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HIGHER EDUCATION INSTITUTIONS AND DIGITAL TRANSFORMATION

BUILDING UNIVERSITY-ENTERPRISE COLLABORATIVE RELATIONSHIPS

Marcin Lis

Higher Education Institutions and Digital Transformation

The growing complexity, fluidity and instability of the environment as well as changing needs are challenges that both enterprises and higher education institutions must face. Higher education institutions understand that their key product, i.e. knowledge, is a value that can and should be offered to enterprises in a desirable form, as a key to innovation and development as well as the basis of the necessary internal transformation to respond to the requirements of our times. Attempts to explain the process of collaboration between higher education institutions and businesses based on an institutional perspective often fail to capture the complexity of this process.

The purpose of this book is to develop a model approach to managerial competencies that affect the innovativeness of enterprises, and to identify internal and external key factors strengthening or limiting the impact of managerial competencies on the innovativeness of an enterprise, including organizational structure, strategy, organizational culture and more. It will be of value to researchers, academics, and students in the fields of entrepreneurship, innovation, management, strategy, and will be particularly useful to organizations that are aware of their operating conditions in the knowledge-based economy and of the impact of the COVID-19 pandemic on the acceleration of the digital transformation of the contemporary world.

Marcin Lis is an Associate Professor and a Vice Rector for Students Affairs and Environment Cooperation at WSB University, Poland.

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Introduction

At the time of rapid technological development, enterprises are becoming increasingly aware of the need to develop various forms of inter-organizational cooperation and to invest in relationships to support them in the recognition and adaptation of technologies to improve the competitiveness and innovativeness of enterprises (Poznańska, 2012). The expansion of modern technologies with the related increased demand for knowledge are prerequisites that encourage a closer look at relations between higher education institutions[1] and enterprises whose activities are closely related to the same subject area. The growing complexity, fluidity and instability of the environment as well as changing needs are challenges that both enterprises and higher education institutions have to face. Better awareness of current changes intensifies the need to explore their nature and, as a consequence, to have an effective and multidimensional transformation as a response to a change or as an early intervention. The new reality requires proper interpretation and understanding of social and economic processes that are becoming less and less predictable and increasingly dynamic. Therefore, the learning that makes development of available knowledge resources possible is becoming one of the key business processes and knowledge itself gains importance as the most desirable resource, competence and value on the basis of which one can develop relationships that are so significant in the contemporary socioeconomic system. The growing interest in knowledge acquisition and use and, at the same time, in the learning process makes enterprises and higher education institutions open up to new areas and forms of cooperation with their environment.

Higher education institutions notice that their key product, i.e. knowledge, is a value that can and should be offered to enterprises in a desirable form as a key to innovation and development as well as the basis of the necessary internal transformation to respond to requirements of our times. The implementation of the idea of an entrepreneurial university continues to be a difficult challenge for many higher education institutions; however, the belief that competitiveness on the market of higher education services means not only being informed by knowledge but also being oriented on the market and its needs is rapidly becoming more and more

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popular in the academic circles. What is more, higher education institutions attach increasing importance to the strengthening of relations with key interested parties such as enterprises, seeing them as opportunities to acquire external expertise. It means that higher education institutions are increasingly aware of how they model their relations, in particular, with those enterprises that can also offer something to them. Thanks to such awareness, the importance of higher education institutions as partners in formal and informal inter-organizational relations, among other things, aimed at the cooperation to exchange knowledge resources, learn together and absorb knowledge is on the increase.

However, attempts at the explanation of the cooperation modelling process between a higher education institution and an enterprise based on the institutional perspective do not make it possible to capture the complexity of the process because inter-organizational relations between such entities also have a strong market context. As a rule, higher education institutions act as offerors of knowledge-based services while enterprises play the role of clients using such services. However, we can see a reversal of these roles more and more often. Higher education institutions become clients of enterprises that have resources necessary to develop the academic offer, e.g. know-how necessary for practical education, infrastructure or technology necessary to conduct research. In practice, both situations can occur simultaneously, which means that both a higher education institution and an enterprise wish to develop a beneficial relationship. The establishment of strong inter-organizational links between higher education institutions and enterprises in the market environment indicates that they can be solidified thanks to the relationship marketing. In this case, the value on which such relationships are based is knowledge as the core of various services related to its transfer or expansion for subsequent appropriate use or diffusion both in enterprises and in higher education institutions. Therefore, the ability to develop inter-organizational links is particularly valuable for enterprises and higher education institutions when they can offer significant value to exchange with each other thanks to acquired unique knowledge or an equivalent payment for its use.

From the perspective of both parties to the relationship, striving to consolidate such links on a market platform will be beneficial, which justifies the analysis of this process from the point of view of strategic management, marketing theory including the concept of the relationship marketing stressing direct interactions between both parties. The contemporary approach to the concept of the relationship marketing clearly accentuates the connection between the depth, durability and profitability of inter-organizational links and the value on which the exchange between the cooperating parties is based and the resulting satisfaction. Such multidimensional value is co-created by parties to the exchange in the process of the inter-organizational cooperation that goes beyond traditional market relations. This is why clients taking part in a simple transactional exchange

can be transformed into reliable and strongly linked partners connected by common interests and a similar approach to challenges from the environment that they want to face together.

One of such challenges results from the above-mentioned dynamic development of technologies that catalyzes changes and improves the innovativeness of enterprises, determining their development rate. Technologies create new opportunities for action and different conditions in which competition occurs on the market; this is why they are perceived subjectively as opportunities or threats. The variety of technologies surrounding an enterprise often intensifies the confusion about which technologies to implement and how to do it to make the most of them in an organization. The definition of directions of technological development is fundamental for the shaping of an enterprise development strategy but it also requires a careful observation of the enterprise's environment and its changing trends. Digitization is one of the leading contemporary technological trends; when combined with the growing importance of data flow processes in inter-organizational relations, it offers new conditions for the development of knowledge-based economy.

Digital maturity embedded in properly developed inter-organizational relations guarantees the access to knowledge necessary for the creation of innovations defined by very advanced technologies. This is why knowledge of digital technologies and their applications is currently one of the most desirable resources and a unique competence determining the organization's survival in the more and more rapidly changing world. Multidimensional digital transformation is one of the most characteristic contemporary socio-economic processes reflecting inevitable and permanent technological changes affecting states, societies and organizations. The dynamism of this process has been additionally intensified due to the COVID-19 pandemics that became a catalyst for the digital transformation both for enterprises and for higher education institutions. Digitalization-based changes in the life cycle of business models stimulate the demand for new technologies, which means that enterprises are more willing to search for related specialist knowledge beyond their organizations. Similar processes occur in higher education institutions that introduce digitization to the area of education, science and research as well as to their organizational and administrative sphere. Even though the speed of digital transformation in higher education institutions varies, there is no doubt that the COVID-19 pandemic made this process more dynamic and brought the awareness of multidimensional benefits that the academic sector can attain thanks to due to such situation. Higher education institutions are developing educational, research and scientific and implementation services related to digital technologies as well as modern systems for administration management and communication with the environment. In the light of the fact that the competitive pressure related to technological development encourages enterprises to intensify digitization processes in their cooperation with organizations that can offer valuable

knowledge, one can ask whether and to what extent higher education institutions can become a partner for the business sector in that area.

Even though the cooperation between enterprises and higher education institutions is discussed in many studies and scientific publications, processes of knowledge transfer and joint learning are usually analyzed in the context of knowledge management, the network theory or the inter-organizational cooperation concept while the science-business relations relating to services rendered by higher education institutions for enterprises are analyzed on the basis of the management of relations with a client, from the perspective of the theory of marketing including the relationship marketing. However, the unique type of links between higher education institutions and enterprises developing on the basis of the joint use of knowledge including knowledge of digital technologies suggests that the issue may need to be analyzed in a wider context. Increasingly entrepreneurial higher education institutions, oriented on the market and professionally managed, are offerors of knowledge-based services while enterprises are clients using such services. Additionally, the process of knowledge exchange in that relationship is based on the value co-created by the enterprises and higher education institutions, which is characteristic for the inter-organizational cooperation. Only such a broad approach to the relations between higher education institutions and enterprises allows us to fully recognize the complexity and the nature of inter-organizational links built between them, also in the context of the digital transformation they are facing. Considering the scope of analyzed topics, the research issue of the work has been defined as the building of long-term relations between higher education institutions and enterprises on the basis of the value represented by knowledge of digital technologies. Such an identification of the problem has not been extensively recognized by researchers and, therefore, there are no scientific monographs discussing the subject. The majority of available papers relating to similar issues separately analyze processes of inter-organizational learning or relationship management based on marketing concepts. This work combines these issues in a holistic and multidimensional manner while taking into consideration one of the most important contemporary challenges of multidimensional digitization.

The following research questions result from this issue:

- Q1: How does the transformation of a higher education institution into a knowledge-based entrepreneurial organization promote its inter-organizational cooperation with enterprises?
- Q2: What factors influence the shape of long-term relations between higher education institutions and enterprises?
- Q3: Which digital technologies are material in the process of the establishment and strengthening of links between higher education institutions and enterprises?

- Q4: What are the components of the model illustrating the building of long-term relations of higher education institutions with enterprises (which model will illustrate this process)?
- Q5: What are the possibilities to apply and combine various research methods to analyze the building of long-term relations between higher education institutions and enterprises?

While being aware of the strategic importance of the knowledge of digital technologies both for enterprises and for higher education institutions and having in mind the possibility to improve the effectiveness of its application thanks to intensified inter-organizational cooperation and the consolidation of ties between them, the author's aim for this work is to work out a model for the building of relations between higher education institutions and enterprises in the digital transformation context. To attain the main goal of the work, the author has also defined the following detailed objectives:

- To indicate those characteristics and competencies of higher education institutions that promote their inter-organizational cooperation with enterprises
- To define factors that influence the shape of long-term relations between higher education institutions and enterprises
- To identify digital technologies of key importance for the establishment and strengthening of ties between higher education institutions and enterprises
- To define the mechanism and components of a prescriptive model illustrating the building of long-term relations between higher education institutions and enterprises
- To develop a research procedure allowing for the construction of a prescriptive (optimization) model of the construction of long-term relations between higher education institutions and enterprises.

In the light of the fact that both qualitative studies from the perspective of interpretative research and quantitative studies as per the positivist research procedure were conducted, the author additionally proposed the following research hypotheses:

- H1: The higher education institution's knowledge of digital technologies has a stimulating (positive) influence on the willingness of enterprises to establish relations with such a higher education institution
- H2: The higher education institution's knowledge of digital technologies has a stimulating (positive) influence on the willingness of enterprises to strengthen relations with such a higher education institution
- H3: Long-term relations between higher education institutions and enterprises can be shaped on the basis of the value derived from knowledge of digital technologies (all the factors distinguished by the

author that focus the higher education institution's knowledge of digital technologies have a stimulating, i.e. positive, influence on the willingness of enterprises to establish and strengthen relations with a higher education institution).

The research process described in detail in subsection 4.1 is based on the assumptions of the grounded theory. The complexity of the issue in question required the presentation of its theoretical, methodological and empirical aspects in a logical sequence even though some of them naturally penetrate other parts of this work. The entire work consists of five chapters. These chapters offer an orderly presentation of material conditions determining the building of ties between higher education institutions and enterprises in a knowledge-based economy from the perspective of inter-organizational cooperation, relationship marketing and in the context of the digital transformation starting from the theoretical aspect, proceeding to the presentation of research results and ending with a description of the proposed model for the building of such relations.

In Chapter 1, the author analyzes the importance of knowledge in contemporary socioeconomic relations and analyzes the issue of transformation of a higher education institution into an entrepreneurial knowledge-based organization oriented on the market. The chapter also characterizes the inter-organizational cooperation as a process of development of ties between higher education institutions and enterprises, both interested in joint learning and mutual knowledge transfer. It presents results of the author's own research serving the analysis and evaluation of areas of the inter-organizational cooperation between higher education institutions and enterprises on a regional level as well as a better recognition of the research issue described in the work, e.g. prevailing behaviours and trends.

Reflections on the shaping of ties between higher education institutions and enterprises continue in the second chapter where they are subjected to an analysis from the perspective of the relationship marketing. Among other things, the author defines the area for further analysis including the needs of enterprises relating to the use of external knowledge resources and the subsequent opportunities to satisfy such needs in the process of establishment and development of relations between enterprises and higher education institutions. The author gives particular attention to the significance of the value of exchange and the satisfaction with such an exchange as determinants of relations between the academic sector and the business sector.

In the third chapter, the author focuses on problems with the digital transformation of enterprises and higher education institutions and their implications for the development of the inter-organizational cooperation between such entities. The analysis of the impact of digitization on higher education institutions and companies takes place in the context of possibilities to expand the exchange of knowledge between them and the internal transformation focused on organizational changes inspired by digitization.

This was the context surrounding the development of relations between higher education institutions and enterprises indicated as a motive of further research.

The research part of the publication is based on results of empirical, qualitative and quantitative studies. Among other things, the analysis refers to most frequent forms of cooperation between higher education institutions and enterprises and their connection with the strength of relations between them, their satisfaction with and benefits of the cooperation, the demand for resources of the higher education institution in the digital transformation process and the interest of enterprises in the cooperation with higher education institutions in specific technological areas. Research results presented in Chapter 4 were based on in-depth individual interviews with representatives of higher education institutions (15 IDI), computer-assisted telephone interviews (CATI) with 350 enterprises participating and 4 sessions conducted in the form of focus group interviews (FGI) with enterprises both engaging and not engaging in the cooperation with higher education institutions.

The fifth and final chapter presents the model of building of long-term relations between higher education institutions and enterprises in the digital transformation conditions. It is a new approach to the problem highlighting especially elements such as the co-creation of values and joint learning conditioning the accrual of knowledge of new digital technologies in a higher education institution and in an enterprise, which is the basis for the establishment and strengthening of ties between both these entities. This part of the publication discusses the process of identification and selection of enterprises as potential partners developing relations with higher education institutions as well as the influence of value offering and co-creation on the nature of the relation connecting these entities. The chapter indicates both digital technologies most interesting for enterprises as a subject area for joint learning and knowledge co-creation with a higher education institution as well as actions to be taken jointly at the stage of relationship establishment and strengthening to guarantee their durability and stability.

The author hopes that topics contained in this work will offer a source of inspiration to academics and practitioners dealing with inter-organizational cooperation and management of relations between higher education institutions and enterprises, especially in the context of the dynamic digitization of both the business sector and the academic sector. This work can be particularly useful to all organizations that are aware of their operating conditions in the knowledge-based economy and of the impact of the COVID-19 pandemic on the acceleration of the digital transformation of the contemporary world. To deal with the resulting challenges, enterprises and higher education institutions should develop and strengthen relations enabling them to exchange knowledge resources, learn together and co-create knowledge to attain the synergy effect thanks to its use and diffusion.

Note

1 Terms such as a "higher education institution" and "university" are used interchangeably in this publication because formal requirements of the possibility to use the term "university" resulting from current statutory laws have no direct bearing on the subject area of this work.

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Poznańska, K. (2012). Współpraca nauki z gospodarką na przykładzie szkół wyższych na Mazowszu [Cooperation Between Science and Economy on the Example of Higher Education Institutions in Mazovia]. *Nauka i Szkolnictwo Wyższe*, 1(39), pp. 95–112.

1 A Higher Education Institution as an Actor in Knowledge-Based Economy Development Processes

1.1 Focus on knowledge as the requirement of today

The building and strengthening of a knowledge-based competitive edge in the context of continuous changes and globalization of the economy (Kowalczyk & Nogalski, 2007) is becoming the only effective course of action for those organizations that want to not only survive but also to develop these difficult conditions. This is a part of the rationale explaining the growing demand for knowledge and the interest in cooperation with entities offering knowledge such as higher education institutions. Another part of this rationale consists of the rapid development of information and communication technologies. It is the reason why the contemporary information society reports an increasing demand for science, technology and knowledge (Boguski, 2009) and, therefore, searches for their sources.

Even though knowledge has always been treated as one of the key factors of economic development (Michalski, 2020), the current growing turbulency and lability of the environment, strong market pressure and impermanence of the competitive edge are the reasons why the importance of knowledge is even greater (Gąsowska, 2011). This is a special market opportunity for those organizations who build their competitive edge on knowledge. Such organizations as well as their environment including the interested parties are increasingly affected by the rapid pace of social, economic and technological changes as well as the current multidimensional consequences of the COVID-19 pandemic lasting since 2020. Technologies and products become outdated more quickly and are pushed out of the market by better solutions. Bisociations of the digital technology, new communication tools (e.g. cellular telephony, the Internet) with new economic trends (globalization, privatization, deregulation, liberalization of commerce, investments in renewable sources of energy, growing social inequalities) bring about unforeseeable consequences that require organizational transformations and a complex reconfiguration of economic systems. It is likely that about 70 percent of current professions will be replaced till the end of the 21st century thanks to automation and robotization based on artificial intelligence and machine learning among other

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things. New specialist jobs, new categories of goods and services and new complex models of economic activity (Kafel, 2013) will appear.

Liquidity, instability, complexity and multidimensionality will be accepted as obvious in future organizations. Multidimensional variability will be commonly accepted. The importance of knowledge as a catalyst of innovative technological solutions will grow even more. Innovations will create the demand for new, even more innovative solutions that will increase the demand for knowledge even more (Poznańska, 2016). Such a new reality will require an appropriate interpretation and developed capabilities for adaptation in an organization. To benefit from changes that will create the economy of the future, organizations will have to learn continuously and skilfully use the resources of internal and external knowledge available to them. Organizations offering various knowledge and explaining increasingly complicated socioeconomic phenomena will be extremely helpful in that regard. As knowledge will be an even more desirable resource in the new reality, higher education institutions will face a great challenge related to an effective creation, development and propagation of knowledge as well as its use by other organizations (Zawiła-Niedźwiecki, 2014).

