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SHAPING RELATIONS BETWEEN HIGHER EDUCATION INSTITUTIONS AND THE ENTERPRISE WORLD IN THE AGE OF DIGITAL TRANSFORMATION

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Abstract Contemporary economy and societies are characterised by highly dynamic growth processes, which impact changes in the relationships between entities representing various sectors, driven chiefly by innovation in its broadest sense of the notion. The key players in the innovation development process – companies, enterprises and universities – keep changing and opening up to their surroundings by fostering ever-tighter cooperation. At the same time, the emergence of new challenges associated with the digital transformation process that create new platforms and mechanisms is being witnessed, which underpin this cooperation. The aim of this article is to outline the main aspects of the relationship between universities and the business sector in the context of digital transformation processes. The article presents selected results of a study conducted with the participation of representatives of the business sector, which identifies factors and determinants of university-business relations. The analysis covered the current state of cooperation, determinants affecting the strength and scope of relations between universities and enterprises, as well as directions of intensification of cooperation postulated by entrepreneurs. Moreover, entrepreneurs' interest in using digital tools, including the context of starting cooperation with universities as well, was also examined.

Keywords: relationships, cross-sector cooperation, digitalisation, digital transformation.

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Introduction

The contemporary world is characterised by highly dynamic changes in many areas of life, unprecedented in history to date – concerning the economy, including changes in the factors impacting competitiveness, managements systems and the role the companies play in their local, regional or global surroundings, as well as the society at large, encompassing life aspirations, attitudes and preferences of people.

These changes are closely linked to the quick development of innovative technologies and the growing popularity of ICT tools, as well as products and services based on the dynamic development of science. At the same time, the development of both modern societies and contemporary companies hinges upon technological, organisational, product, process and social innovations. New solutions also give rise to new platforms and mechanisms of cooperation resulting from and related to technological, social and cultural changes.

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These extensive changes, their dynamics, as well as the fact that they are all based on innovative solutions, which permeate nearly all areas of life, also bring upon a change in intersectoral relations between particular actors of socio-economic development processes. Relations, which for the purpose of this paper are defined as a relationship between at least two entities, are one of intangible values, which are based on culture, attitudes and behaviours, and determine the quality of cooperation and the possibilities of taking advantage of the joint potential (Wasiluk and Tomaszuk, 2020). In the context of the nature of current changes, largely based on and triggered by the development of knowledge, competence, as well as tools that promote and facilitate further growth, the relationship between the university and academia as a whole, as well as the enterprise world becomes key. The diversity of motives for the cooperation between universities and enterprises, which lead to the development of common areas of cooperation between enterprises and scientific centres for technological innovation should also be noted. These include, among others, development of advanced knowledge resources, re-education of R&D activity costs, improvement of production processes, extension of assortment, search and management of talents, possibility to use the infrastructure of scientific centres (Trzmielak and Grzegorczyk and Gregor, 2016 [after] Kuo and Shih and Sher, 2012).

In this context, one may not forget the dimensions of cooperation between companies and its broadly understood local environment results in the implementation of the concept of CSR, or corporate social responsibility. Also important in this respect is the process of evolution of the role of universities, which are opening up to the local actors and striving to play an active role in fostering actual social and economic growth processes. Universities will increasingly be organisations and entities that support and develop regional and national innovation systems, playing a central role in developing the competitiveness of European economies (Paleari and Donina and Meoli, 2015). The traditional concept of the work and role of universities, which focused on its educational and research activities, is thus expanded to include creating and developing effective relations with local actors, and the traditional model of knowledge development, which encompassed knowledge production, its transfer and implementation is being replaced with an interactive model, in which interactions take place in various directions (Karwowska and Leja, 2017 [after] Pinheiro et al, 2015; Stuss, et al. 2019).

This development path for universities and other higher education institutions is also envisaged by the Act on Higher Education and Science (Act of 20 July 2018), whose Article 2 highlights that the mission of the higher education and science is to provide education and conduct scientific activities at the highest level, while playing an active part in social and economic development, which is based on innovation.

In order to carry out these tasks and successfully make higher education institutions play this role, it is necessary to foster building relations between universities and

enterprises based on the principles of voluntary cooperation and continuous building of trust and dialogue.

One of the key processes involved in building competitive advantages in the age of Industry 4.0, also dubbed the fourth industrial revolution, is digitalisation and the process of digital transformation. McKinsey & Company defines digitalisation as undertaking activities using digital tools in order to increase productivity and accelerate economic growth. It contributes to productivity growth through process optimisation, market expansion, innovative products and more efficient use of human capital (Cyfrowa Polska. Szansa na technologiczny skok do globalnej pierwszej ligi gospodarczej, 2016). The process of digitalisation is recognised as one of the key and most dynamic changes and is a factor of innovation development in most sectors of the economy (Gudanowska and Kononiuk, 2020).

Thus, the process of digitalisation sets new standards and builds new platforms of cooperation, thus reducing the gap in the relation between higher education institutions and the enterprise world, enabling both parties to formulate their needs and expectations in a more effective manner.

