718300225
Ulewicz R., Mazur M., 2019. Economic Aspects of Robotization of Production Processes by Example of a Car Semi-Trailers Manufacturer. Manufacturing Technology, 9(6).
Ulewicz, R., Siwiec, D., Pacana, A., Tutak, M., Brodny, J., 2021. Multi-criteria method for the selection of renewable energy sources in the polish industrial sector, Energies, 14(9), 2386.
Valente, TW,. 1995. Network Models of the Diffusion of Innovations, Hampton Press, Cresskill 1995.
Wolniak, R., Grebski, ME., Skotnicka-Zasadzien, B., 2019. Comparative Analysis of the Level of Satisfaction with Services Received at the Business Incubators (Hazleton, PA, USA and Gliwice, Poland. Sustainability (Switzerland), 11(10), 2889. DOI: 10.3390/su11102889.
Wójcicka, K., 2021. The efficiency of municipal sewage treatment plants inspiration for water recovery. Technical Transactions, 118, art. e2021023. DOI: 10.37705/TechTrans/e2021023
Yuan, L., Chen, X., 2015. Managerial learning and new product innovativeness in high-tech industries: Curvilinear effect and the role of multilevel institutional support. Industrial Marketing Management, 50, October, 51-59.
Zastempowski, M., Cyfert, S., 2021. Social Responsibility of SMEs from the Perspective of Their Innovativeness: Evidence from Poland. Journal of CleanerProduction, 317(1), 12840. https: //www.sciencedirect .com / science / article / pii / S0959652621026135.

支持创新的社会氛围

關鍵詞
创新
社会支持
创新支持
对比分析

摘要
这篇文章描述了一项研究，重点是确定对创新活动的社会支持水平。 根据对在美国和波兰工作的工程师进行的问卷调查和深入访谈，获得了数据以确定社会接受程度以及第三方和鼓励创新活动的机构的支持程度。 通过对美国和波兰的创新支持进行比较分析，可以了解两国社会气候加强和抑制创新行为的情况。 社会接受方面的一个重要因素是从企业社会责任、商业领袖和工程师的责任以及可持续发展的角度对创新的认识。