Joint learning will probably be one of the key and more popular business processes in the future. Even now, more and more organizations notice the strategic importance of learning and want to develop competencies related to knowledge absorption.

The phenomenon of knowledge has many definitions and approaches discussed by branches of science dealing with management and quality. Knowledge should be objective and universal (Sułkowski, 2013). As an intangible resource, it is not easy to capture and measure, which makes it even more difficult to manage it in organizations. The most common approach defines knowledge as the combination of data and information supplemented with experts' opinions, skills and experience (Chaffey & Wood, 2004) that make it easier for organizations to make decisions. Data are objective source facts with no context or interpretation, not processed and offering no opportunities for the formulation of conclusions (Gierszewska, 2011). Data interpretation, assignment of a specific meaning and context to them give rise to the information (Jemielniak, 2012) used in various areas of the organization's management. Those categories that remain above knowledge, i.e. wisdom, intelligence and thinking (Skyrme, 2001) understood as the skill and ability to acquire, collect and create knowledge and to learn thanks to the skilful transformation of data and information (Grudzewski & Hejduk, 2004) are particularly important for the development of organizations. Therefore, it is possible to conclude that knowledge is a form of an effective use of the information in the activity of an organization (Drucker, 1999) and to solve its problems (Applehans, Globe & Laugero, 1999), using competencies and skills of the organization and its staff, creative or mimetic abilities. Knowledge is collected in human

minds (Dolińska, 2010) but also in documents, procedures, processes, practices and organizational standards (Davenport & Prusak, 1998) and in repositories and data collections – both traditional and electronic. Knowledge is a fluid combination of established experience, values, contextual information and conclusions providing the framework for the evaluation and absorption of new experience and information. The awareness of acquired knowledge or access to knowledge can become a source of an organization's competitive edge.

The vision of knowledge prevailing in the literature originates from the logical behaviourism and perceives knowledge as a continuum (Jashapara, 2004) between tacit knowledge ("I know how") embedded in human minds and experience, manifested in practical actions and explicit knowledge ("I know what") illustrated in collections of data and facts (Polanyi, 2009; Ryle, 2009). Other important aspects of the perception of knowledge include 'knowing why' when it comes to relations between the phenomena and processes and 'knowing who' with regard to individuals having the knowledge of "what", "why" and "how" (Hargreaves, 2000). More and more organizations decide to cooperate with other organizations to optimize the transformation of tacit knowledge into explicit knowledge (Nonaka, 2000) and to increase its resources, among other things, thanks to the joint creation of new knowledge.

An organization's approach to knowledge determines the way in which it manages knowledge. A growing number of organizations aware of their limitations relating to obtained knowledge strive to establish relations that allow them to use external knowledge better to gain competitive edge. Drucker maintains that there are no organizations without knowledge, there are only organizations that manage it poorly (1999). Knowledge management is an important and even multi-layered subsystem of the organization's management (Zawiła-Niedźwiecki, 2014) but its development requires the attainment of a certain maturity relating to the organizational and inter-organizational learning or the search for, use and propagation of knowledge. An organization can develop knowledge management when it is aware of the significance of knowledge as an asset on the basis of which it can generate wealth (Bukowitz & Williams, 2000) and when it takes action to achieve it.

Knowledge is currently becoming the dominant resource and a prominent competency of many organizations. Some of them associate knowledge development and complexity with threat but others are becoming increasingly aware that the access to extensive knowledge resources can benefit their development (Probst, Raub & Romhardt, 2002). This is why organizations unceasingly strive to improve the effectiveness of knowledge utilization by learning necessitated, among other things, due to technological changes and the organizational culture. Technology development can inspire a change of the offer proposed by the market and influence the learning process itself, e.g. by making access to electronic databases and

knowledge transfer acceleration possible. This aspect is particularly important in the light of the emerging post-pandemic reality and rapid development of virtual communication that also influences changes in the organizational culture. Organizational culture is defined, among other things, as knowledge shared, to a greater or lesser degree, by members of an organization and expressed in actions and words. An analysis of the influence of organizational culture on the effective management of an organization mostly relates to its approach to knowledge. According to Sułkowski, the development of knowledge management transfers the point of gravity from values and standards adhered to by the organization to cognition and knowledge. The cultural approach entails the need to search for new ways to understand organizations and economic life, which also naturally links the organizational culture to knowledge management (2008).

Effective knowledge management in an organization is closely linked to the development of human capital including key competencies and creativity (Poznańska, 2018), leading to improvements within an organization, e.g. related to interpersonal communication or conducted research (Zawiła-Niedźwiecki, 2014). Thanks to creative thinking and knowledge application, an organization can attain a higher functional level, e.g. implement and innovation (Skrzypek, 2002), and ultimately improve its image in the environment and strengthen its impact on other organizations, e.g. on the competition. This is why many organizations strive to build their competitive edge based on knowledge while carefully analyzing signals from the environment to prevent mistakes and losses. A skilful application of knowledge in an organization as a response to changes in the environment allows for a flexible and streamlined transformation and the rapid introduction of corrections (Penc, 2004).

Change is one of the distinctive features of contemporary times and the path of development for each organization (Osbert-Pociecha, 2011). To attain its natural goal of continuity, an organization has to respond to changes and adapt to them or even keep abreast of them. A change is a disturbance that throws an organization out of some form of balance it usually has (Sarayreh, Khudair & Barakat, 2013). The response to change requires demonstrating the ability to adapt quickly, be flexible and innovative (Heckmann, Steger & Dowling, 2016). As a result, the organization reconfigures, integrates and expands its internal and external resources and competencies. Changes in the life of an organization were relatively rare in the past. The current complexity, unpredictability and turbulence of the environment subjects each organization to many factors causing changes and contributing to its irreversible transformation in a longer perspective (Czop, 2016). Therefore, changes occurring in an organization are consequences of the awareness of the need for a response to a disturbance throwing the organization off balance and an opportunity to use abilities available to the organization, e.g. to adapt or take pro-active action (Klarner, Probst & Soparnot, 2007).

Contemporary organizations should be able to face challenges resulting from the operation in a knowledge-based economy, e.g. adapting to objective conditions of our times and changes implied by the environment as well as keeping abreast of them and actively shape the environment. Knowledge (Penc-Pietrzak, 2016) as the basis for the existence, functionality and development of each organization (Dolińska, 2010), individuals and communities (Dahlman, 2000) as well as of the entire global socioeconomic system is a strategic resource making such activities possible. In the era of knowledge-based economy, all organizations heavily depend on technology and information processing. The rapidly developing new information technology paradigm requires the multidimensional creation, condensation and implementation of knowledge (Brett, 2002) that is becoming a fundamental source of the economic success or failure. Additionally, an increase in the importance of knowledge in global processes, not only technological but also social ones, caused a change in the attitude of organizations to the structure of resources, e.g. putting more emphasis on the development of intangible resources and various interorganizational relations.

Contemporary requirements imposed on organizations by the knowledge-based economy determine a change of their attitude to the resource structure or an increased importance of intangible assets and the development of interorganizational relations (Mikuła, 2007). Such a change makes possible the consolidation, complementary use of available resources and the creation of mutually competitive network organizations (Mikuła, 2007; Moszkowicz, 2002) that are also willing to cooperate in certain areas (e.g. coopetition). The ability to cooperate makes it easier for organizations to respond to contemporary socioeconomic changes and to adapt to the functioning in turbulent conditions.

Proper use, development or renewal of resources in an organization depends on the organizational ability to learn (Penc-Pietrzak, 2015) and draw conclusions from the management of change in an organization (Penc, 2004). Organizational learning not only makes it possible to respond to changes in the environment (Rutka, 1996) in a flexible manner but also provides an incentive to face new challenges such as challenges relating to innovativeness.

In the knowledge-based economy where more and more organizations refine their ability to learn, the acquisition of valuable and useful knowledge from the best sources becomes a strategic skill in addition to the competence relating to the proper use of knowledge. One can distinguish sources of knowledge based on four barriers to its creation: the environment, internal structures of the organization, the present and the future. According to this approach, the environment imports knowledge, internal structures of the organization implement and integrate such knowledge, the present determines in what way joint problem-solving is possible while the

future encourages experimentation (Strojny, 2000). To overcome these barriers, organizations need to develop their key competencies.

Knowledge creation within an organization is based on the use of relatively easily available sources. Among other things, these are sources of explicit knowledge or organizational documents (procedures, regulations, instructions), archives and data from IT system containing the information about contracts, clients, purchases, etc. It is also important to use sources of tacit knowledge in an organization; such knowledge can come from managers and owners and, to the greatest degree, from employees. Organizational culture and the value system on which it is built play a big role in this case. However, the value system cannot reduce managers and employees with their creative objectives to their function of resources and means conducive to the attainment of economic and market goals of the organization (Sułkowski, 2011); it should treat them as partners in the acquisition and development of knowledge supporting the attainment of goals of the organization and its interested parties. The construction of experience exchange communities not only allows employees to exchange knowledge but also improves their personal satisfaction with work (Chen, 2019).

Sources of external tacit knowledge include, among others, external experts and scientists, collaborators, clients and competitors. External sources of explicit knowledge used by organizations can include materials available at fairs, exhibitions and conferences, contents of online portals and databases and scientific publications. Organizations should have many types of knowledge at their disposal and obtain it from different sources (Michna, 2017) to subsequently use it in a manner most appropriate for them, e.g. to define strategic elements of management such as the mission, vision, goals, plans and strategies (Liao, Fei & Liu, 2008). External knowledge (both explicit and tacit) can be obtained from various interested parties. Their unique role includes experience sharing, knowledge transfer from beyond to the organization and, quite often, also knowledge transfer from the organization outwards, especially within the consortiums, partnerships or alliances. The value added of such a cooperation is, in particular, in the extensive possibility to use various types of knowledge for the needs of an organization and the alignment of knowledge within an organization and between organizations (Nonaka & Takeuchi, 2000).

The selection of knowledge sources depends on many factors including their cost. The cost of knowledge acquisition from internal sources is generally lower than the cost of knowledge acquisition from beyond; therefore, a lot depends on financial capabilities of the organization in this case. Rapid development of the information technology reduced the cost of search for external knowledge and the effectiveness of its absorption has increased. As a result, firms can acquire more knowledge more effectively (Majewska-Bator & Bator, 2011) while retaining the same financial capabilities (Poznańska, 2016).

Table 1.1 External knowledge search process from the synthetic perspective

Knowledge search dimension	*Measure*	*Measure description*
Knowledge search width	Number of knowledge sources used by the organization	The greater the number of sources of external knowledge, the greater the width of knowledge search beyond the organization.
Knowledge search depth, i.e. intensity of knowledge search in various sources	Degree of materiality of knowledge from external sources	The greater the materiality of knowledge from external sources, the greater the depth of knowledge search beyond the organization.

Source: Own work based on Greco, Grimaldi and Cricelli (2016) and Bohdanowicz and Dziurski, (2020).

The search for external knowledge often results from the development of open innovations. Contrary to the creation of innovations in a closed model, the concept of open innovations is becoming increasingly important as a paradigm of the innovative activity of contemporary enterprises (Sopińska, 2017). According to this approach, organizations should use both external and internal ideas, inspirations and technologies to create innovations (Poznańska, 2012). The purposeful inflow and outflow of knowledge, i.e. knowledge transfer in both directions is the most effective way to use knowledge that accelerates innovations (Chesbrough & Garman, 2010). Laursen and Salter have based their approach to the management of open innovations on the strategy of search for external knowledge. They have distinguished two parameters of the search for knowledge: the width and depth of knowledge search beyond the limits of the enterprise (Laursen & Salter, 2006). Relations between the two are explained in Table 1.1.

The strategy of a wide search for knowledge beyond the enterprise is more common than the strategy of a deep search for external knowledge. Most organizations search for knowledge in many and varied sources but not too intensely. Both the wide and the deep search for external knowledge is costly and requires choices due to limited resources (Bohdanowicz & Dziurski, 2020). The correlation between the width of the search for external knowledge and the depth of this search is usually negative. For this reason, organizations strive to attain a certain optimum when it comes to the number of knowledge sources used, the scope of their use and their acquisition cost. Dziurski observes that individual organizations offering external knowledge compete for the interest of those who demand knowledge, especially when knowledge transfer can be a source of income (2020). Such behaviour intensifies among higher education institutions and other scientific institutions competing for the cooperation with firms.

According to the research, narrow width of the search for external knowledge is characteristic for Polish enterprises introducing open innovations (Sopińska & Dziurski, 2018). In 2019, as much as 47.54% of the responding enterprises were searching for external knowledge with only one type of partner, 38.52% of them with two partners, 12.39% with three partners and only 1.64% with four partners. Partners included clients, science and research institutions and suppliers. Additionally, shallow depth of the search for external knowledge was also characteristic for Polish enterprises. A large group of enterprises (14.75%) did not make an intense use of knowledge available in various sources; such enterprises were looking for external knowledge but in a very shallow manner (the depth of the search for external knowledge equals 0). A half of the analysed enterprises were intensely searching for external knowledge but only from one source while 27.05% of enterprises searched in two sources, 7.38% in three sources and 0.82% in four sources.

This research makes it possible to conclude that enterprises search for external knowledge among clients in a shallow manner only while they are much more willing to search for it among suppliers and science and research institutions (large depth of the search for external knowledge). In turn, the cooperation with R&D institutions is of particular importance for enterprises as it gives them access to highly innovative knowledge. Even though such knowledge is also relatively easily available, it can be difficult to understand, process and apply. Enterprises cooperate with science institutions less frequently than with clients but it is the area of science that inspires them to search for external knowledge (Bohdanowicz & Dziurski, 2020). The research confirms (De Wit-de Vries, Dolfsma, van der Windt & Gerkema 2019; Kobarg, Stumpf-Wollersheim & Welpe, 2018) that giving the enterprises access to knowledge is an important challenge for scientific institutions as the reported demand for knowledge opens extensive opportunities to offer it in many forms. Therefore, science can play a material role in the organizational transformation of enterprises, in particular, it can encourage their intense search for knowledge (wide and deep), develop such knowledge with them and support them in the knowledge-based responding of contemporary multidimensional challenges.

1.2 Transformation of a higher education institution into an enterprising knowledge-based organization

Academic centres play the fundamental role in the socioeconomic development as organizations that produce knowledge, share it with students and participants (internal world) and with the environment (external world, e.g. the business sector) (Jasiński, 2016) and use knowledge for self-improvement. In the knowledge-based economy (Denek, 2011), the academic mission or the multiplication, storage, transfer (Kukliński, 2003) and propagation of knowledge in the environment (Leja, 2006) and the

capitalization of knowledge (Etzkowitz, 2008) becomes even more important than before (Leja, 2011), especially when it comes to the cooperation with interested parties (Etzkowitz, 2008). Higher education institutions that still respect fundamental values and traditions while also attaching growing importance to the modernization of academic activities and demonstrating more and more openness to their environment. Multidimensionality of the academic mission makes a contemporary higher education institution not only model key competencies and skills of its staff and students but also influence many other interested parties through its activities. Higher education institutions participate in processes important for the society and for the state: they care for universal values, maintain the historical and cultural continuity of the society, search for truth in all the branches of human knowledge (Wawak, 2019) implement the cultural mission, model elites and create examples of citizenship (Denek, 2013) as well as influence the human capital and social capital (Marciniak, 2012).

Even though more and more higher education institutions accept the cooperation with their socioeconomic environment as one of the objectives of the academic mission, traditional and conservative organizational attitude continues to prevail in many academic centres. A higher education institution as an organization should base its activities on knowledge but it frequently continues to effectively resist changes that happen around it. One can say that the image of the contemporary higher education institution remains bipolar. Its characteristics include both certain rigidity and attachment to traditions (e.g. fragmentation of fields of study, assignment of subjects to departments and lecturers, predominance of the employment of theoreticians, permanent organizational structure) as well as modernity, flexibility and adaptability (e.g. multi-stage studies, elective subjects, scoring system, e-learning, the use of communication platforms to conduct online classes) (Leja, 2006).

Trends visible in recent decades towards the mass academic education do not always entail an improvement of the quality of education and research but, as a rule, they respond to the demand for studies demonstrated in the environment. Additionally, courses on offer are still not well correlated with the labour market in many cases. This is due to a certain well-established rigidity of educational curricula and a function of didactic competencies of the employed staff. The higher education institution's internal autonomy is also a frequent source of resistance to changes even though the increasing complexity of the environment demonstrates the need to face new challenges such as the modernization of curricula, greater focus on inter-disciplinary research and its usefulness for the surrounding environment. Despite the multitude of changes and reforms, at least a part of the academic circles continues to be greatly attached to the functional philosophy of a traditional university developed in the 19th century and identified with the Humboldtian model (Antonowicz, 2005). Great internal autonomy with the right to make independent decision relating to the

activity model is characteristic for it (the first medieval universities established from the 11th to the 13th century had equivalent rights). Modern universities developing in the conditions of the institutionalization of science retained this privilege (Bartnicka, 2015). Characteristic features of a traditional university included the freedom of scientific views and the unity of science and didactics (Boguski, 2009). Such a university would focus on basic research while retaining the external funding of its research (Jabłecka, 2004) and guaranteeing the unity of the national spirit (Sułkowski, 2017). This approach made it possible to disseminate research results among students as a part of the incessant process of establishing the truth (Michalski, 2020). However, the practical application of research result was not sought.