The sheer scale and intensity of the process of digitalisation, as well as its ubiquitous nature leads to its understanding as a process of digital transformation, or a transition to a new, higher level of organisational capabilities, ensuring its functioning in highly volatile, uncertain, unpredictable and competitive environment (Kowalczyk, 2018). According to the Center for Digital Business Massachusetts Institute of Technology and Capgemini, digital transformation means using technology to radically improve the performance or reach of businesses – something that is currently becoming an important aspect of functioning for companies around the world (Westerman and Calméjane and Bonnet and Ferraris and McAfee, 2011). In its report, the institution highlights the fact that the success of digital transformation hinges upon transforming the organisation to leverage its existing valuable strategic assets in new ways. What is more, the organisation also points out that successful digital transformation is not merely a result of implementing new technologies – it requires transforming the organisation to take advantage of the opportunities presented by new technologies (Westerman and Calméjane and Bonnet and Ferraris, McAfee, 2011). This means that digitalisation may not be reduced solely to its technical aspects – instead, this issue needs to be approached in a comprehensive manner, as a combination of technologies, tools, competencies and the culture of relations enabling an efficient and systemic transformation.

The concept of digital transformation is a multifaceted one, covering both internal processes and relations with the environment covering several areas (Pietrzak, 2019):

-organisational culture, which includes in particular, changing the project implementation and talent development process and developing interaction with the surroundings;

-capabilities and the role of IT departments in the process of supporting business operations and development of business ideas;
-business processes based on comprehensive digitalisation;
-organisational changes enabling close cooperation within the company and their openness to implementing innovative solutions;
-ecosystem and partners focused on lowering risks and fostering faster implementation of innovative solutions;
-communication with customers and clients, based on diversified communication channels;
-employees, who have opportunities to acquire new skills and knowledge, as well as access to modern communication platforms and tools;
-market strategy, which should be specific and based on the right mix and integration of physical sales channels, as well as their digital counterparts.

It should be highlighted that digital transformation understood in such a way concerns not only the business sector but also higher education institutions. In this area, the understanding of digital transformation is broad, like in the case of business, and it is not limited to the implementation of new technologies. In the case of universities and higher education institutions, digital transformation encompasses (Mazurek, 2019):
-systemic change, taking into account shifting organisational culture from hierarchical to a network-based one;
-implementing new decision-making processed, based on centralised, standardised data;
-enhancing digital competencies of university employees;
-using tools supporting and developing educational innovations and carrying out scientific activities, as well as building relations with alumni using new communication channels.

Thus, upon taking note of the digital dimension of socio-economic changes, foundations and directions of development of relations between higher education institutions and the enterprise world, one may conclude that the level of innovation and competitiveness of modern economies, which constitute both complex and dynamic socio-economic systems, will increasingly depend on the ability to establish and maintain relations based on partnership between universities and enterprises using tools supporting digital transformation.

In the process of digital transformation, the university may play the role of a hub that both fosters and drives the establishment of a cross-sectoral networking organisation, which:
-stimulates economic and social growth;
-creates and implements modern solutions and innovations;
-builds the value of intellectual, social and relational capital.

Literature review

University-business relations play an increasingly important role in generating and transferring technologies, marketing knowledge, improving human capital, and consequently they determine the strength of economic structures, influence economic growth, support competitiveness and attractiveness of areas (cities, regions, countries, but also international groupings, such as the European Union). Therefore, the study of relations - strength, scale, areas of cooperation - that are forming between the worlds of science and business is becoming an increasingly interesting thread of scientific research (Ripoll and Diaz Rodriguez, 2017, Mahfoudh and Boujelbene and Mathieu, 2019).

As indicated by Galan-Muros, van der Sijde, Groenewegen, Baaken (2017), traditional interest in the spheres of university-business collaboration has focused on the commercialisation areas of the collaboration, including patents, licences, spin-outs and spin-offs, involving primarily one-way knowledge flows (D'Este and Patel, 2007). However, there are indications in terms of the need to capture the value that universities bring to business and society (Galan-Muros and van der Sijde, Groenewegen and Baaken, 2017, Hughes, 2006, Klofsten and Jones-Evans, 2000).

Collaboration between the sectors under study may include areas such as (Sojkin and Michalak, 2016):

-market - joint R&D work and commercialisation of research results, creation of scientific and research teams,

-human resources - participation in education of practitioners, joint creation of an educational offer, joint implementation of internship projects,

-education processes - study visits, lectures by practitioners, internships and apprenticeships.

Much of the research presented in the academic literature on science-business collaboration relates to engineering education, which supports the formation of competencies in the context of specific needs making graduates more attractive to the industry; it also supports collective learning processes. Five major areas of research on university-industry relations in engineering are identified:

-individual and organisational determinants of the cooperation between the university and industry,

-the impact of university-business cooperation on industrial activity,

-the relationship between scientific productivity and cooperation with industry, entrepreneurship of universities (scientists' business plans),

-motivations of universities to cooperate with the industry (Miranda and Pertuz, 2021) .