The consolidation of the trend consisting of the unity of science and knowledge led to the development of applied sciences, including technical and social sciences, at the end of the 19th and early in the 20th century. Development of the industrial society promoted the development of knowledge driving the industrial revolution (Sułkowski, 2017), especially in Germany and the United States where the demand for knowledge supporting technological progress was on the increase. Science was more and more frequently financed by the business practice, especially at American universities (Michalski, 2017), which was making it dependent on donators and external funds. This trend opened such higher education institutions to their environment even more and made them more sensitive to the needs of interested parties while proving that one can knowledge can be monetized – also beyond the limits of the educational activity (Leja, 2006). European universities gradually adopted the same approach. The process was supported by the development of neoliberal thinking highlighting the role of the free market, private ownership and limiting the role of the state in the lives of free citizens and entrepreneurs. Economic transformations of the 1980s also initiated discussions about the transformation of higher education institutions, in particular, towards their greater pragmatism (Olearnik & Pluta-Olearnik, 2016). Reports compiled by the World Bank and UNESCO in 1990s pointed to a crisis of higher education manifested, among other things, as the mass use of education and deepening differences in the access to education. Some suggestions made to counteract these trends included diversification of courses on offer and sources of funding, better adaptation of higher education to social needs and the need for the closer cooperation with the environment (Jabłecka, 1996). First attempts at the definition of characteristics of an entrepreneurial university as an innovative institution (Drucker, 2004) open to changes were the response to these challenges. Research conducted by the team of M. Gibbons among others, relating to knowledge production in the context of its applications (1994) positioned a higher education institution as a centre for the creation of scientific and technical knowledge and strongly accentuated the entrepreneurial aspect of purely academic activities.

Clark also greatly contributed to the development of the idea of an entrepreneurial university, among other things, by indicating its five key characteristics (1998):

- strengthening of the control centre – application of the managerial approach to the management of a higher education institution, e.g. looking for opportunities for change and taking advantage of them;
- development of peripheral segments – creation of entities with flexible or even temporary organizational formats that guarantee the end-to-end approach to the operations and intensified knowledge transfer to the environment, development of relations with interested parties, acquisition of financial funds, intellectual property protection, development of lifelong learning and maintained contact with graduates;
- diversification of funding sources to increase budgets of higher education institutions with additional income, among other things, thanks to various forms of intellectual property and R&D work conducted for businesses and, e.g. as a result of the more intense market orientation of educational services (the introduction of tuition fees);
- stimulation of the academic centre – departure from a stereotypical, traditional organizational structure of higher education institutions towards entrepreneurial departments, vigorously managed on each organizational level;
- creation of an integrated entrepreneurial culture, organizational culture promoting distinguishing academic characteristics such as tradition, identity of a higher education institution and nurturing of its image (Jabłecka, 2004; Leja, 2006).

Clark gave strong emphasis on the autonomy of higher education institutions reflected in the distribution of tasks between the academic structure, managers and administrators (Sułkowski & Seliga, 2016). He posited the importance of highlighting the autonomy and academic traditions in the image of a higher education institution while pointing to the need to create a mechanism guaranteeing financial security, that would help acquire funds from various sources (e.g. investments in start-ups (Rasmussen & Borch, 2010) or special purpose vehicles). Diversification of funding sources and an expansion of the third stream of funds from the sales of intellectual property rights and the commercialization of research results combined with the dynamic development of other forms of the higher education institution's cooperation with businesses are key characteristics of an entrepreneurial university (Jasiński, 2016).

The same scientist also suggested the triangle of coordination in the higher education system based on relations between the higher education institution, the state and the market as the resultant of four theoretical models of coordination of the higher education system: collegial (control over the activity of higher education institutions exercised by the academic

community), bureaucratic and political (coordination of the academic formal administrative system by the state or by an interest group) and a market model (higher education institutions independently model educational and research services for their environment) (Leja, 2006). This postulate has been developed by Etzkowitz & Leydesdorff (1999). The triple helix model developed in 1999 described the impact of the educational sphere, the sphere of economic practice and the state and local government regulatory sphere. This approach assumes that educational institutions are the driving force in the development of the knowledge-based economy. Despite many supplements and expansions, this concepts is still based on knowledge development in the academic sphere (Carayannis & Campbell, 2010) Subsequent works by H. Etzkowitz (2004, 2013) and other researchers (Geels, 2005) also stress the impact of an entrepreneurial university as an academic centre on the regional socioeconomic environment. As a result, there appeared a new academic function in addition to those relating to scientific research and education, i.e. the impact on the socioeconomic environment thanks to stronger ties between the higher education institution and the economy, market and business on the local, regional, national and international scale (Olearnik & Pluta-Olearnik, 2016). Even though the idea of a higher education institution as an entrepreneurial organization oriented on the market continues to face opposition of some academic circles, an increasing number of researchers support that model based on four entrepreneurial orientations: economic, market, innovative and managerial (Olearnik & Pluta-Olearnik, 2016; Popławski, Forkiewicz & Markowski, 2014). Not only entrepreneurial higher education institutions but also individual departments and even employees (depending on their competencies and needs) should focus on activities that offer the best competitive edge in the academic environment. Among other things, this need results from the deepening specialization and internationalization of higher education institutions due to the increasing openness of the academic world as well as the mobility of lecturers and students (Sułkowski & R. Seliga, 2016).

J. Jabłecka has transferred the idea of an entrepreneurial university to the Polish literature. The model of coordination of the academic research she proposes considers the self-governance of science, impact of the state on research priorities and control over the compliance of pursued research objectives and political goals, standardization of scientists' actions from the perspective of the evaluation of social and economic benefits of the research compared with expenses as well as the selection of research directions on the basis of the law of supply and demand (2002). The market coordination model stressing the independence of a higher education institution when it comes to the exchange of goods with the environment (e.g. education and research services) for which it gets remunerated on market terms is an important component of that concept. Such a role of a higher education institution is particularly desirable in the light of the development of

technological entrepreneurship that should be based on external sources of know how (higher education institutions, research and development entities, other companies, private inventors, etc.) and technology transfer channels (purchases of licenses patents, research cooperation, etc.) (Matusiak, 2011).

Extensive opportunities for development in the academic world are supported thanks to the internationalization and expansion of many business sectors and to the general economic condition of the country (Boguski, 2013). The operation in market conditions entails a range of new challenges and threats for science. One of the threats consists of the outflow of talented academic employees to other sectors where they are offered better employment conditions. Another material symptom of the greater market focus of higher education can be seen in the strengthening of non-public higher education institutions that develop courses and research on offer. Thanks to managerial governance, they are in many ways more innovative than public higher education institutions. Therefore, the competition for a student, specialized scientist or business cooperation is becoming fiercer. Other contemporary challenges for the higher education include meeting expectations of various interested parties cooperating with higher education institutions (e.g. employers), more extensive use of communication technologies (van Vught, 1999), especially in the new reality arising after the COVID-19 pandemics as well as high effectiveness in the competition for partners demanding knowledge, in particular, in the light of activities pursued, among others, by commercial research centres and laboratories (Fuller, 2003). K. Leja stresses that higher education institutions should not compete with other organizations offering knowledge but rather cooperate with them to co-create the network society consisting of centres developing and propagating knowledge in the cooperation with the society that expects access to knowledge (2011).

The approach to methods of organization of the academic activity and its goals is gradually changing in many higher education institutions. They are becoming increasingly entrepreneurial when it comes to educational services and research as well as other areas of cooperation with their interested parties thanks to which sources of funding of academic activities expand and relations with the environment are strengthened. An improvement of the effectiveness of higher education institutions that have developed at least some entrepreneurial characteristics confirms that the academic sector has a high potential to co-create the knowledge-based economy. Two knowledge processing modes prevail in a contemporary higher education institution: expansion of the limits of knowledge thanks to the exploration of phenomena and laws of nature and the use of knowledge to create new products and technologies. The mission of a contemporary higher education institution covers:

- education leading to specific effects (knowledge, skills and social competencies);

- research (basic research enabling the development of applied research conducted in the cooperation with interested parties);
- development of various forms of lifelong education addressed to various age groups willing to gain new qualifications or develop their interest, the culture-creating mission and development of the cooperation with the economy (such as technology transfer and commercialisation) (Leja, 2011).

Due to the fundamental importance of knowledge for the building of relations with interested parties, a contemporary higher education institution should have the characteristics promoting knowledge creation and processing and knowledge management. Such characteristics include certain features of professional bureaucracy, i.e. highly qualified staff, specialization, autonomy of employees, the authority of employees and the cooperation between individual organizational units when it comes to didactics and research (Martin & Marion, 2005). A higher education institution should promote teams able to learn and understanding the meaning of learning. It is extremely important to create the knowledge culture in a higher education institution, to learn from previous experience or even failures, remain open to the exchange of views and respect different points of view. It is necessary to develop academic contacts with various higher education institutions (academic authorities and employees) both internationally and in the local environment. Such an approach facilitates knowledge sharing, learning and the transfer of good practices, thus contributing to an improved use of knowledge and know how in various functional areas of a higher education institution. Unfortunately, the abovementioned positive aspects of a higher education institution's orientation on the use of available knowledge usually do not develop without hindrances. One can distinguish at least a few types of barriers that make this process more difficult both within the higher education institution and in its environment (Table 1.2).

Ch. Evans has formulated a model of an organization subordinated to knowledge in an academic sector (2005) and assigned to it the characteristics such as strong and servicing leadership of an academic centre towards individual organizational units of a higher education institution that have the freedom to solve issues and self-organise as well as flexibility as a response to changeability of the environment and internal impulses, especially when it comes to didactic activities and research. As stressed by Krupski, adaptive-inertial flexibility prevails in higher education institutions, which consists of a delayed response to expectations of the environment while a knowledge-based higher education institution should strive to attain the anticipatory flexibility to take action in advance (2005). One can also distinguish territorial flexibility (popularization of remote learning), temporal flexibility (employing academic staff part-time or on the basis of civil law contracts) and functional flexibility (hiring external

Table 1.2 Barriers hindering extensive knowledge use for a higher education institution

Barrier occurrence area	*Barrier examples*
Organizational structure – internal barrier	• Extensive hierarchy and complexity of an academic institution • Attachment to traditional rigid structures hindering knowledge sharing • Partial decentralization of higher education institutions and multitude of decision centres • Federalization of higher education institutions hindering the cooperation • Ineptitude of the information and communication system of a higher education institution
Power structure – internal barrier	• Few decision-making powers of the rector/dean • Extensive collegiality • Resistance to delegate powers • Resistance to change • The fear of self-organization and increased independence, "a race to the bottom" in teams • Prevailing competition and limited cooperation among organizational units within a higher education institution • Resistance to functional principles of a higher education institution being challenged by employees • The fear of establishment of informal decision centres
Employees – internal barrier	• The fear of uncertainty • The fear of the loss of position due to knowledge sharing, especially when it comes to tacit knowledge • Fear of the strengthening of an informal authority of certain employees • Hierarchy and distance resulting from differences in scientific achievements and age differences • The lack of motivation to share knowledge and learn together • No tolerance for errors • Poor communication skills • Poor personal entrepreneurial skills and low innovativeness • No marketing training needed to cooperate with businesses
Organizational culture – internal barrier	• The lack of mutual trust • Imperfect communication (different communication methods and languages, limited contact) • Pragmatic approach to the academic work – pressure on productivity at the expense of quality • Identifying available knowledge with occupied positions • The lack of knowledge sharing and common learning culture

(*Continued*)

Table 1.2 (Continued)

Barrier occurrence area	*Barrier examples*
	• Rewarding exclusively knowledge holders and not, e.g. its distributors • No support for employees willing to expand knowledge • No access to knowledge sources • No conditions for knowledge creation, e.g. due to the routine workload • Low degree of internationalization and poor mobility of the academic staff and students
Knowledge quality and usefulness – internal barrier	• Poor quality of knowledge • A gap between the demand for specific types of knowledge and what a higher education institution can offer • The environment not interested in using knowledge held by a higher education institution
Environmental conditions – external barrier	• Poor economic situation in the environment hindering the development of the science-business-local government cooperation • Fierce competition on the market for higher education services • Unfavourable legal system, including poor protection of intellectual property • Demographic decline limiting the interest in education offered by higher education institutions • Poor innovativeness of the environment and no demand for knowledge • Low prestige of academic professions

Source: Own elaboration based on Jacob and Hellström (2003); Evans (2005); and Leja (2011).

specialists to execute classes and research, e.g. renowned experts who attract students and enterprises taking advantage of the research and development on offer) (Evans, 2005). On the basis of the concept proposed by Evans (2005), Leja suggested a comprehensive approach to a university as an organization subordinated to knowledge (Figure 1.1.).

Strong and servicing leadership managing the centre for the academic community makes possible the harmonization and coordination of activities pursued by individual organizational units, flexible approach to problem-solving and guarantees opportunities for employees of a higher education institution to self-organise, which is characteristic for a knowledge organization. The internal differentiation of the higher education institution's organizational system is particularly important. It has to match the diversity and complexity of the environment to guarantee the full use of excess knowledge by creating self-organising and multidisciplinary groups qualified to execute specific ventures (Morgan, 1997), among other things, for the environment of the higher education institution. Such an approach is

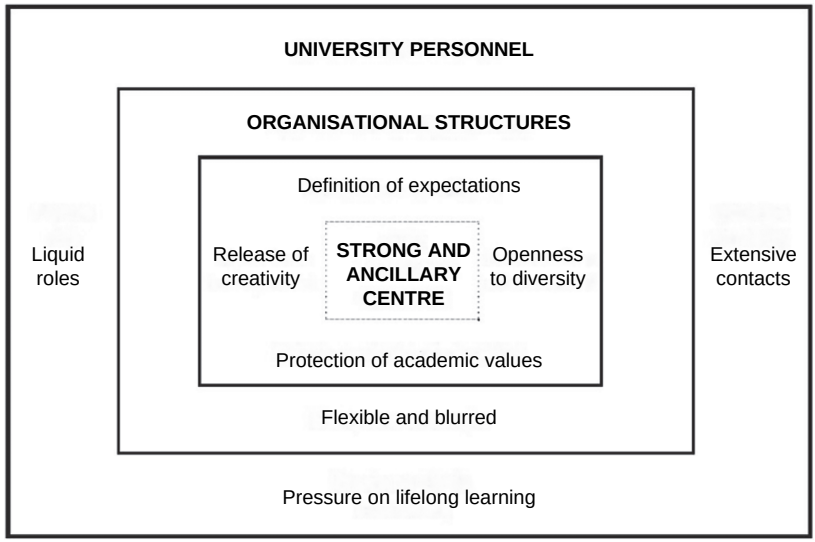

Figure 1.1 A university subordinated to knowledge.
Source: Leja (2011, p. 151).

convergent with the trend forecasted by Sułkowski towards the propagation of a managerial-ownership governance model in universities of the future (2014). Even though higher education institutions will be increasingly oriented on the free market and competition, adherence to values should continue to be highly important (Kwiek, 2010) and this is the task for a strong leadership centre of a university. Academic and administrative employees are also responsible for the activities of a university subordinated to knowledge and they should be challenged when it comes to their adherence of values and mission of the higher education institution, their readiness to share knowledge, work within a team or develop communication skills. Appropriate conditions for creativity development also have to be guaranteed to employees. They have to be given powers and properly motivated. Those who perform the functions of experts, cooperate with research teams of conduct didactic classes as specialists in a specific field are particularly worth being supported (Oleksyn, 2003). Specialisation in research and didactic activities is a material distinguishing feature of universities of the future (Sułkowski, 2013), just like their openness to diversity supporting creativity and manifested thanks to the establishment of teams representing varied views and skills and diverse knowledge.

As we know, a higher education institution is a complex structure that should be managed on each level with the use of knowledge embedded in each organizational unit responsible for a specific task area. Therefore, it is important to strive towards the development of blurred structures while

avoiding situations in which conditions for the execution of academic ventures are bent to adapt to the existing organizational framework (Leja, 2006). The organizational structure of a higher education institution subordinated to knowledge should be flexible, conditional upon legislative changes and changes resulting from market orientation according to which a higher education institution has to respond to changes in the competitive environment and, in particular, to expectations of its interested parties. Free market and competition are the environment in which higher education institutions, most of them private, will operate in the future (Sułkowski, 2014).

A higher education institution subordinated to knowledge should also emphasise the continuous learning of employees. Propagation of learning in teams is of fundamental importance for knowledge acquisition and for the creation of the atmosphere of openness that makes it possible to attain a specific level of knowledge quality, among other things, thanks to the development of national and international contacts offering opportunities for knowledge transfer and contributing to its creation. The creative search for and endeavour to know the truth requires flexibility; therefore, guaranteeing the liquidity of roles and tasks to the academic staff and administrative employees so that they can make the best use of their potential wherever they are necessary at the moment should be an important attribute of a higher education institution (Leja, 2011).

Deliberations presented above on the development of a higher education institution as an entrepreneurial knowledge-based organization are reflected in the changes that occurred in recent years in the higher education service sector. They refer to the above-mentioned various conditions, links and factors revealed at the micro scale (the higher education institution and its internal interested parties), meso scale (local and regional environment of a higher education institution and its interested parties) and the macro scale (state institutions). However, factors visible on the international scale were equally important (the European Knowledge Area) (Olearnik & Pluta-Olearnik, 2016). As a result of the Bologna Process, common space called the European Higher Education Area was created in 1999. This action led to a significant enhancement of the academic cooperation in the area of education, research, exchange programmes and other forms of the inter-university cooperation (Wesołowska, 2013); it also allowed for the approximation of higher education systems in European countries. A lot of space was devoted to education and research in the Lisbon Strategy (Greta, Tomczak & Lewandowski, 2012) that defined EU objectives for the years 2000–2010 and, after that, in the Europe 2020 Strategy (Wronowska, 2016). One of the priorities of this strategy consists of smart development or the development of the economy based on knowledge and innovation where the entire society takes part in its creation. Higher education institutions as knowledge suppliers play a very important role in the attainment of this objective. It is necessary to strengthen the relations between the economy and academic sphere to implement one of the key priorities of the strategy, i.e. the employment

increase, creation of high-quality jobs and development of innovative sectors and industries (Poznańska, 2000). According to the document prepared by the European Commission in 2013 (*UE,* 2013), it should be the priority for Poland and other countries to strive towards an improvement of the scientific base quality and development of the innovativeness of enterprises by way of a closer cooperation between science and business thanks to investments in knowledge and new technologies. It also means that there is a heavy responsibility on higher education institutions and businesses when it comes to the development of the economy based on innovations and knowledge.

1.3 Conditions for development of inter-organizational cooperation between higher education institutions and enterprises in knowledge-based economy

It is difficult to be self-sufficient nowadays (Lynch, 1993), therefore, the ability to assess the environment and its direct or indirect impact is acquiring strategic importance. The tendency to cooperate with the environment is a natural aspiration of each contemporary organization as an open system(Koźmiński & Piotrowski, 2004) interacting with external elements, in particular, with its interested parties. They are individuals and groups under its influence or influencing it materially (Freeman, 2010) with whom an organization has both unilateral relations and relations based on mutuality (Koźmiński & Jemielniak, 2009). The understanding of the environment and relations with interested parties is the key to an improvement of the organization's functioning. The strategic place belongs to suppliers supplying an organization with resources necessary in its activities and recipients of its offer (Freeman, Harrison & Zyglidopoulos, 2018). The exchange can involve the mutual availability of goods or services and resources interesting for each of the parties. If the exchange offers expected benefits and satisfaction to each party it can build mutual trust and attachment in the longer term and, therefore, it can lead to the development of inter-organizational ties. The value of an offer is determined as a result of relations between many entities cooperating in various conditions and making resources available to one another.

Knowledge is one of the resources that are most desirable for contemporary organizations. This is facilitated by the paradigm of the knowledge-based economy with which many contemporary organizations build their competitive edge thanks to reciprocal access to knowledge, joint use of available external knowledge and the individual, group, organizational and inter-organizational learning. This is one of the more important prerequisites of development for various forms of inter-organizational cooperation.

Inter-organizational cooperation is a union of two or more organizations developing as a result of the evolution of mutual relations, beneficial for each of the parties (van Winkelen, 2010; Berlin & Carlström, 2011). In this case, there are both resultant benefits, e.g. better access to knowledge, and there is

the inter-organizational cooperation as a value in itself that requires each of the parties to provide abilities, competencies and knowledge necessary to create specific interpersonal and inter-organizational relations (Sitko-Lutek & Pawłowska, 2008). Inter-organizational cooperation is based on specific, more or less formal dependencies between the partners. Organizations that are independent when it comes to their decision-making processes can but do not have to submit to recommendations of other partners; however, proper coordination is necessary to give the cooperation an appropriate direction.

Collaboration is the key attribute of an inter-organizational cooperation (Kale, Dyer & Singh, 2002). It consists of the partners striving to attain convergent intentions and goals in the same or diverse manner. It can happen through full collaboration or just coopetition in certain areas. Inter-organizational cooperation can develop both in the form of bilateral relations between two organizations and in the form of network relations, e.g. consortiums, alliances, networks or clusters. The cooperation can vary depending on the scopes of activity of the parties (from the passive, one-way use of knowledge to an active co-creation) or on the type of knowledge transferred (explicit or tacit) (Olszewski, 2020). The more organizations participate in the cooperation the better the effects that can be obtained when it comes to the exchange of the information, knowledge and experience or when it comes to the synergic use of common potentials and resources. However, a greater number of organizations participating in the cooperation means that it is more difficult to synchronize the decision-making processes, define common interests, build compromise relating to risk taking and distribute costs and benefits resulting from jointly executed activities (Payan, 2007). Inter-organizational cooperation is only justified when partners believe that benefits are greater than costs, e.g. resulting from the invested time.

Inter-organizational cooperation can develop between organizations with very similar or very different characteristics (Lundberg & Andresen, 2012), in the private, public and non-governmental sector (Kożuch & Sienkiewicz-Małyjurek, 2015) as well as among sectors. Not only the cooperation area but also the dynamics, goals, scope and legal form of the cooperation can vary significantly. The asymmetry in the structures and methods of management of the cooperating organizations (Kaiser, 2011; Young & Denize, 2008) as well as differences in their organizational cultures significantly impact the progress and results of joint activities. In practice, it can mean that differences between organizations can greatly hinder the collaboration despite the efforts made by each of the parties. Enterprises that intuitively operate in the spirit of rivalry only start to cooperate when they believe that they can improve their competitiveness in this way as the prerequisite of their survival on the market (Kożuch, 2011). Non-governmental organizations usually do social work addressed to specific groups of interested parties. They solicit resources necessary to attain the defined goals or to gain specific values and treat collaboration as a mechanism facilitating the attainment of expected results.

When compared to the commercial or non-governmental sector, authoritarianism and formalization are much more noticeable in public organizations where the autonomy of operation and decision-making is limited while competitive pressure is hardly ever involved (Kearney, Hisrich & Roche, 2009). It is most difficult for public organizations to commit to the cooperation that, by its very nature, requires some flexibility and adaptability.

Collaboration is a riskier form of operation than independent functioning (Czakon, 2007); this is why inter-organizational cooperation is not easy. It is possible to identify multiple factors contributing to a high level of uncertainty in such relations, e.g. periodicity of operation, divergence of interests, difficulties with capturing the organizational affiliation, dispersal of activities or the lack of competencies necessary to cooperate (Sokołowska, 2005). In extreme cases, commitment to inter-organizational cooperation can result in the loss of knowledge as a result of its excessively wide and deep transfer or uncontrolled and undesirable effects of knowledge spillover. When it comes to a significant asymmetry of tacit knowledge, those who have the largest resources of it can choose independent action (Coff, 2010). Becoming dependent on other partners can be another issue in inter-organizational cooperation. Therefore, the price for uncertainty resulting from the cooperation has to be a high value of the organization, exceeding benefits of individual activities.

Various forms of collaboration such as networks of clusters can lead to an increase in knowledge resources in cooperating organizations. They open new opportunities for joint learning and for the management of available knowledge that ceases to be an individual resource of the organization and becomes a common resource to the degree acceptable to all the cooperating organizations. The implementation of inter-organizational learning is necessary to make use of knowledge accumulated in this manner.

Various forms of alliances are a relatively common and flexible form of inter-organizational cooperation. They are formalized or informal inter-organizational relations of undefined duration, usually linked to the mutual offsetting of resources and potentials of any number of partners. Participants in alliances strive to attain common goals, among other things, by compensating for their own weaknesses with the use of others' resources including knowledge (Probst & Büchel, 1997). Alliances are most often established with a view to observe, learn and internationalise the partners' know-how (Parise, Sasson, 2002) and the cooperating organizations are very committed to the generation of key competencies (Harbison & Pekar Jr, 1998) and to the mutual and joint learning. Similarity and complementarity of partners, common skills and unique knowledge offered by each partner play the material role in this type of cooperation. Alliances can help reduce uncertainty and improve the flexibility of activities (Macias, 2013) e.g. they make it easier to incur growing costs of access to knowledge, however, in the light of the varied speed of learning among partners, it is possible that common knowledge at the disposal of the alliance can be used by them

unequally (Pietruszka-Ortyl, 2007). There is no doubt that awareness of the transience of knowledge as it continuously gets out of date is desirable in the joint learning process along with the ability to adapt the operations of cooperating organizations to the jointly developed model of inter-organizational learning. Contemporary motivations underlying the establishment of alliances usually have to do with the competitiveness of an organization, i.e. its willingness to take over technologies or unique abilities, to distribute costs and risks in the course of the joint research, to learn from a partner, to adapt rapidly to new conditions as a result of an intense knowledge transfer (Hamel, Doz & Prahalad, 1989) and to use the partner's intellectual capital (Skrzypek, 2015). Knowledge-based alliances defined in the literature (Probst, Raub & Romhardt, 2002) involve the cooperation of organizations to attain the maximum learning effect as a result of the adoption of a specific collaboration philosophy assuming that (Pietruszka-Ortyl, 2007):

- learning is the priority goal of the alliance and each participant is aware of it,
- human resource management philosophy in cooperating organizations complies with the assumptions of the joint organizational learning process for all members of the alliance,
- cooperating organizations have financial and material resources necessary for joint organizational learning and, as a part of this process, they have established representatives with appropriate talents, competencies and skills to make the best use of the learning effect,
- each of the cooperating organizations has realistically assessed its learning abilities and continues to improve them, e.g. by building an organizational climate promoting learning, guaranteeing the best conditions for its representatives to cooperate with partners and minimizing barriers hindering the learning process such as barriers resulting from cultural differences.

The strategic role of knowledge in the contemporary world encourages the search for it and its development in various forms of inter-organizational cooperation. The knowledge-based alliance mentioned above is just one of such forms. Those who commit to the inter-organizational cooperation, e.g. enterprises, are usually interested in a better access to knowledge and a more effective use of knowledge. This is also an attractive area of activity for organizations that offer knowledge to others as their key product and to organizations using knowledge for self-improvement and development so effectively that others want to learn from them. Higher education institutions are an example of such organizations. Many in-between variants are also possible when organizations able to offer knowledge also look for it themselves and are able to exchange their resources of to learn jointly while using the potential of all partners synergistically.

The activity of higher education institutions is commonly linked to the production and release of knowledge (Breznitz, 2014). Because of that, a contemporary higher education institution implements three missions: education, research and development activities and the building of mutual relations with the environment. The third mission is to promote an intensified commitment of academic institutions in social development processes on various levels, e.g. economic or social (Leja, 2015). In practice, the quality and usefulness of academic knowledge for the environment as well as the way in which it is offered including marketing skills (Olearnik & Pluta-Olearnik, 2015) and the attractiveness of a higher education institution as a partner for various forms of inter-organizational cooperation can vary significantly. It is worth noting that inter-organizational cooperation in the case of higher education institutions should entail not only outward transfer of knowledge but also the inflow of knowledge from beyond, in practice, the continuous exchange of knowledge in the spirit of the academic entrepreneurship (at arm's length) (Poznańska, 2014) or through activities related to the social responsibility of science (non-profit) (Jasiński, 2016). In addition to typically educational knowledge transfer processes (the academic teacher-student relationship), basic research is being developed in higher education institution along with commercial processes of knowledge exchange such as the joint execution and use of research results in relations between higher education institutions and enterprises. Additionally, there are socially oriented knowledge exchange processes taking place in relations with local governments or non-governmental institutions.

According to Jasiński, a higher education institution should be perceived as a modern institution operating in a market environment, i.e. in a business environment among other things. The combination of many factors forced contemporary higher education institutions to turn towards the cooperation with their environment, in particular, to commit to activities that help modernize the economy and develop the cooperation with enterprises. Therefore, higher education institutions can develop the inter-organizational cooperation in many spatial dimensions[1] and on various markets (2016):

- the market of services (educational, research, advisory and expert advice, design);
- the market of goods relating to the use of the science infrastructure (e.g. conference halls, laboratories, recreational, accommodation and gastronomic infrastructure);
- the market of external funds (e.g. participation in competitions for various types of grant funds for executed ventures);
- the labour market (graduate training[2] the operation of academic career offices, HR processes relating to the academic and administrative staff of higher education institution employed on the basis of various contracts);
- the market of social services (such as non-profit activities, charity actions, volunteering).

From the economic perspective, not only higher education institutions can represent the supply side on each of the above-mentioned markets; suppliers can include all the other entities able to render the above services[3]. This market is becoming more and more competitive with certain forms of the inter-organizational cooperating developing as well, e.g. between higher education institutions. In general, however, the prevailing trend is to compete for users and recipients of higher education institution's representing the demand side (student, entrepreneurs, social partners) as well as for resources such as funds for operations, best specialists or most effective advertising.

The demand side of the market on which higher education institutions operate consists of diverse interested parties whose role in the environment of the academic sector is on the increase (Popławski, Forkiewicz & Markowski, 2014) giving an impulse to create new knowledge useful to them (Wawak, 2019) as a product to be exchanged with such interested parties. Knowledge, according to Jasiński, should be created not only for the interested parties but also with their increasingly intense cooperation so that they can be not only recipients of services offered by a higher education institution but also their co-authors (2015). Therefore, this is a prerequisite for the development of the inter-organizational cooperation between the demand side and the supply side of the market of higher education services. The effectiveness of such activities requires a higher education institution to not only guarantee an appropriate quality and availability of knowledge and its effective transfer but also appropriate marketing training, among other things, to create various forms of inter-organizational cooperation with recipients of services offered by the higher education institution. It is stressed that the entrepreneurial focus of a higher education institution makes the agreement with interested parties from the business sector significantly easier and minimizes cultural barriers (De Wit-de Vries, Dolfsma, van der Windt & Gerkema, 2019) hindering such a cooperation. As Kwiek maintains, higher education institutions have never been under the changing pressures of its main interested parties for so long before. Therefore, higher education institutions should respond not only to the changing expectations of the state but also to the new needs of students, employers and entrepreneurs operating in regions where such institutions are located (2011).

Among other things, the particular need for an intensification of the collective learning process of representatives of science and business in "learning regions" was highlighted in a report by the OECD (Ischinger & J. Puukka, 2009). Spatial (geographical) proximity is one of the most important criteria or the selection of partners for inter-organizational cooperation. Certain research also indicates that the cooperation between higher education institutions and enterprises is usually local as knowledge flows require the establishment of a network of relations and the maintenance of direct contact. Spatial proximity makes it easier to transfer complex academic knowledge that is difficult to codify (Crescenzi, Filippetti &

Iammarino, 2017). Firms with a low ability to absorb knowledge use local knowledge to a greater degree while firms with a high ability to absorb knowledge and globally related firms use knowledge from beyond the region. Local acquisition of knowledge also depends on the degree to which local sources are able to provide knowledge corresponding to the recipient's need for information (Olszewski, 2020). Higher education institutions whose offers can satisfy the needs of firms looking for local knowledge will find many potential exchange partners in their immediate environment. Higher education institutions that specialize in narrow fields of research will surely have to take a different path to reach potentially interested businesses with their knowledge. Organizational proximity, i.e. the degree of similarity of operating conditions (Boschma, 2005) and the cognitive proximity or the access to similar databases of reference knowledge and similar knowledge absorption capability also support the inter-organizational cooperation of higher education institutions and enterprises.

Cognitive proximity is linked to mutual knowledge (Cramton, 2001) held by partners, which is particularly important during the joint research. Organizations communicate more efficiently the more similar is their reference knowledge. Cognitive proximity is beneficial to the speed and accuracy of communication but it also determines its scope (Nooteboom, 2000). The cognitive aspect of proximity is correlated with the learning process much more than with the geographical or organizational proximity (e.g. joint learning to ensure the development of a smart specialization in the region (Orlando, Verba & Weiler, 2019)). Institutional proximity understood as the degree of similarity of institutional conditions can also be a significant catalyst of the joint learning process but it is not beneficial in every situation. The greater the institutional proximity the better conditions are there for knowledge transfer and interactive learning; however, an excessive institutional proximity can create barriers to efficient action and introduce certain routines (Czakon, 2010). The diversity of experience is definitely a greater advantage for the cooperation between higher education institutions and enterprises than the institutional proximity. In turn, social proximity is always a significant factor. Social relations are the natural environment for the development of economic interactions. Social and economic structure influence each other thanks to the interplay of interpersonal relations, similarities, joint actions and experience. The greater the social proximity, the more efficient learning becomes as reflected, e.g. in communities of practice (Molina-Morales & Martínez-Fernández, 2010). The source literature also points out some dangers resulting from the elimination of opportunistic behaviour (Karpacz, 2014) from the cooperation or from the unchanged operation within a closed system of relations limiting the willingness and ability to deviate from the established procedures (Oerlemans & Meeus, 2005).

The ability to absorb knowledge mentioned above is a particular determinant of the inter-organizational cooperation between higher education

institutions and enterprises. It is the ability to recognize new external information, assimilate it and use it for specific purposes including business purposes (Lane & Lubatkin, 1998). From the perspective of an organization acquiring external knowledge, inter-organizational cooperation depends, among other things, on the recognition of the value of knowledge held by the partner and opportunities for its acquisition, assimilation, processing and use. The ability to absorb external knowledge in an inter-organizational system depends on the type of knowledge absorbed and on similarities between the cooperating organizations when it comes to structures and organizational conditions (Lis, 2017). This view refers to the significance of the organizational proximity in the inter-organizational cooperation. When it comes to knowledge absorption, the partner providing access to knowledge is worth noting. Whether such a partner will be ready to disclose knowledge and share it is a material determinant of the effectiveness of the learning process for the knowledge recipient. The positive behaviour of the knowledge supplier supporting the recipient's learning improves the effectiveness of inter-organizational learning. Therefore, greater transparency of the knowledge transfer helps improve learning results for the knowledge recipient. An organization that is highly open to learning will be more persistent while learning than a less open organization. It will not find it easy to give up the opportunity to learn even when faced with frustrations and challenges (Nogalski, Karpacz & Wójcik-Karpacz, 2014). Therefore, triggering the greatest possible openness to joint learning in higher education institutions and enterprises is at the core of their effective cooperation.