Against the background of engineering, organisational and digital issues, there is a research being carried out relating to Industry 4.0, operating interconnected technologies based on IoT and the provision of useful digital solutions; the operation of companies within Industry 4.0 requires a broad set of services and

facilities that are difficult to find in a single technology provider, especially in the case of small and medium-sized enterprises (SMEs).

Universities and solutions provided by them are an important entity in innovation ecosystems that enable SMEs to integrate resources and co-create solutions for Industry 4.0 (Benitez and Ayala and Frank, 2020). Industry 4.0 is not only technologies, but also, or maybe first of all, human capital and process of its creation and strengthening (also through cooperation of business and universities). There is a research undertaken conducted in the framework of human factors engineering on the subject of changing needs of people in the Industry 4.0 environments and preparation of human resources for the modern economy (Neumann and Winkelhaus and Grosse and Glock, 2021).

Nowadays, the business-science relationship should be viewed in the context of the digital transformation process. There are a large number of articles in the literature on technological and organisational aspects of digital transformation (Nadkarni and Prugl, 2021). The challenges of digital transformation (in terms of technological and organisational aspects) for companies are constantly growing and becoming more complex. This is particularly evident in the case of SMEs, whose capacity makes it difficult to undertake digital transformation activities on their own. Attempts are being made to develop an organisational competence model for digital transformation, that takes into account the importance of organisational learning and organisational knowledge. These models may be useful in the context of setting directions for SME-university cooperation (Gonzalez-Varona and Lopez-Paredes and Poza and Acebes, 2021).

In the context of digital transformation, not only the functioning of enterprises, but also of universities is examined. The electronic university is seen as an entity of great importance for the generation, development, accumulation, provision of knowledge, among others, through variously implemented educational process, including e-learning (Azarov and Mayboroda, 2020). Artificial Intelligence (AI) is increasingly entering the academic reality and can be a tool to improve the efficiency of the university and support the building and contextual transformation of relations with the environment (Vinichenko and Melnichuk and Karacsony, 2020).

Analyses devoted to the effects of cooperation between universities and business can be treated as a separate research topic. It concerns both the influence on the level of entrepreneurship and creation of new companies (Sarceda and Cho, 2020), as well as the influence on the effectiveness and competitiveness of existing companies. In scientific research not only the directions of cooperation between science and business are analysed, but also the conditions determining this cooperation; the studies on the real factors determining the importance of academic knowledge for the innovative activity of companies are especially interesting. Increasing the importance of knowledge transfer to companies is facilitated not only by the quality of conducted research, but also the entrepreneurial orientation (EO) of universities (Bellucci and Pennacchio, 2016). This feature - next to the

size of the university and the presence of science, technology, engineering and mathematics (STEM) - is one of the most important factors in the context of commercialisation of intellectual property. The results of the ongoing research highlight the need to consider university EO as a binder linking different resources for the creation of innovations with deployment value; the use of university EO can influence the indicators highlighted by many stakeholders. Large universities and those with a focus on STEM are better able to leverage their position in rankings as well as strategically create and develop new academic programmes (Balasubramanian and Yang and Tello, 2020).

Another important research issue is the identification of channels through which knowledge and technology are transferred between universities and industry (Bekkers and Bodas Freitas, 2008). This issue is crucial for building lasting, even daily, relationships and for developing a common language to ensure communication between actors from different sectors.

Relations between science and business are also part of a broader context of research on local and regional development, especially in terms of the importance of innovation and creativity in this process. These relations are perceived as part of the genetic code of cities and regions, as a strong factor of strategic development and generator of structural changes (D'Acci, 2014, Klasik and Wrana, 2018). In the processes of socio-economic development, academic interdisciplinarity gains particular importance; it is a feature that makes it possible to face the complex challenges of the contemporary world and creates new opportunities for the development of knowledge beyond narrow specialisations. University Interdisciplinary Organisations (IDOs) not only strengthen the interdisciplinary collaboration of researchers, but - contrary to intuition - also serve the interests of faculties and disciplines (Yang and Albats and Etzkowitz, 2021).

Research methodology

The research conducted by WSB University has been prepared in dialogue with entrepreneurs who are members of the University's Expert Council. The research was carried out within the project "PERFECT - Regional Excellence Initiative at WSB University". During the initial phase, a set of issues relevant to establishing effective relations between business and universities was identified. Among the most relevant issues justified for investigation, the following were indicated:

-evaluation of own experience in using knowledge transfer to the company:
  -substantive scope,
  -tools supporting the transfer,
  -scientific entities transferring knowledge,
  -key undertakings of the company within the scope of transfer,
  -assessment of the scale of transfer in relation to the needs of the company,
  -assessment of the effects of knowledge transfer,
  -risk assessment,

-the internal model used in the company for knowledge transfer:

-the process of identifying the need for knowledge: strategies, participation of managers and employees,
-model of implementation of the acquired knowledge,
-assessment of industries in terms of knowledge transfer needs:
-'knowledge' gap assessment: technologies, industrial designs, management, marketing,
-assessment of knowledge about available tools for knowledge transfer to business:
-levels: local, regional, national,
-company plans to use knowledge transfer to business:
-expected benefits,
-interesting fields of support: processes, products,
-forms / tools of transfer: projects, research, personnel,
-barriers that hinder the realisation of knowledge transfer to business:
-barriers from the side of companies,
-barriers from the scientific sector,
-other barriers: common to the science-business sector, specific barriers hindering the transfer on the side of other sectors,
-proposed changes to the current model of knowledge transfer to business:
-tools,
-directions.
-evaluation of the forms of knowledge transfer support provided by WSB University.

After the prioritisation of issues and their grouping in cooperation with the representatives of the Board of Experts, the preparation of the survey began.

The main objective of the measurement was to obtain information related to the formation of long-term relations between HEIs and institutional stakeholders (with particular emphasis on tools based on modern technological and IT solutions). It required identification of conditions of relations between HEIs and institutional stakeholders, including entrepreneurs and representatives of local government entities (i.e. cities with county rights). The information was collected on the interest in establishing a relationship with the university, and then strengthening it, as well as the strength of the impact of the tools from the area of modern technologies used by universities on the above-mentioned processes.

The research was quantitative and qualitative in nature, in accordance with the principle of methodological triangulation. "Hard" data was obtained and used to describe various aspects related to building relations between the university and the environment. The image obtained is multithreaded, multifaceted, and also - due to the possibility of comparing and contrasting the opinions of different groups of respondents - multi-dimensional.

Below are the result of a quantitative study carried out as part of the project. The survey was conducted on a group of 350 companies using the Computer Assisted Telephone Interview (CATI) method.

The recruitment criteria for entities to the Reaserch involved undertaking of at least one of the following activities by the company:
1: accepting students for internship,
2: searching for employees or volunteers in higher education institutions,
3: providing an opinion on the curricula of universities,
4: conducting joint educational modules, courses, training,
5: participating in meetings and conferences organised at universities,
6: cooperating with universities as a partner in projects, e.g. research and development projects,
7: using the expert knowledge of the academic staff,
8: using the results of research conducted at universities,
9: engaging in charity actions and other social activities organized by universities,
10: participating in advisory bodies operating at universities,
11: being inspired by innovations disseminated by the university, e.g. new technologies,
12: inviting universities as partners to organised events, campaigns, etc.
The research was nationwide and the respondents were: owners or co-owners of companies, presidents, board members, directors, middle managers (e.g. department managers), HR managers, PR managers (public relations, communication), marketing managers.
The results obtained were analysed, among others, in terms of the selected variables. Appropriate statistical operations were carried out, and this kind of data is normally analysed at a 95 per cent level of significance.

Research results

The scope of the quantitative study, the key research questions posed as key problems included:
-determinants of relations between higher education institutions and institutional stakeholders;
-possibilities of using and combining various tools from the area of modern technologies in the process of forming long-term relations between universities and institutional stakeholders.
The assessment of the forms and platforms of cooperation between enterprises and universities employed to date, one could draw the conclusions that enterprises are far more likely to take advantage of forms of cooperation, which do not require involvement and building strong relations with universities. The most common form of cooperation between entrepreneurs and universities, which was brought up by 66% of the participating entities, involved internships and placements for students. 32% of respondents looked for staff members and volunteers at universities.
Another important field of cooperation with higher education institutions concerned issues pertaining to strengthening the innovative potential of companies, including:

-taking advantage of the expert knowledge of academic staff, cooperation with universities as a partner in research and development projects and other initiatives, as well as taking part in meetings and conferences organised by academic entities (25% of respondents);
-taking advantage of the results of studies carried out by universities (19%);
-providing feedback on curricula by entrepreneurs (21%),
-conducting joint courses, training sessions, educational modules (18%).