Recommendations of the European Union for national approaches to the making of the policy relating to higher education highlight the significance of a greater intensity of relations with the world of work, research activities and the society. Entrepreneurship development is another important factor. Above activities require many forms of cooperation with interested parties. However, the establishment of partner relations between higher education institutions and enterprises faces many challenges. The most important of them consists of the attachment of the world of science to the search for theoretical knowledge while the world of business is attached to designing fast and pragmatic solutions (Geryk, 2015). Global changes in the economy and the creation of a knowledge-based community significantly raised the importance of higher education institutions in the environment while creating new challenges that only some academic centres are able to face, e.g. relating to their information policy, which is closely related to the classic cycle of acquisition, consolidation, sharing and expansion of knowledge (Kamińska & Zawiła-Niedźwiecki, 2015) (Figure 1.2).

Objective conditions of the cooperation between higher education institutions and their socioeconomic environment are regulated, among other things, in the Act of 20 July 2018 – Higher education and science law. The mission of the higher education system consists of the provision of the best

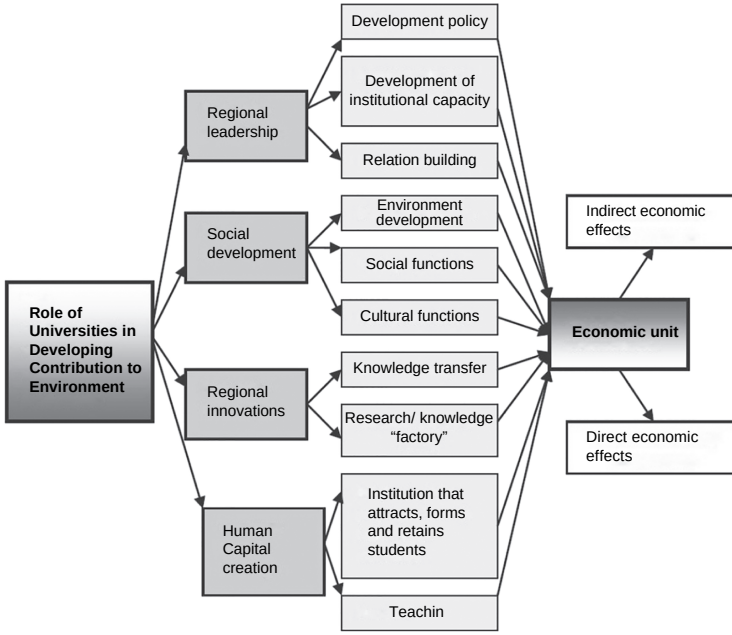

Figure 1.2 Higher education institution's role in the environment.

Source: Chirileasa (2013, after: Geryk, 2015). The publication is available under the Creative Commons Attribution 3.0 Poland license.

quality education and scientific activities, research services and the transfer of knowledge and technology to the economy, education and promotion of the academic staff, work for local and regional communities, modelling of citizenship and participation in social development and creation of the economy based on innovations (Dz.U, item 1668, 2018). A higher education institution has the unique role of developing the personalities of students and equipping them with knowledge and skills. This role has direct implications for the quality of the existing and future staff of those organizations that take advantage of the education offered by such institutions (enterprise employees, local governments, public institutions, non-governmental organizations, etc.). Additionally, interested parties cooperating with the higher education institution play a material role in the development of the academic offer they receive. They have a real impact on the formulation of effects of the education, are invited to participate in practical classes and can also organize such classes for students on their own premises (e.g. as field training or internships) (Górniak, 2015). Scientific research conducted by higher education institutions are frequently addressed directly to enterprises that use it for commercial purposes while also frequently allowing for at least their partial propagation in the form of scientific publications. Enterprises also use other forms of science promotion, e.g. through participation in scientific events or projects (Ernst &

Young, 2010). The effectiveness of a higher education institution's cooperation with the environment is one of the areas of higher education institutions' academic activities evaluated by the Ministry of Education and Science as a part of the systematic assessment. In particular, the application aspect of the research and its usefulness to the socioeconomic environment is considered, e.g. compliance with smart specialisations of the region and influence on the resolution of practical economic problems. One can advance a thesis that enterprises are the key partner of higher education institutions when it comes to all the three aspects described below: education, research and other forms of the higher education institutions' cooperation with the environment. Enterprises comprise the largest group of institutional interested parties taking advantage of the staff trained by a higher education institution (students and graduates) and services it offers: educational or related to the transfer of knowledge in another form (as research services, experts' opinions, etc.). This is why what a higher education institution offers and whether it meets the expectations and needs of its interested parties in this way is extremely important from the perspective of an effective development of its cooperation with enterprises.

Ławicka conducted interesting studies of the cooperation between higher education institutions and enterprises in 2017. The results demonstrate than nearly 90% of representatives of analysed higher education institutions cooperate with enterprises but only a small percentage of them declare that the cooperation makes the long-term development of the higher education institution possible. The cooperation usually has to do with the current research, e.g. the organization of conferences or execution of courses. There is a lack of cooperation with businesses during the strategy determination by department or when long-term goals are being set. Only a small percentage of analysed firms (7%) are interested in the permanent cooperation such as involving a product/service improvement, innovation or commitment to the execution of courses (2020).

Another similar research was initiated by the author of this work in 2020. The objective was to analyse and evaluate areas of inter-organizational cooperation between a higher education institution and entrepreneurs in the same region to determine the prevailing behaviour and trends. Purposeful sampling was used and the CAWI survey covered 68 enterprises from the Śląskie Voivodeship cooperating with at least one higher education institution. The research served the more extensive and deeper recognition of research problem discussed in this work. As for the current scope of the cooperation between enterprises and higher education institutions, most frequently mentioned forms of cooperation include the following:

- admission of students to professional practice;
- using expert knowledge of the academic staff;

- participation in events organised by higher education institutions (e.g. conferences);
- participation in projects, including R&D projects;
- using results of the research conducted by higher education institutions;
- being inspired by innovations publicized by a higher education institution, including technological innovations.

Most infrequent forms of the cooperation between higher education institutions and businesses:

- participation in advisory bodies active in higher education institutions;
- participation in the issue of opinions about education curricula;
- participation in charity actions and other social activities of a higher education institution;
- using the support of a higher education institution while recruiting employees or volunteers;
- inviting higher education institutions to participate in the organization of joint ventures and actions (Figures 1.3 and 1.4).

Enterprises see the greatest potential for more intense cooperation with higher education institutions in using research results and expert knowledge of the academic staff and being inspired by the innovations publicized by a higher education institution. The above scopes of cooperation obtained high scores when it comes to the current cooperation but the desired scope of cooperation is definitely greater. Enterprises declare their significant interest in admitting students to practical training (a big gap between the current situation and expectations). At the same time, enterprises are not very interested in being more active issuing opinions about the curricula, participating in advisory groups active in higher education institutions or engaging in charity actions and social activities (Figure 1.5).

The research demonstrates that having access to specialists with good practical training is the most important determinant of the cooperation between enterprises and higher education institutions. Businesses also attach great importance to the access to experts' knowledge and advice. They highly value the opportunities to engage scientists to cooperate with enterprises in such roles and appreciate the opportunity to offer internships to students. All the forms of cooperation between higher education institutions and enterprises already mentioned are about knowledge as a resource and, at the same time, as a value that a higher education institution can make available to enterprises. Factors considered to be of least importance when it comes to the building of cooperation between higher education institutions and enterprises included opportunities for implementation doctorates, international cooperation development and the acquisition of foreign contacts, competitiveness improvement thanks to participation in

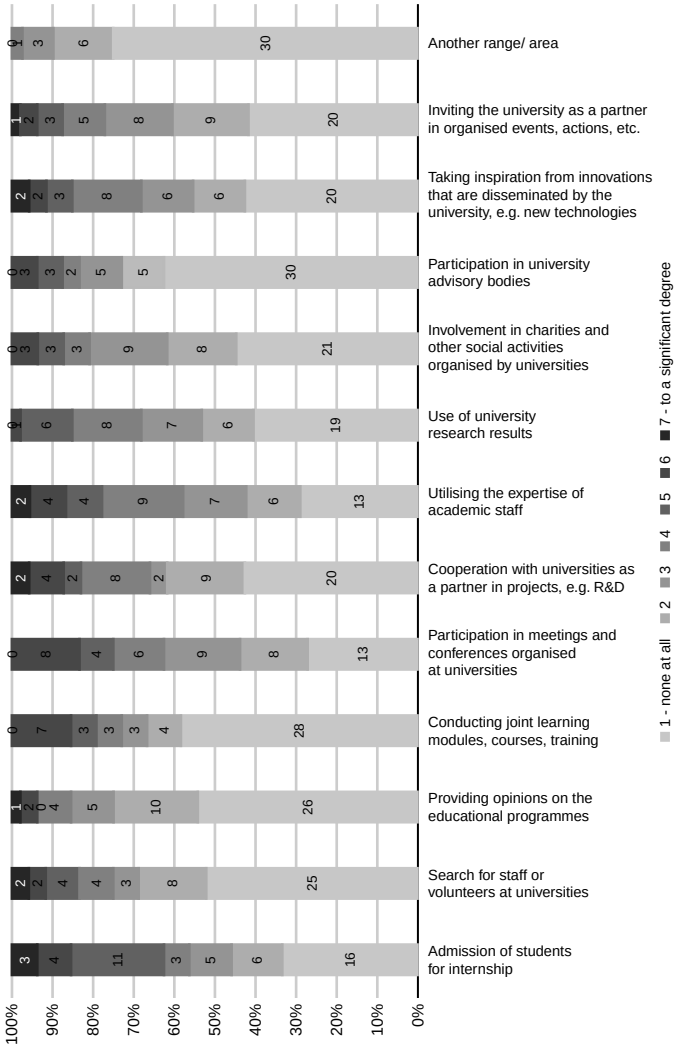

Figure 1.3 Current scope of cooperation between enterprises and higher education institutions.
Source: Own work based on research results.

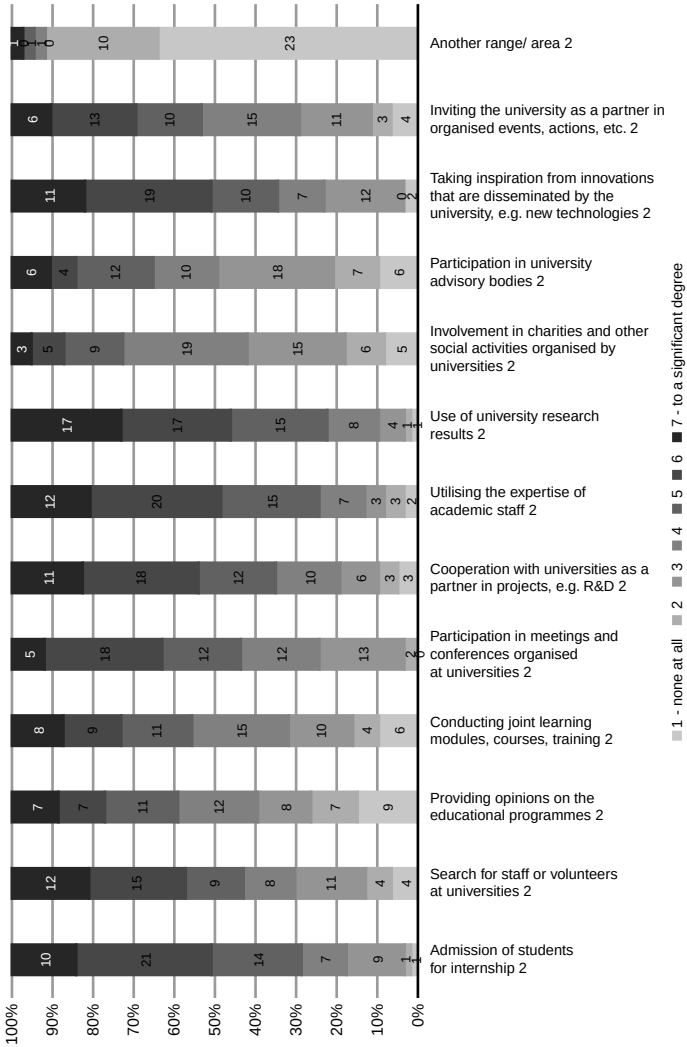

Figure 1.4 Expected scope of cooperation between enterprises and higher education institutions.
Source: Own work based on research results.

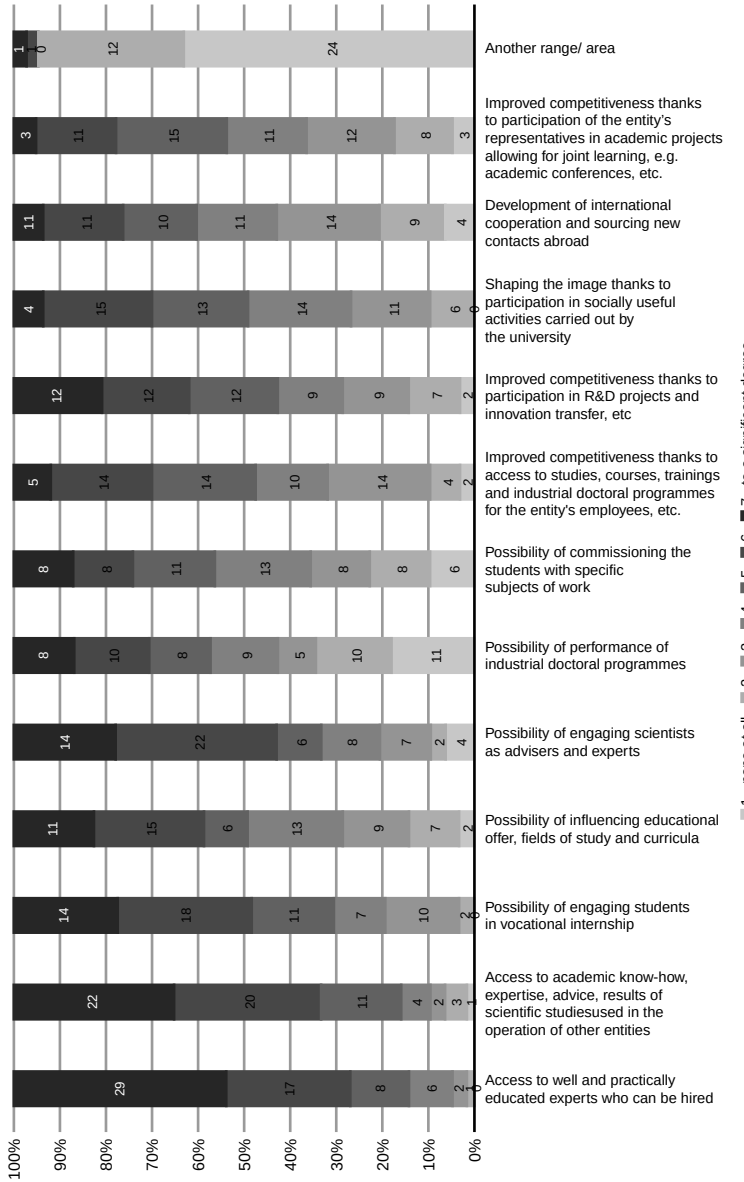

Figure 1.5 Evaluation of opportunities created for enterprises thanks to cooperation with higher education institutions.
Source: Own work based on research results.

academic ventures and image shaping thanks to participation in social activities of a higher education institution. Opportunities to work with students or doctoral candidates, including commissioning students to solve specific issues in the business practice, also scored low. The research shows that entrepreneurs focus on a finished product, i.e. knowledge transferred by a higher education institution in various ways, the application of which brings direct, fact and positive results to entrepreneurs.

Notes

1 The dimension can be local, regional, national or international.
2 Among other things, the role of a higher education institution in the development of professional and general competencies was discussed by Borowiecki, Kusio (2016); Motoyama, Mayer (2017).
3 In the case of the market of higher education services (education market), we can talk about direct competition only among higher education institutions (beyond the market of training services) but, e.g. on the market of research or experts' services, higher education institutions have a strong and much broader competition, i.e. experts offering professional services, consulting companies, law firms, commercial laboratories or R&D institutes. From another perspective, the competitive environment of higher education institutions also includes, e.g. non-profit organizations, among other things, due to the fact that they compete with higher education institutions for funds on social activities (e.g. subsidies from local governments) – see Pluta-Olearnik (2015).

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2 Building Relations Between Higher Education Institutions and Enterprises – Literature Review

2.1 Using the relationship marketing to build inter-organizational relations between higher education institutions and enterprises

Relationship marketing has been recognized in two research approaches (Möller & Halinen, 2000). The first of them is the interinstitutional approach that explains the process of relationship building between a company and various entities with which it interacts in its environment. High complexity of long-term relations between all parties to the cooperation is characteristic of this approach. Due to the joint use of relatively varied resources, such organizations remain co-dependent, which helps strengthen their ties. Additionally, the inter-organizational area offers a certain autonomy to partners connected by specific relations whose activities result from the chosen method of coordination of their cooperation in a non-randomly structured environment (Czakon, 2017). The second research approach posits a much lower co-dependency between parties to the cooperation. The offeror–client relations prevail and the one who offers resources (e.g. products, information) is the more active party. It is much easier to change a partner according to this approach because resources of value to a potential partner are usually substitutable. Their use does not have to result from long-term relations, just episodes are enough. The exchange is based on transactions and does not automatically result in the building of a relationship. Relations are established because many organizations strive to improve the terms of their exchange with entities in their environment. In relations based on such exchange interactions, the managerial, economic and psychological aspects are of key importance (Rudolf, 2014).