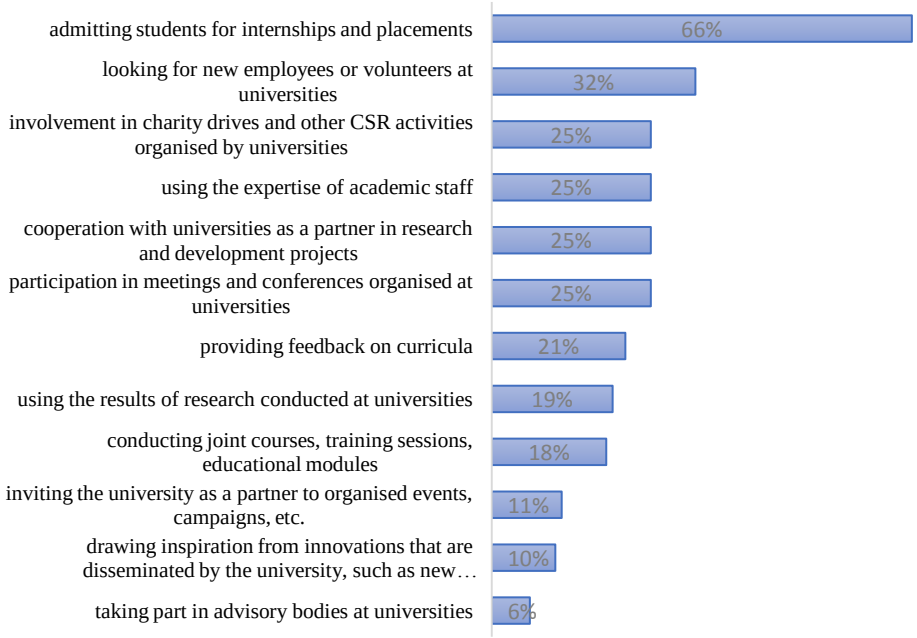

Figure 1: Forms of cooperation between enterprises and higher education institutions
(Own study based on a report from a study carried out as part of the "PERFECT - Regional Excellence Initiative at the WSB University" project, 2021)

Among the respondents, nearly half of them assess the relations between their companies and universities as strong, a similar number of respondents deemed them neutral or ambivalent, while only 3% claim that their mutual relations are weak. The average score on the scale of 1-5 is 3.49, which means that the declared strength of relations with universities is situated between ambivalent (3) and moderately positive (4).
At the same time, the strongest relationships are typical for entrepreneurs who undertake cooperation with universities in a number of fields, including:
-drawing inspiration from innovations that are disseminated by the university, such as new technologies;
-conducting joint courses, training sessions, educational modules;
-looking for new employees or volunteers at universities;

-inviting the university as a partner to organised events, campaigns, etc.;
-taking part in advisory bodies at universities;
Based on the quantitative study, one may conclude that the strength of the relation between higher education institutions and enterprises is positively influenced by:
-company size (number of employees);
-duration of cooperation;
-the number of universities with which a given company maintains relations.
The entrepreneurs participating in the study, who have already had advanced forms of cooperation with higher education institutions, who believe the existing relations to be strong and who collaborate with 2 or 3 universities, as well as maintain relations with the higher education sector entities for 4-5 years would generally like their relations to be stronger.

Table 1. Strength of existing and desired relations of enterprises with higher education institutions (in % of indications and mean score on a 1-5 scale)

Fields of cooperation	implemented			desired		
	strong (4+5)	weak (1+2)	average on a scale of 1-5	strong (4+5)	weak (1+2)	average on a scale of 1-5
Total	47%	3%	3,49	30%	1%	3,35
drawing inspiration from innovations that are disseminated by the university, such as new technologies	57%	5%	3,76	31%	-	3,45
conducting joint courses, training sessions, educational modules	63%	-	3,74	34%	2%	3,39
looking for new employees or volunteers at universities	68%	2%	3,72	35%	-	3,44
inviting the university as a partner to organised events, campaigns, etc.	56%	5%	3,72	36%	-	3,56
taking part in advisory bodies at universities	57%	5%	3,7	38%	-	3,61
cooperation with universities as a partner in research and development projects	59%	1%	3,66	37%	1%	3,47
participation in meetings and conferences organised at universities	62%	3%	3,65	37%	-	3,44
using the results of research conducted at universities	56%	1%	3,64	29%	-	3,37
using the expertise of academic staff	49%	-	3,58	29%	-	3,33
providing feedback on curricula	51%	1%	3,57	22%	-	3,25
involvement in charity drives and other CSR activities organised by	49%	3%	3,53	40%	1%	3,49

universities						
admitting students for internships and placements	47%	3%	3,49	26%	0%	3,31

Own study based on a report from a study carried out as part of the "PERFECT - Regional Excellence Initiative at the WSB University" project, 2021.

The survey indicates that the level of satisfaction of enterprises with their cooperation with higher education institutions was high – this rating was selected by 93% of respondents. A significantly higher satisfaction value (98%) was reported by entities, which cooperate with universities to provide joint courses, training sessions and educational modules. The perception of a strong relation fosters a high level of satisfaction with the existing relation.
The areas, which the companies considered desirable and wanted to further strengthen their relations with universities concerned taking advantage of the offering of the universities, such as expertise and research. They also reported slightly lower preference for more advanced forms of cooperation, requiring building stronger relations, trust and good recognition of the partner's potential, such as joint digital transformation and creating international ventures.

Table 2. Areas for the development of strengthening business ties with the university (rated on a scale from 1-7)

Areas	average on a scale of 1-7
Taking advantage of the expertise and advice of selected higher education institutions	5,54
Taking advantage of knowledge transfer and innovations from selected HEIs to the company	5,53
Taking advantage of new technologies promoted by selected HEIs	5,48
Getting involved in the activities of expert institutions and advisory bodies	5,48
Involvement of HEIs as a partner of campaigns and social activities	5,45
Carrying out joint ventures with HEIs	5,44
Taking part in conferences and other meetings organised by HEIs	5,43
Taking advantage of research outcomes to grow the company	5,43
Carrying out joint R&D ventures with HEIs	5,42
Carrying out international ventures with HEIs	5,41
Carrying out digital transformation with the support of HEIs	5,38
Having an impact on the educational offering, courses and curricula offered by HEIs	5,25
Learning more about their offering	5,03

Own study based on a report from a study carried out as part of the "PERFECT - Regional Excellence Initiative at the WSB University" project, 2021.

Among the respondents, 36% indicate that fulfilling the university's teaching and educational mission has the greatest impact on building strong relations between the institution and the company, while 32% of them point out that high-quality scientific research with results applicable for the society and economy is key in that regard. Innovation, knowledge transfer and providing broadly understood support offered to various stakeholders who are close to universities is generally deemed less important.

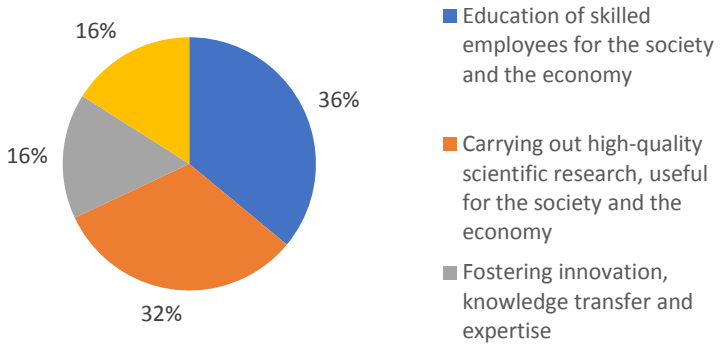

Figure 2: Functions of higher education institutions with the greatest impact on building relations between then and entrepreneurs ***(****Own study based on a report from a study carried out as part of the "PERFECT - Regional Excellence Initiative at the WSB University" project, 2021)*

The study also identifies a set of desired competencies of a university as a partner in digital transformation. The respondents usually highlighted competencies pertaining to factual knowledge and broadly understood social competences, as well as relationship building skills as the main factors in this regard. Other important aspects also included ethical concerns and international activities.

Table 3. Competencies of a higher education institution as a partner in the digital transformation of the company (rated on a scale from 1-7)

Competencies	average on a scale of 1-7
Digital transformation expertise	5,89
Flexibility, ability to adapt to the needs oof other entities in the process of digital transformation	5,88
Promoting innovative solutions in the area of digital transformation	5,85
High level of ethics	5,82
The ability to compete and cooperate with other HEIs involved in the process of digital transformation	5,81
International cooperation in the area of digital transformation	5,81

Soft skills, including efficient communication and relationship building	5,7
Educational competencies, ensuring practical education in the context of digital transformation	5,67
Using technologies and solutions in the area of digital transformation, available on the market	5,67
The ability to cooperate with other economic and social entities by the HEI	5,65
The ability to motivate the academia to get involved in the process of digital transformation	5,64
The ability to take advantage of resources of other organisations involved in the process of digital transformation	5,62
Scientific and research competencies in the context of digital transformation studies	5,59
Managerial competencies in terms of HEI development, including digital transformation	5,5

(Own study based on a report from a study carried out as part of the "PERFECT - Regional Excellence Initiative at the WSB University" project, 2021)

The success of a digital transformation, which is an issue that permeates virtually every area of operations of an organisation, hinges upon internal factors that define the organisational culture of a company. According to the respondents, the key determinants, which foster digital transformation include creativity, flexibility and the ability to initiate change and adapt the organisation.

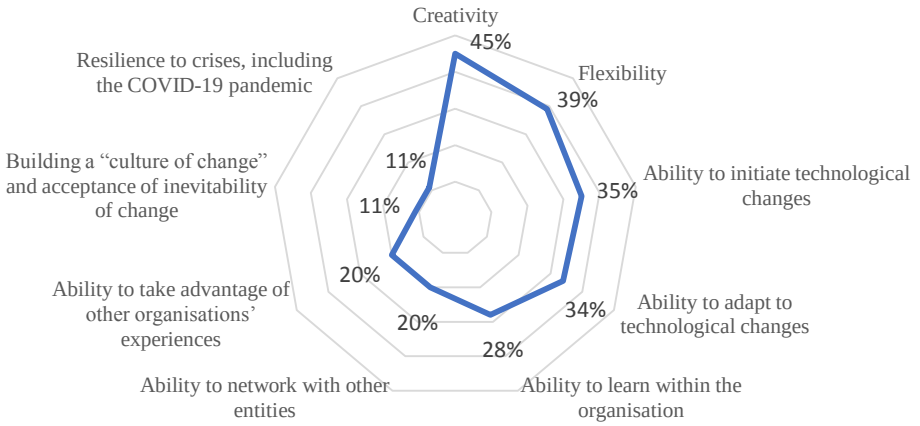

Figure 3: Characteristics of organisational culture that foster digital transformation process in a company in % (respondents could pick up to 3) (Own study based on a report from a study carried out as part of the "PERFECT - Regional Excellence Initiative at the WSB University" project, 2021)

Another key aspect of the study was to identify the needs of enterprises in terms of digital solutions they would like to learn about or implement in the upcoming five years, which might constitute important platforms for developing relations between higher education institutions and enterprises.
It should be noted that this interest in the aforementioned solutions is impacted by the size of the company in terms of the number of employees – the larger the company the higher the interest.
Based on the results of the study, the key digital solutions, which are of interest for entrepreneurs, include:
-security technologies;
-technologies concerning the development of IT systems enabling efficient and effective information management;
-technologies that enable automation of management processes;
-technologies that foster relationships between organisations and their customers.