The unique type of ties based on the use of knowledge (Krupski, 2014) that are developing very dynamically between higher education institutions and enterprises suggests the need to analyse this issue not only from the perspective of knowledge management and inter-organizational cooperation but also in the context of strategic management, which requires looking at the management of relations with a client from the perspective of the marketing theory. There is no doubt that contemporary higher

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education institutions developing on the basis of market orientation and managerial governance can be treated as offerors of knowledge-based services rendered at arm's length while enterprises can be treated as clients using such services. Only such a broad approach to the relations between higher education institutions and enterprises allows us to fully recognize the complexity and nature of inter-organizational ties between them.

Management sciences assume that the concept of a relationship is indefinable while the essence of inter-organizational relationships can be explained thanks to an analysis in the context of inter-organizational relations or interactions (Krzyżanowski, 1994); however, interactions usually are the only ones to shape inter-organizational ties.[1] As explained by P. Klimas, inter-organizational ties are long term, non-hierarchical and non-capital, constituting a unique type of a relational resource that can generate competitive edge (2015), particularly important if the organization is market oriented. In the context of the building of relations between higher education institutions and enterprises, organizational ties can be considered the common resource allowing both organizations to attain goals in line with their strategies. As relational resources, inter-organizational ties are defined by three key characteristics: exchange, commitment and mutuality (Table 2.1) (Czakon, 2018).

Higher education institutions and enterprises found the development of inter-organizational ties on premises such as effectiveness increase, reduction of transaction expenses, learning, gaining access to resources or uncertainty reduction (Czakon, 2007). These ties develop on the basis of an exchange of specific values. Great changes have occurred when it comes to the clients' perception of value. In contemporary conditions for the development of network and knowledge-based relations, it would be difficult to agree with the statement that an organization can continue to create value independently from the buyers. The 21st-century buyer of services has transformed from an isolated one into one cooperating with others, from an unaware one into an informed one and from a passive into an active one (Prahalad & Ramaswamy, 2005). Dialogue and co-creation of value for the client are gradually starting to prevail in the cooperation between enterprises and higher education institutions. The exchange of value (Dziewanowska, 2012) between the one who offers value and the one who uses it is also at the core of contemporary marketing activities. The development of value co-creation processes is increasingly well visible on the market and value gets created at the moment of the interaction between the buyer and the supplier of value (Ławicka, 2020). Therefore, the concept of the relationship marketing can also be referred to relations related to the exchange between a higher education institution and an enterprise that can be based on one or more similar or different transfers (e.g. transfer of knowledge in the form of an educational service and research results). Value creation for the client on the basis of inter-organizational ties entails the need for the supplier of value to adapt to the recipient's needs. The process of value creation involving stakeholders should include their identification, the definition of common areas of interest, objectives and benefits as

Table 2.1 Characteristics of inter-organizational ties between higher education institutions and enterprises

Characteristics	*Reference to the nature of inter-organizational ties between higher education institutions and enterprises*
Exchange	Two-way material or informational transfer of resources (e.g. knowledge) between higher education institutions and enterprises including learning, considering: • content of the exchange, e.g. intellectual property rights, research results, etc.; • the form of exchange, e.g. sale-purchase transactions, payment-free transfer, etc.
Commitment	Deepening and expansion of the exchange relationship between higher education institutions and enterprises to give the exchange the flavour of inter-organizational ties. Among other things, commitment manifests in the form of: • an increase in the number of joint activities to benefit from returns to scale; • intensified information exchange to improve the inter-organizational learning process and create conditions for the joint creation of value, e.g. building knowledge as a part of research and development work; • strengthening of material ties (joint investments of higher education institutions and enterprises, e.g. in the research infrastructure) and social ties (modelling positive interpersonal relations between representatives of science and business in the course of joint R&D projects).
Mutuality	It ensures that the synergy of commitment and exchange is maintained in the area of common goals and requirements in the form of: • reciprocation of behaviour of the other party, e.g. two-way knowledge transfer, • symmetry of influence on the shape, content and terms of the exchange, e.g. equivalent commitment to joint learning, payment for knowledge transfer adequate to its real value, etc.; • securing the power, e.g. the possibility to impose the commitment to the cooperation on the academic staff in the case of a higher education institution and to knowledge workers in the case of an enterprise; • co-dependency, e.g. complementarity of tasks carried out by a higher education institution and an enterprise in the course of a joint R&D project determining their interest in the collaboration; • common goals, shared direction of endeavours, e.g. development of application research and methods of attainment of common goals, e.g. through the execution of R&D projects.

Source: Own work based on Czakon (2007).

well as the challenges faced by the company in building relationships with these groups (Dacko-Pikiewicz, 2022). At the same time, the recipient also commits and makes its contribution to the value creation process. For many organizations, joint commitment in the creation of value is still difficult as exemplified, among other things, by barriers in relations between higher

education institutions and enterprises (Jacuński, 2019; Poznańska, 2017). At the same time, the number of catalysts of the development of such relations is on the increase due to the growing importance of knowledge for each organization (Lechwar & Puchalska, 2017; Rzempała, 2017). Inhibitors and stimulants of the development of inter-organizational ties between higher education institutions and enterprises are presented in Tables 2.2 and 2.3.

Table 2.2 Inhibitors of inter-organizational ties between higher education institutions and enterprises

Category	*Example of impact*
Finances	• no funds available to enterprises for the use of academic knowledge • no funds available to a higher education institution for hiring business practice experts
Human resources	• resistance to changes resulting from cooperation development for the higher education institution and for the enterprise • no mutual trust in relations between a higher education institution and an enterprise (among other things, using a different language, no common goals) • introverted, conservative culture with a tendency towards self-dependence in a higher education institution and in an enterprise
Knowledge and technology	• incompatibility of resources in higher education institutions and enterprises • limitations in the use of resources of higher education institutions and enterprises, e.g. due to patent protection • heterogenicity or homogeneity of resources restricting the possibility to take advantage of ties for a higher education institution and for an enterprise • asymmetry of quality and availability of resources, e.g. knowledge • the risk of the loss of knowledge and competencies as a result of their sharing
Relationship	• no relational competent in a higher education institution and/or enterprise • excessive commitment to relations resulting in dependency on the partner, e.g. dependence of enterprise development on results of the research conducted by a higher education institution • no experience in the development of inter-organizational ties in a higher education institution and/or enterprise • low capability for knowledge absorption in the process of individual, team, organizational or inter-organizational learning in a higher education institution and/or enterprise
Organization and management	• divergence of strategies, management styles and organizational cultures of a higher education institution and an enterprise potentially resulting in identity loss • no need for collaboration in a higher education institution and/or enterprise

Source: Own work based on Klimas (2015).

Table 2.3 Stimulants of inter-organizational ties between higher education institutions and enterprises

Category	*Example of impact*
Resources	• minimization of resource imperfection, i.e. conscious acquisition of access to unique resources, e.g. knowledge by enterprises or higher education institutions or restricting the access to them (aspiring for the exclusive cooperation in exchange for specific benefits interesting to the other party to the exchange)
Effectiveness	• reduction of costs of use of the resources, e.g. using external resources of knowledge instead of creating one's own • cost distribution, e.g. sharing knowledge within alliances, clusters and networks • strengthening the ability to compete thanks to the synergy effect, e.g. by jointly using knowledge available to partners to create innovations • benefitting from the resource leverage resulting from an increase in knowledge value
Learning	• an improvement of organizational processes including the organizational and inter-organizational learning process as well as team learning to improve competencies and skills for the higher education institution and for the enterprise and to acquire knowledge
Management and development	• maintaining or improving the competitive position in the environment thanks to knowledge acquisition and application • increase in the value of an organization (higher education institution and enterprise) • risk management thanks to its distribution among the cooperating organizations • reduced uncertainty when responding to changes related to the use of knowledge (transformation of a higher education institution and/or enterprise due to changes in the environment)

Source: Own work based on Klimas (2015).

The balance between barriers and stimulants of the development or inter-organizational ties between cooperating entities fundamentally impacts their ability to develop, deepen and consolidate. What is more, the dynamics of internal changes occurring in cooperating entities and turbulences in their environment significantly impact the inter-organizational cooperation. K. Dziewanowska defines ties as something that connects or unites (Dziewanowska, 2012). The element around which inter-organizational cooperation is being developed is the basis of such ties. In the case of a higher education institution and an enterprise, it can be a joint research programme, education offered by a higher education institution to the enterprise, the launch or a specialization or direction of studies in a higher education

institution in cooperation with an enterprise, etc. M. Mitręga points out that ties develop as a result of the development of certain relations between the parties and determine the way in which the client evaluates the entirety of interactions with the supplier. According to K. Rogoziński, relations influence the establishment and consolidation of inter-organizational ties, transforming clients taking advantage of an exchange into parties interested in the cooperation (Freeman, 1984) and, eventually, into the commonality of interest (Rogoziński, 2006). According to K. Mazurek-Łopacińska, ties can be transformed into a partnership (Mitręga, 2019) described as an optimal (target) system of ties between the supplier and the client (Mazurek-Łopacińska, 1999). Nevertheless, the widest and richest meaning can be assigned to the concept of a relationship, most accurately referring to relations between suppliers of value and recipients of value or clients. These roles are interchangeably attributable to higher education institutions and enterprises participating in the value co-creation process.

Restricting the impact of barriers and taking advantage of stimulants for the development of ties between higher education institutions and enterprises are important challenges for the contemporary relationship marketing. It is most generally defined as the creation, maintenance and enrichment of relations with a client (Berry, 1983). From this perspective, a higher education institution is a typical supplier while an enterprise is a client. One can imagine a situation in which an enterprise would be a supplier of practical knowledge to a higher education institution. In both these situations, as M. Ławicka 2020 points out, it is possible to talk about the co-creation of such a relationship and the resulting value. Tish's approach approximates even more both research approaches mentioned at the beginning to which the relationship marketing relates. Approaches having similar meanings and considering the expanding meanings of the relationship marketing are presented as follows:

- creation, maintenance and enrichment of ties with clients and their partners through bilateral exchange and keeping promises (Gronroos, 1990);
- ties, networks and interactions (Gummesson, 2000);
- imminent generation of client-focused project management (Meng & Boyd, 2017);
- creation of a database of existing and potential clients and impacting them with an appropriate information transfer and, at the same time, the evaluation of costs and benefits of such relations (Copulsky & Wolf, 1990);
- using knowledge of clients to design an appropriate service or product and, after that, developing mutually beneficial ties (Cram, 1994);
- a concept accentuating not only the traditional marketing mix but also customer service and quality (Armstrong, 2001);
- the process of the creation, development and maintenance of durable ties highlighting the direct and interactive nature of contacts between

the seller and the buyer and other entities participating in that process (Fonfara, 1999);
- identifying, acquiring, retaining and nurturing profitable clients by building and maintaining long-term relations with them (Adikaram, Khatibi & Yajid, 2016);
- practical implementations with client relations within the strategy (Rigo, Pedron, Caldeira & Araújo, 2016);
- maintaining the balance between three key organizational resources, i.e. people, technologies and processes, used in the management of relations with clients to guarantee their high satisfaction level and retain them (Manzuma-Ndaaba, Harada, Romle & Shamsudin, 2016).

Table 2.4 presents key elements of inter-organizational ties between a higher education institution and an enterprise analysed from the perspective of the

Table 2.4 Categories of terms used in definitions of the relationship marketing to describe the development of inter-organizational ties between higher education institutions and enterprises

Basic term	*Supplementary term*	*Reference to inter-organizational ties between higher education institutions and enterprises*
Creation	Attracting (new clients), establishing, creating (ties)	An invitation from a higher education institution for an enterprise to participate in the first stage of an R&D programme related to the industry in which the enterprise operates.
Development	Strengthening, consolidating, deepening (ties)	Expansion of the cooperation between a higher education institution and an enterprise to other research areas interesting to the enterprise.
Maintenance	Sustaining, stabilization, existence (of ties)	Continuation of the cooperation between a higher education institution and an enterprise at the second stage of an R&D programme related to the industry in which the enterprise operates.
Interaction	Exchange (of value), mutual (exchange), cooperation	Joint learning of enterprise employees and the higher education institution's academic staff as well as organizational learning as well as the organizational learning of an enterprise and a higher education institution and inter-organizational learning being a part of the R&D programme conducted jointly by the enterprise and the higher education institution.

(*Continued*)

Table 2.4 (Continued)

Basic term	*Supplementary term*	*Reference to inter-organizational ties between higher education institutions and enterprises*
Long term	Existing, long term, sustained (ties)	The conclusion of a long-term partnership agreement between a higher education institution and an enterprise in all research areas that can interest both parties to the cooperation, considering the willingness to mutually transfer knowledge and other materials necessary to conduct joint research in the agreement.
Emotional content	Attachment, trust, promise	Building interpersonal and inter-organizational relations consolidating the cooperation, an increase in mutual trust making the execution of a long-term partnership agreement possible.
Result	Profitable, effective, mutually beneficial (maintenance of ties)	Definition of a permanent algorithm of the distribution of intellectual property rights to results of the research conducted under the long-term partnership agreement.

Source: Own work based on Dziewanowska (2012).

relationship marketing. The establishment of ties requires their creation. Long-term cooperation and exchange of resources interesting to both parties in order to jointly create value are the basis for the development of ties. Stable ties and trust between the parties lead to a long-term partnership. A positive emotional connection between representatives of a higher education institution and of an enterprise and the acquisition of bilaterally beneficial effects as a result of the development of inter-organizational ties have a favourable influence on the process.

Relationship marketing attaches particular importance to the creation, development and maintenance of market ties while highlighting the direct and interactive nature of contacts between the organization offering value and the organization interested in acquiring such value (Fonfara, 1999). Both an enterprise and a higher education institution can play any of these roles. Relationship marketing explains conditions promoting the consolidation of ties between exchange partners with the departure from the exchange focused exclusively on a given transaction towards the close cooperation that allows both parties to attain joint benefits considered of key importance. Considering such an approach to the cooperating between higher education institutions and enterprises makes it easier to evaluate the process of relationship building occurring between them in the context of the joint creation of knowledge-based value.

2.2 Enterprises as interested parties of higher education institutions

The concept of an "interested party" was used for the first time in the management literature in 1963 to describe a group of entities to which enterprise owners should be answerable and without whose support the organization would cease to exist. This concept was further developed by R.E. Freeman who stressed the importance of interested parties as those who influence an organization or are influenced by an organization in an attempt to attain its goals (Freeman, 1984). Interested parties are those who, directly or indirectly, benefit or incur costs as a consequence of the results of operations executed by the organization with which they are related (Bielski, 2004). The feedback between interested parties and the organization suggests that their relations can have a varied nature and objectives, e.g. they can exist to pursue the interests of the enterprise (Donaldson & Preston, 1995). From the very beginning, the concept of interested parties has been related to the traditional understanding of business as an integral part of the society (Freeman, 1996); therefore, it also refers to the relations between enterprises and higher education institutions (Marshall, 2018).

Even though management and quality science acknowledge the theory of interested parties, one has to note that, in fact, this is not a single unified concept but rather many varied approaches, among other things, referring to the organizational theory, decision theory, social network theory, transactional cost theory and social contract theory (Andriof & Waddock, 2002). The review of publications in the Scopus and Web of Science databases shows that the concept of interested parties is most frequently linked to the theory of contracts and the idea of the social responsibility of organizations. An enterprise is most frequently perceived as a bundle of contracts where the interested parties make specific contributions to the organization (e.g. capital, products, services, skills, cash) and receive specific benefits in return (e.g. dividend, remuneration, products, services, interest, taxes) (Sunder, 1997). In turn, the idea of the social responsibility of organizations stresses the need for an entity's sustainable influence on the economic sphere (key interested parties are clients, owners, suppliers or contracting parties), social sphere (e.g. employees, local or regional communities) and the sphere of the natural environment (e.g. non-governmental organizations) (Andriof & Waddock, 2002). The presented interested party theories point to various interest groups concentrated around the organization. In principle, they can be divided into two categories, i.e. internal and external interested parties, or, according to a different approach, primary and secondary interested parties.

Enterprises are classified as external (from beyond an organization) and primary interested parties (their activity strongly and multidimensionally impacts the functioning of higher education institutions) (Slabá, 2015). For them, relations with a higher education institution are a form of the inter-organizational cooperation that can serve, e.g. the mutual transfer of

information (Kamińska & Zawiła-Niedźwiecki, 2015), the pooling of strengths to attain common objectives and results expected by both parties, the striving towards synergy resulting from the joint use of complementary resources and competencies (e.g. in a research area) or joint learning aimed at a more use of knowledge already acquired or the joint creation of new knowledge. The cooperation also often results in the value added: an increase in the trust and commitment of partners, satisfaction and consolidation of the relationship (Doz, Prahalad & Hamel, 2017). Wheeler and Sillanpää (1997) as well as Hund and Engel-Cox (2002) treat enterprises as the primary advocacy group of a higher education institution, highlighting their role in the financing of development processes (among other things, the acquisition of research results, using experts' services) (Bergman, Geissler, Hundt & Grave, 2018). The importance of these groups of interested parties of a higher education institution is all the more important for a market-oriented higher education institution (Kuzu, Gökbel & Güleş, 2013) (e.g. where revenues from beyond the public sphere are more important) (Bischoff, Volkmann & Audretsch, 2018) and where relations with the environment play a greater role in the strategy of the higher education institution (Fijałkowska & Hadro, 2018). Selected areas of the enterprises' commitment to relations with higher education institutions are presented in Table 2.5.