Table 4. Interest in information and technology solutions among entrepreneurs (rated on a scale of 1-7)

information and technology solutions	Average on a scale of 1-7
Solutions ensuring better protection of IT networks, devices, software and data from hacker attacks, damage and unauthorised access (cybersecurity)	5,63
IT systems that enable gathering, analysis and management of data from multiple sources (Big data)	5,46
Solutions that enable fostering relationships between organisation and their customers using IT systems for analysis and evaluation of mutual experiences (experience design)	5,4
Solutions that enable secure data storage based on creating and recording full data flow chain (Blockchain)	5,39
Solutions that enable storage of data, files, applications, software or IT systems on vendors' external servers (Cloud computing)	5,39
Solutions enabling increasing the speed and security of data processing, based on moving the computing power closer to the sources of data (Edge computing)	5,38
Solutions geared towards automation of governance and management processes (e-mail handling, financial transaction processing) (process automation, robotic process automation)	5,35
IT systems supporting decision-making in organisations (artificial intelligence)	5,15
Solutions replacing people in simple household chores (smart vacuum cleaners, lawn mowers)	5,07
IT systems enabling conversations with a computer, virtual assistants providing advice or answers to frequently asked questions (Chatbot)	5,06
Solutions that enable making devices smart by connecting them to the Internet, such as smart fridges, which can be looked into via a smartphone application	5,04

(Internet of Things)	
Solutions enabling combining computer simulations with real world, for example by superimposing 3D images on real-time camera feed (augmented reality, AR)	5,01
Solutions enabling displaying simulated images of reality and virtual environments, for example computer simulations of objects, spaces and events (virtual reality, VR)	4,99
Solutions based on high-throughput mobile networks, for example remote medicine and monitoring of their vital parameters, remote control of cars and other vehicles (5G technology)	4,98
solutions that replace people in simple professional activities (e.g. holograms providing information or advice to customers)	4,95
solutions aimed at so-called machine learning (e.g. enabling a computer to perform tasks for which it has not previously been programmed) (machine learning)	4,95
solutions that replace people in more complex professional activities (e.g. a humanoid robot replacing a receptionist in a hotel or a salesman in a shop)	4,74
solutions that replace humans in more complex household tasks (e.g. humanoid robots caring for elderly or people with disabilities)	4,7

Own study based on a report from a study carried out as part of the "PERFECT - Regional Excellence Initiative at the WSB University" project, 2021.

Results discussion

The completion of the research enabled verification of the main challenges related to the cooperation between universities and enterprises; the main trends present in global research and described in the second point of the article were taken into account. A significant interest of enterprises in establishing relations with the academic world in Polish conditions is also apparent. At the same time, however, entrepreneurs raise a number of issues that require significant improvement:

-Generally, the assessment of the quality of the science-business cooperation is moderate; enterprises in Poland are not fully satisfied with both the forms and scope as well as results of the partnership; in the context of the cooperation of entities, the importance of creating broader, multi-entity cooperation arrangements allowing to generate more valuable innovative solutions and to diversify the performed scientific researchis - in comparison with global research - less emphasized (Yang and Albats and Etzkowitz, 2021); partly, it may be due to a stronger orientation of Polish companies towards competition than towards cooperation;

-relatively limited interest of the surveyed companies in permanent, deep involvement in the creation of educational programmes and research projects; indeed, there is a certain proportion of companies undertaking such activities, but a significant part of the surveyed companies use ready-made "products" offered by universities; in this aspect, it is worth taking advantage of global studies analysing

experiences in the use of communication tools integrating the activities of universities and companies (Bekkers and Bodas Freitas, 2008);
-in the conducted research, the study of organisational culture in enterprises from the point of view of willingness and ability to cooperate with universities became an important thread; complementary results - referring to the study of organisational culture of universities, in particular entrepreneurship - can be found in interesting world studies (Bellucci and Pennacchio, 2016);
-it is advisable to continue research relating to the interest of entrepreneurs in information and technology solutions; entrepreneurs have pointed to a change in the perception of the importance of these tools and areas of their use; the perception of digital tools changed significantly during the COVID-19 pandemic; it seems that this research thread may be of interest both nationally and globally.