Another classification of interested parties aptly reflecting the specificity of relations between higher education institutions and enterprises was suggested by Mitchell, Agle and Wood (1997). It is based on the evaluation of the degree of importance of interested parties for an organization depending on power, legitimization and urgency (Mitchell, Agle & Wood, 1997). Power refers to the real possibilities of interested parties impacting the decisions and operations of higher education institutions. The four types of powers applicable to specific interest groups can be distinguished in the case of higher education institutions (Lavrence & Weber, 2008):

- voting power, e.g. the influence of owners of a higher education institution (they can also be founding enterprises in the case of non-public higher education institutions [Bozbura, Bayraktar & Tatoglu, 2011]) or partners (enterprises can be shareholders of companies established by higher education institutions, among other things, in a spin-out company);
- economic power referring to advocacy groups such as investors (e.g. enterprises executing commercial R&D projects as a part of their partnership with a higher education institution and making their own contribution to them), clients (among others, the staff from enterprises studying at a higher education institution thanks to the employers funding their education), business partners and collaborators (e.g. consortium

Table 2.5 Selected areas of commitment of enterprises as interested parties of higher education institutions

Area	*Selected areas of commitment of enterprises as interested parties of higher education institutions*
Knowledge and information, intangible assets	• enterprises delivering practical knowledge, e.g. for research and implementation projects, in the course of the didactic process, etc. • enterprises using expert knowledge of the academic staff, results of the academic research and commissioning commercial research at a higher education institution • enterprises making results of research and analyses available to higher education institutions • delivering research problems to be solved by higher education institutions as well as data and information related to such research • dissemination of the information about the activities of a higher education institution in the business environment • using the cooperation with a higher education institution to promote the enterprise • enterprises taking advantage of knowledge dissemination activities at a higher education institution, e.g. scientific conferences, science festivals, etc. • enterprises participating in a higher education institution's advisory panels • mutual access to international contacts to internationalize activities of higher education institutions and enterprises • mutual inspiration with the available know-how and innovations
Human resources	• enterprises co-creating curricula and graduate profiles and participating in the evaluation of curricula • enterprises offering internships to students • enterprises offering internships to scientists and engaging academic staff in the conducted research and projects • organization of study visits and other forms of academic education in enterprises or with the involvement of enterprise staff • posting employees from enterprises to various forms of academic education (studies, training, implementation doctorates, etc.)
Financial resources	• financing education, R&D and experts' services offered by higher education institutions to businesses • joint acquisition of external funds for the implementation of projects • joint investing in business ventures, Bailetti (2011), e.g. spin-out companies or Åstebro, Bazzazian and Braguinsk (2012) start-ups • rendering outsourced services for a higher education institution, e.g. marketing, research, ITC, etc. • sponsoring socially useful activities executed by higher education institutions • participation in charities and other social activities organized by higher education institutions
Material resources	• chargeable/free mutual provision of space (e.g. conference rooms) and equipment (e.g. laboratories) • joint development of the infrastructure of higher education institutions and enterprises (e.g. purchasing machinery, equipment and apparatus as a part of R&D projects)

Source: Own work.

members) and academic staff who at the same time conduct their own business activities;
- political power available to interested parties at the central and local levels (e.g. chambers of commerce, employer organizations, industry associations, clusters and networks) potentially influencing the enactment of new laws and regulations by way of lobbying;
- legal power potentially available to all advocacy groups linked to a higher education institution because every entity can invoke a higher education institution's responsibility for a breach of laws in force.

The second attribute is about the legitimization of the foundation of relations between the interested parties and a higher education institution. Such relations can be legal in nature (e.g. a cooperation agreement relating to a project), and they can also be moral (e.g. ethical standards applied in a higher education institution, universal values: fairness, trust, loyalty) and customary (e.g. customs respected in a specific culture). Urgency is the third attribute in the classification of interested parties of a higher education institution. It refers to situations in which relations between the interested parties and a higher education institution or their expectations of such relations depend on the passing of time and are special or even critical to them. In other words, it is the degree to which the expectations or claims of the interested parties require an immediate response from the higher education institution. High degree means that an interested party is prioritized in the hierarchy of priority actions of an organization (e.g. it can be an enterprise with which a higher education institution cooperates to execute a strategic project). The classification of interested parties based on the three above attributes is presented in Figure 2.1.

Figure 2.1 shows that power, influence and possibilities of impact available to a specific advocacy group with regard to a higher education institution are related to the number of attributes such a group has. The greater this number, the more important an interested party will be to a higher education institution. Interested parties with all three attributes are the group of utmost importance for a higher education institution, which is why they should prioritized. These are definitive interested parties and include, e.g. strategic partners of pending projects. Such employees have great economic power, legal empowerment (cooperation agreement) and urgent requirements regarding the fulfilment of commitments undertaken by a higher education institution. Another group (of moderate importance to a higher education institution) consists of the pending interested parties with two out of three attributes: legitimization and urgency ("dependent interested parties"), power and legitimization ("dominating interested parties") or power and urgency ("dangerous interested parties").

Dependent interested parties of a higher education institution can include, e.g. suppliers or contracting parties having the legal legitimization and urgency resulting from the timely settlement of dues while their strength of influence is not that great. The potential fulfilment of their expectations or claims very

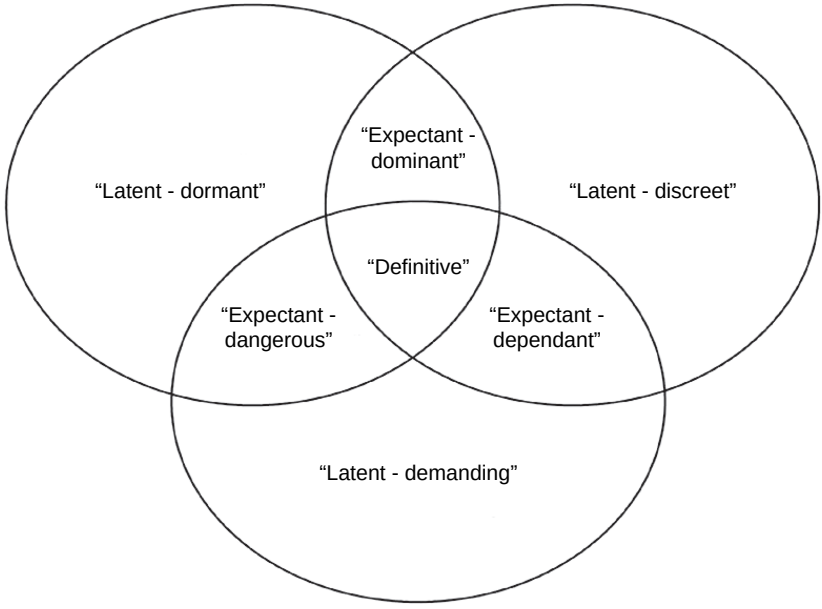

Figure 2.1 Classification of interested parties according to Mitchell, Agle and Wood. Source: Mitchell, Agle and Wood (1997).

often depends on the intervention of other, stronger groups. Dominating interested parties can be, e.g. students assigned to study by their employers who pay for the studies. They have the economic power and a service agreement with a higher education institution as the basis for their legitimization but a great part of their claims cannot be satisfied (e.g. they cannot graduate before passing all the forms of knowledge verification). Dangerous interested parties can be entrepreneurs who use a higher education institution's expert knowledge but the cooperation is not sufficiently formalized to guarantee the full protection of intellectual property. Such enterprises often have both the economic power and claims relating to the maintenance of the cooperation on terms advantageous to them and can threaten the higher education institution with the cessation of their cooperation and with the use of acquired knowledge without the involvement of the higher education institution.

Latent interested parties are the last group. This category has the lowest rank and importance for a higher education institution. It only has one attribute: demanding interested parties have urgency (e.g. business advisors requiring a response to a service offer submitted to a higher education institution), discreet ones have legitimization (e.g. employer organizations with legitimization based on ethical standards) and sleeper interested parties have power (e.g. enterprises with huge sponsoring budgets that have the financial power over entities operating in their environment). Obviously,

one has to remember that attributes of individual interested parties are not constant; they can be acquired or lost. An important thing is that interested parties do not have to be aware of them or, even if they are aware of having specific attributes, they do not always have to invoke them.

Another, even more in-depth analysis of enterprises as interested parties of higher education institutions takes their power of impact into account, measured with the number of attributes they have (one, two or three) and the likelihood of reaction or of the use of such attributes in practice. A matrix of interested parties of a higher education institution can be developed on the basis of these assumptions. By adopting three-stage scales of power: high (three attributes), moderate (two attributes) and low (one attribute) and a three-step scale of the likelihood of response: high (aware of having attributes and willing to take advantage of them), moderate (aware of having attributes but not willing to take advantage of them) and low (not aware of having attributes and, as a result, not willing to take advantage of them), it is possible to suggest the division of enterprises as interested parties of a higher education institution into nine groups presented in Figure 2.2.

Each of the groups of interested parties presented in Figure 2.2 has its particular interests, often contradicting the interests of other groups. Therefore, a tailored approach to each of the partners is very important from the perspective of managers of a higher education institution (Bae, Qian, Miao & Fiet, 2014). Understanding the nature of individual advocacy groups, the ability to evaluate priorities when it comes to satisfying their needs, degree of materiality of their interest in the building of positive relations and the degree of influence on an organization is of key importance in the context of the effectiveness and efficiency of attainment of

Probability of reaction	Power of impact: Minor	Power of impact: Average	Power of impact: High
Low	Weak Ignorant	Not too strong Ignorant	Strong Ignorant
	Weak Undecided	Not too strong Undecided	Strong Undecided
Average	Weak Determined	Not too strong Determined	Strong Determined

Figure 2.2 Matrix of enterprises as interested parties of a higher education institution.
Source: Based on Szwajca (2016).

objectives pursued by a higher education institution (Andruszkiewicz, Nieżurawski & Śmiatacz, 2014; Blowfield & Murray, 2008).

The above deliberations confirm that enterprises as an advocacy group have a widespread effect on the functioning of higher education institutions. A higher education institutions' use of different forms of cooperation with enterprises to improve their competitiveness in the market of higher education services and to consolidate their position in the environment requires an in-depth analysis of relations between these entities.

2.3 Development of relations between higher education institutions and enterprises

The concept of ties is linked to the concept of an exchange. An exchange entails specific effort and expected benefit. Ties connecting and uniting collaborating organizations (Furtak, 2003) develop as a result of an interaction occurring between them (Grönroos, 2006). Each interaction has its characteristics when it comes to:

- duration (the interaction process can be divided into active periods when interactions happen and passive periods when the interested parties do not maintain contact with an organization, which does not rule out its interaction with other entities at the same time);
- subject of an exchange (e.g. economic or social exchange or the exchange of information and knowledge);
- behaviour of participants in the exchange (e.g. active behaviour initiating the relations and passive behaviour awaiting the suggestion to establish relations).

The interaction process covers specific activities and sets of activities, i.e. episodes as a result of which a single exchange occurs. A few interrelated episodes comprise a sequence. A relationship consisting of a series of sequences (Liljander & Strandvik, 1995) occurring one by one or overlapping (Furtak, 2003) can be considered the highest aggregation level for an interaction (Figure 2.3).

In the third decade of the 21st century when the competitive system on the market of higher education services is changing more and more dynamically (among other things, influenced by the growing competitiveness of non-public higher education institutions and changes in the education process due to the COVID-19 pandemics), all relations as more or less developed forms of inter-organizational cooperation are very important. They are cardinal not only for parties directly participating in an exchange (e.g. higher education institutions executing research projects and enterprises cooperating within a consortium) but also for their environment, including other interested parties, e.g. other enterprises that use results of such research as a result of the diffusion of innovations (Danielak, 2012). Additionally, higher education institutions

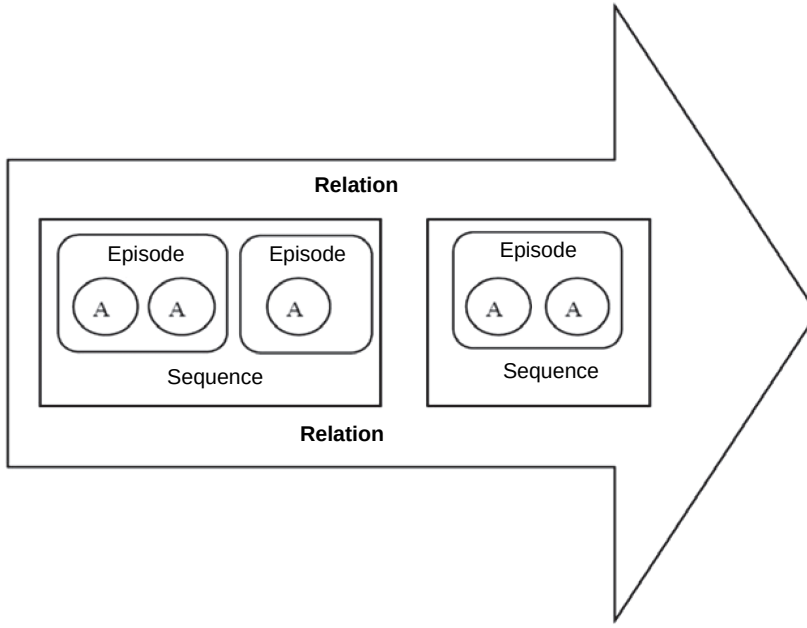

Figure 2.3 Relationship as an interaction.
Source: Dziewanowska (2012).

themselves notice more and more benefits resulting from the professional building of relations with interested parties and want to develop relations with partners who guarantee a satisfactory level of benefits from the exchange.

When analysing the area of relationship building, one needs to clarify the concept of relations first as it has many meanings in science. In the relationship theory formulated as a part of the set theory, relations are very often equated to sets (pairs, triples, quads, etc.) of organized, complex objects among which such relations occur (Marciszewski, 1970). A relation can also be perceived as any connection (or dependence) between two or more objects of a specific (any) type, e.g. equality of numbers, length between sections, seniority among people (Marciszewski, 1970). However, relations are most frequently defined as what holds people together (Szymczak, 1995). One also needs to remember that relations connect not only people, they also exist between symbols, objects, people and organizations or between various entities (including higher education institutions and their interested parties). Key dimensions of a relation are as follows: its duration, frequency (intensity) in a certain period, regularity of interactions, type and content of the exchange and the duration of a relation. Each relation consists of the following elements (Kolemba, 2018):

- connections and dependencies between organizations (formal or informal);
- trust as the foundation for the building of relations between organizations;

- commitment, i.e. tangible and intangible contribution to the development of relations by cooperating organizations;
- long-term nature of the relation proportional to benefits that all parties to the relation can get as a result.

Scientists conducting research relating to relationship development stress that the establishment of a relationship entails the fulfilment of requirements such as attachment, mutual trust and respect, commitment, capability of efficient communication, willingness of each party to compromise, provision of support, help and care to the partner and long-term thinking (Ballantyne, Christopher & Payne, 1995; Ballantyne, 2000; Gummesson, 1999a; Gummesson, 1999b). Relational factors also include keeping promises, having values in common and the possibility to guarantee appropriate satisfaction to all cooperating partners (Wittmann, Hunt & Arnett, 2009). The above factors also determine the strength of the relationship, which illustrates links between the parties and their willingness and ability to persevere when faced with various obstacles (Hausman, 2001). K. Dziewanowska distinguishes factors directly influencing the strength of a relationship depending on the specificity of the interaction (duration of relations, frequency of contact, belief that the relationship is the key success factor and a comparative reference level as well as communication and professional knowledge of the supplier of value, dependency, satisfaction and loyalty, trust and commitment) and factors associated with the relationship as its derivatives (flexibility, balance of power, orientation on the value recipient) (Dziewanowska, 2012).

As the recipient of service cannot evaluate the relationship fully before its establishment, trust is treated as an element that reduces the risk of a relationship and increases its value. It helps improve the sense of safety and offers stability and certainty. Trust is the basis for each exchange based on partnership (Morgan & Hunt, 1994). It can be defined as the readiness to rely on a partner of the exchange in whom we believe (Moorman, 1991). In this context, faith in the partner's good intentions resulting from the partner's behaviour is necessary, which is particularly important considering the risk and uncertainty associated with relations between entities as different as higher education institutions and enterprises. Trust is the basic strategy of dealing with uncertainty and inability to control the future (Miłaszewicz, 2016). Trust combined with commitment and reputation (Zakrzewska-Bielawska, 2016) makes it possible to transform a relationship into a long-term bond as it guarantees:

- mutual resources for cooperation;
- common values as the basis of the care for a high standard of the cooperation;
- clear communication between partners;
- abstaining from actions detrimental to the partner (Morgan & Hunt, 1994).