Managerial Implication

The results obtained in the course of the research may provide support for the universities striving to strengthen their position in the networks of intersectoral relations. Based on the research, the main directions of activities for intensification of cooperation between science and business can be indicated; these are seven main recommendations:
-replacing in the innovation process the traditional one-way relationship in which the university is a "donor" and the enterprise a "recipient" of innovation with a two-way relationship in which innovation is generated in a close dialogue and partnership between science and business,
-reinforcing the entrepreneurial orientation of universities, which in practice involves seeking opportunities for the commercialisation of knowledge created in partnership with businesses,
-seeking to create long-term relationships that are rated by companies as more valuable than shallow and ad hoc relationships,
-setting up partnerships in the system of many entities (several universities and many enterprises) allowing for complementary supplementation of potentials and competences and creation of more advanced and complex innovative solutions,
-broadening partnerships in the area of human capital formation, in particular for the joint development of curricula and combining theoretical and practical modules,
-widespread use of digital tools to improve communication between universities and enterprises and to create an educational offer carried out in the form of e-learning or blended learning,
-supporting businesses by universities in their digital transformation process, including the identification of new application areas for digital tools and ensuring digital security.

Conclusion

Digital transformation is strongly redefining today's socio-economic systems. It is a driving force for new sectors, but also a factor of transformation in traditional sectors. Digital tools radically change the ways in which people communicate with each other. These phenomena contribute to deep changes in the nature and scope of intersectoral relations. This is particularly true for the science-business system. Managers of enterprises and scientists perceive the necessity of cooperation enabling knowledge transfer between universities and companies. The benefits of establishing such relations are mutual, although they refer to different values. For companies it is, above all, an increase in competitiveness through access to knowledge, the carrier of which are people, products and technologies. For universities, the main benefits are strengthening their position as leaders in creating useful solutions and increasing the attractiveness of the educational offer. University-business cooperation requires constant search for new grounds and forms of dialogue referring to the challenges of the changing world. Enterprises are aware of the positive influence of continuous cooperation with universities on strengthening their market position. At the same time, however, they must take a more active attitude in the process of communicating their needs. In turn, universities must improve their ability to read current and forecast future needs of the economy and society. Like no other entity in the innovation ecosystem, they must be able to create new ideas and assume leadership functions. Strengthening the relationship between science and business requires improving forms of cooperation and raising the level of trust capital between the two parties. The development of these relations should take into account the challenges of digital transformation, both in terms of creating tools and in terms of attitudes, competencies and mechanisms for their implementation.

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KSZTAŁTOWANIE RELACJI UCZELNI ZE ŚWIATEM PRZEDSIĘBIORCZOŚCI W DOBIE TRANSFORMACJI CYFROWEJ DIGITAL

Streszczenie: Współczesna gospodarka i społeczeństwa charakteryzują się bardzo dynamicznymi procesami rozwojowymi, które wpływają na zmiany w relacjach pomiędzy podmiotami reprezentującymi różne sektory, napędzane głównie przez szeroko rozumianą innowacyjność. Kluczowi gracze w procesie rozwoju innowacji – firmy, przedsiębiorstwa i uczelnie – nieustannie się zmieniają i otwierają na swoje otoczenie poprzez zacieśnianie współpracy. Jednocześnie pojawiają się nowe wyzwania związane z procesem cyfrowej transformacji, które tworzą nowe platformy i mechanizmy, które leżą u podstaw tej współpracy.Celem artykułu jest zarysowanie głównych aspektów relacji uczelni z sektorem biznesu w kontekście procesów transformacji cyfrowej. W artykule przedstawiono wybrane wyniki badania przeprowadzonego z udziałem przedstawicieli sektora biznesu, które identyfikuje czynniki i determinanty relacji uczelnia-biznes. Analiza objęła aktualny stan współpracy, determinanty wpływające na siłę i zakres relacji pomiędzy uczelniami a przedsiębiorstwami, a także postulowane przez przedsiębiorców kierunki intensyfikacji współpracy. Zbadano również zainteresowanie przedsiębiorców korzystaniem z narzędzi cyfrowych, w tym także w kontekście nawiązywania współpracy z uczelniami.

Słowa kluczowe: relacje, współpraca międzysektorowa, cyfryzacja, transformacja cyfrowa,

塑造数字化转型时代高等教育机构与企业界的关系

抽象的

当代经济和社会的特点是高度动态的增长过程，它影响代表各个部门的实体之间关系的变化，主要由最广泛意义上的创新驱动。创新发展过程中的关键参与者公司、企业和大学通过促进更紧密的合作不断改变和开放。与此同时，与数字化转型过程相关的新挑战正在出现，这些挑战创造了新的平台和机制，这也是这种合作的基础。本文的目的是概述在数字化转型过程中大学与商业部门之间关系的主要方面。本文介绍了在商界代表参与下进行的一项研究的选定结果，该研究确定了大学与企业关系的因素和决定因素。分析涵盖了合作现状、影响大学与企业关系强度和范围的决定因素，以及企业家假设的深化合作方向。此外，还考察了企业家对使用数字工具的兴趣，包括开始与大学合作的背景。

关键词：关系、跨部门合作、数字化、数字化转型、