Attachment and commitment of both parties to the maintenance of long-term bonds (Berry & Parasuraman, 2004) is considered the most advanced form of their mutual dependency (Burgess & Huston, 2014). High level of trust and attachment is characteristic for strong bonds. Attachment is perceived as the maximization of effort in order to retain the relationship with the exchange partner. The belief in the significance of that bond is the main motive. Attachment is the constant desire to continue having a valuable bond (Blakely, Andrews & Moorman, 2005). It is an explicit or hidden intention to retain the relationship between partners to the exchange. Therefore, the basic condition is to perceive a relationship as significant and the willingness to retain and deepen the bond. The client's attachment to a service supplier is influenced by the client's trust level, the client's satisfaction level and the degree of dependence between participants in the exchange (Furtak, 2003). Also important is the notion of a company's reputation, which is based on its identity and reflects its actual characteristics. Its importance is crucial for companies that operate in sectors in which trust between counterparties is of particular value (Dacko-Pikiewicz, 2022). Attachment exists as an emotional state (emotional connection to the exchange partner, i.e. affective attachment or identification with the other party to the exchange, fondness, friendship and a deep bond) and as a result of the calculation and evaluation. Affective attachment positively impacts the intention to remain in the relationship, the willingness to continue with the union and the willingness to invest in the relationship. As a result of the calculation and evaluation, attachment is perceived as a calculated attachment or the undertaking to continue the bond (loyalty agreements). Such attachment is based on a rational evaluation of the totality of expenses and benefits related to the existence of the bond. The undertaking to continue with the bond is about the degree of the partners' willingness to remain in a relationship. There is a close positive link between affective attachment and the undertaking to continue with the bond (Shemwell, Yavas & Bilgin, 1998).

Commitment is based on motivation, i.e. encourages both parties to act and directs their behaviour. It has two characteristics: the direction of commitment and the power of commitment (no commitment, low, moderate, high, very high commitment). The level of commitment changes depending on the moment in a relationship (type of interaction). Commitment differentiates the purchasing behaviour of clients. In many cases, both a decrease of trust and its increase can play a critical role in the sustenance of relations (Furtak, 2003).

The degree of the partners' dependency is linked to an asymmetry in their mutual relations. The higher the dependence on a service supplier, the greater will be the willingness to continue the relationship. However, the client's lower emotional commitment who feels used by the enterprise is a negative consequence of dependency.

According to the typology suggested by J. Blomberg, J. Löwstedt and A. Werr, inter-organizational relations that higher education institutions

establish can be grouped into the following five categories (Werr, Blomberg & Löwstedt, 2009):

- vertical relations covering suppliers, intermediaries (distributors) and clients of a higher education institution (among others, enterprises supplying a higher education institution with various products and services, individuals assigned to study by their employers, entrepreneurs commissioning research or experts' services from a higher education institution);
- horizontal relations covering competitors, collaborators and various associations or networks (e.g. other higher education institutions and scientific entities, clusters, networks, consortiums consisting of various interested parties, non-governmental organizations and industry organizations to which higher education institutions belong);
- hierarchical relations (internal relations of a higher education institution and relations with entities subordinated to it, e.g. spin-out companies);
- personal relations (referring to interpersonal links not connected to economic interests, e.g. relations with representatives of entities cooperating with a higher education institution as colleagues, friends and partners, e.g. enterprises);
- relations with experts (such as consultants and specialists or practitioners conducting business and cooperating with a higher education institution, e.g. lecturers delivering courses).

Such a relation is also defined as "mutual recognition (and regard) of a certain special status between exchange partners" (Czepiel, 1990). Two very significant elements necessary for the existence of a relation emerge from such an approach to relations. Firstly, parties consciously recognize the existence of a relationship. Secondly, relations have the status that goes beyond accidental contacts between the parties even though it is difficult to specify an exact moment when it is possible to conclude that contacts have transformed into a relationship. A relationship emerging between the parties should also be characterized by the lack of compulsion and the partners' freedom to act (Gummesson, 2011).

A relationship has a certain dynamics and changes in time. The source literature presents various approaches to the division of relationships into stages. The simplest approach distinguishes two stages in the building of long-term relations: establishment of a bond and its subsequent strengthening (Caputa, 2011), among other things, by communicating, negotiating and motivating enterprises towards actions and behaviours beneficial for a higher education institution (Harrison & John, 1994). It is worth remembering that going beyond an individual transaction and adopting a cyclical form is an attribute of long-term relations. It means that a higher education institution offering value to an enterprise and the enterprise that wants to take advantage of such value jointly go through consecutive, repeating stages of relationship

building. If a cycle of a relationship is completed with no disturbances, exchange partners will begin a new cycle. Going through consecutive cycles is a prerequisite of the continuation of their connection. The building of long-term relations is presented in Figure 2.4.

The process presented in Figure 2.4 can be divided into two main phases: the initial phase or the establishment of bonds (it ends as soon as an enterprise as a potential recipient is persuaded to take advantage of the offer made by a higher education institution) and the proper phase or the strengthening of ties (it is a closed cycle that can last for a long time). In most general terms, the initial phase of the process will equate the marketing process from the classic perspective. Appropriate identification of target recipients of offers made by a higher education institution in a group of enterprises is particularly important at this stage, which is why their

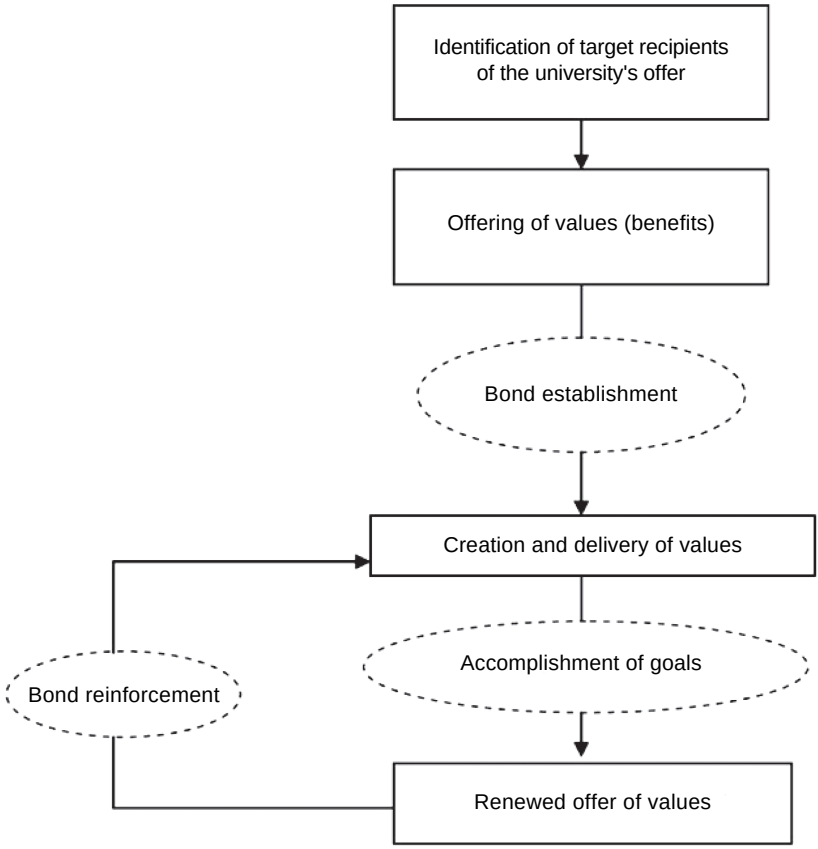

Figure 2.4 Process of relationship building between a higher education institution and recipients of its offer.

Source: Furtak (2003, p. 182).

identification (Furtak, 2003) is necessary on the basis of the criteria such as the degree of attachment and commitment to a relationship and the loyalty level of recipients of the higher education institution's offer as well as the value (benefit) in which they are interested (education, research, experts, etc.). The amount of income from the relationship also has its significance. Factors that can limit the effectiveness (reasonableness) of investing in a relationship (Furtak, 2003) include an insufficient capacity of the sector that cannot guarantee profitability in the longer term to service suppliers (sales revenues do not cover costs of establishment of a bond and the subsequent building and deepening of a relationship, etc.). Such a client can be valuable and, at the same time, difficult or risky for an enterprise.

According to the assumptions of the relationship marketing, value is a wider concept than usefulness. It is because value is determined not only by what service the client receives but also the way in which the service is received is important (the quality of interaction and dialogue with the recipient). The clients' satisfaction, their trust and attachment to the service supplier result from the exchange of tangible and intangible value. Such an attitude of an enterprise to a higher education institution is attainable as a result of the provision of service that meets the expectations and provides the expected value. The service rendering process by itself is also extremely important; its quality and method of execution can significantly impact the perception of a higher education institution among those representatives of an enterprise who contact it directly. Very beneficial interpersonal relations that help consolidate the loyalty of an enterprise towards a higher education institution can develop in this way during the exchange process between employees of the higher education institution and the enterprise. The quality of the interaction and the dialogue between parties to the exchange can be hindered by barriers in mutual relations of higher education institutions and enterprises that most frequently include (Kobylińska, 2018; Tomaszewski, 2019):

- high cost of knowledge;
- the lack of communication skills among representatives of both sectors;
- different approaches to the work speed and organization;
- bureaucracy and formalization of processes in higher education institutions;
- no need for an enterprise to establish formal relations with a higher education institution if direct relations are possible with the academic staff who can be engaged to cooperate with the enterprise;
- diverging directions of the academic research and information needs of enterprises;
- the time-consuming process of creation of inter-organizational relations (Klimas, 2015);
- the ignorance of enterprises regarding the value of what a higher education institution offers and the possibilities of cooperation;

- no interest among the academic staff in the cooperation with enterprises resulting from the failure to consider this criterion in the employee evaluation by a higher education institution.

The communication barrier seems to be the one that is most dangerous for the development of a relationship. When a relationship has already been established, difficulties in understanding each other (scientists and entrepreneurs use a slightly different language) and difficulties in communicating one's expectations clearly (scientists focus on the methodology and on the research while entrepreneurs focus on research results and their usefulness) hinder the dialogue that is of key importance for the maintenance of the bond (Furtak, 2003).

As soon as a potential recipient decides to take advantage of the offer made by a higher education institution (or accepts the value offered by a higher education institution in the exchange process), the relationship marketing proper begins – the bond between a higher education institution and a recipient of its offer is established. Satisfactory contacts between a higher education institution and an enterprise lead to an increase in trust and attachment between both partners and, as a consequence, to the gradual climb to the top on a "loyalty ladder" (from a disloyal recipient to a unique, true recipient). However, the sustenance of the relationship by the renewed offering of value to recipients is the necessary condition if the relationship is to be deepened. Due to the dynamics of the relationship resulting, among other things, from the changing needs of recipients or their solidifying attachment and trust in the supplier of the offer, it is possible that an enterprise may be interested in continuing to take advantage of the same or another offer or that it may increase the frequency with which it uses the offer. However, situations in which the value is rejected also happen and the relationship between a higher education institution and an entrepreneur becomes weaker or gets interrupter in this way. For example, fluctuations in the quality standard of the rendered services also change the standard of value perceived by the recipient. If the distance between the value offered and the value desired exceeds the critical point, the offer will usually be rejected. This is why it is important to continually monitor the progress of the relationship marketing not only from the perspective of the attainment of objectives by a higher education institution in its relations with enterprises but also when it comes to the degree of satisfaction of the enterprise and the occurrence of critical moments such as offer rejection or termination of the relationship.

Another approach describes three phases of the relationship building process (Storbacka & Lehtinen, 2001):

- initial phase that ends when the potential recipient of services offered by a higher education institution becomes an actual interested party. The choice made by a potential recipient of value offered by the higher

education institution means that it establishes a relationship with the higher education institution (traditional marketing instruments play a particularly important role in this phase);

- relationship continuation phase or the period of enduring bonds with an enterprise as a recipient of the value offered by a higher education institution, who can have various interaction with the higher education institution. This is when the value exchange happens (the link between the higher education institution and the enterprise is sustained and even strengthened);
- relationship termination phase starting with the enterprise deciding to choose another higher education institution to meet its needs (the enterprise as a recipient of value offered by a higher education institution can also make decisions regarding the usefulness of the offer addressed to it). This phase can be an initial stage leading to the enterprise establishing relations with another higher education institution and it can be the beginning of another relationship with the same higher education institution. It is worth remembering that it is much more difficult to make an enterprise return to the cooperation after it has terminated the cooperation with a higher education institution than to acquire a different cooperating enterprise.

Tzokas and Saren (2004) present an interesting approach to the development of relationships. They are authors of the relationship life cycle concept based on four key phases: introductory phase, experimentation, identification and renewal or demise of the relationship. This cycle, as presented in Figure 2.5, also explains the process underlying the development of relationships between a higher education institution and an enterprise.

The first phase consists of the enterprises gathering the information about what a higher education institution can offer and, at the same time, higher education institutions gathering the information about enterprises that allows

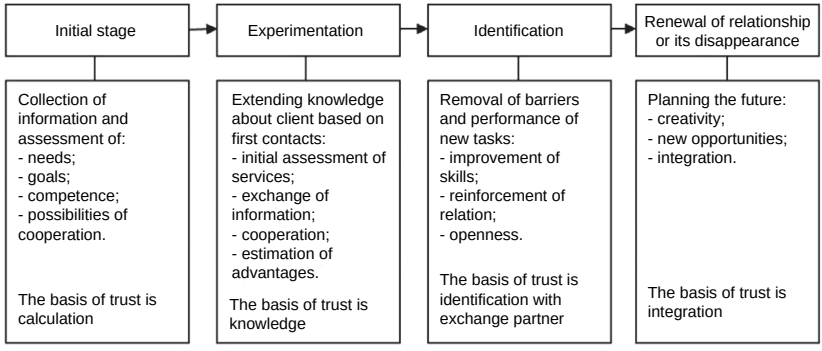

Figure 2.5 Relationship life cycle.

Source: Tzokas and Saren (2004).

them to choose those with which it is worthwhile to establish a relationship. The collected information allows both parties to evaluate their choices. This phase ends as soon as a relationship is established, i.e. the higher education institution chooses enterprises to cooperate with or the enterprise chooses higher education institutions to cooperate with (assuming that any party can initiate the relationship). The next phase consists of the first contact between the enterprise and the higher education institution. This is when expectations of both parties are confronted with the reality. The partners' mutual knowledge of each other expands and both organizations can confirm that the relationship will be beneficial to them. In the third phase (identification), barriers to the relationship between the enterprise and the higher education institution are gradually removed, which leads to the deepening of the relationship (e.g. mutual trust increases, benefits of the relationship are noticed, etc.). The fourth phase consists of the further improvement of the relationship and the deepening integration of partners. The relationship renewal can also be considered an element of this phase (e.g. finding new value that can be exchanged between the parties), but if the higher education institution fails to meet the expectations of the enterprise or the enterprise fails to meet the expectations of the higher education institution, the likelihood of the relationship disappearing increases.

In turn, Powers and Reagan (2007) distinguished even five basic stages of relationship development: partner selection, definition of goals of the relationship, definition of boundaries of the relationship, value creation and maintenance of the relationship. This approach lists maintenance as the last stage of the relationship building even though, as demonstrated above, it would be difficult to assume that a relationship can remain the same for a longer period in a dynamic environment. Relationship changes seem inevitable and organizations should treat them as such. This is why relationship building should entail the monitoring of benefits resulting from the inter-organizational cooperation between the parties and the taking of action if the level of satisfaction with the cooperation diminishes and both parties still want to continue their relationship. This is why the attitude of academic authorities is so important and they should apply the managerial approach to the management of relations between higher education institutions and their environment (this is the approach usually applied by enterprises). It is important to look at relationships as assets to be managed properly and strengthened; therefore, higher education institutions should have a systemic approach to the building of relations with enterprises (Sawhney & Zabin, 2002).

Another approach to the problem is presented in the concept developed by Hunt (1997) who distinguishes the following phases of relationship development:

- selection of a partner to cooperate with and determination of the potential value to be derived from the relationship;

- building the relationship based on trust, understanding and knowledge;
- development of the relationship by creating mutual value, benefits and satisfaction and intensifying the commitment;
- relationship maintenance – the introduction of potential changes in the relationship to maximize its value at the given moment;
- termination of the cooperation with the open possibility of returning to it.

Referring to this concept by Hunt, Drapińska (2012) also suggests first stages of relationship building. By applying this approach to relationships between a higher education institution and an enterprise, the following stages can be distinguished:

1 The partner selection stage is the moment when a higher education institution identifies and evaluates enterprises as potential partners to cooperate with, considering criteria correlated to objectives defined by the higher education institution for the relationship building with this group of interested parties. The starting point of the process is to recognize and define those enterprises that the higher education institution perceives as interested parties material and valuable enough to establish relations with them. It can be assumed that the evaluation of the value of enterprises as interested parties can consider criteria such as:

   - the level of interest in the offer (active or passive);
   - attitude (supportive or blocking);
   - power of impact (significant or insignificant);
   - importance of activities (likelihood of relationship occurrence or determination of the contribution to the relationship);
   - degree of readiness to participate in the co-creation of value material for partners of the relationship.

   The last element should be analysed from the perspective of the interest and goals of the higher education institution that should consciously select groups of interested parties material for it, among other things, by applying the relationship direction criterion (relationship focused only on giving, only on taking or bilateral relations) (Bourne, 2016). After the identification of various groups of enterprises as interested parties, the higher education institution should conduct an in-depth analysis of its relationship with these enterprises, considering the level and depth of the relationship.

2 The relationship building stage entails the need to read, as best as possible, the needs and expectations of enterprises with which the higher education institution wants to establish relations offering them the desired value and exchange terms generating satisfaction. The situation in which an enterprise becomes a loyal partner of a higher education institution after the very first contact is relatively rare in the

market of higher education services. The relationship between higher education institution and the interested parties most often occurs gradually. Distinguished advocacy groups gradually climb the loyalty ladder and their individual levels are very often directly proportional to the duration of the connection and translate into the intensity of contacts. Personal relations between representatives of the higher education institution and the enterprise also develop at this stage to have a significant influence on inter-organizational relations.

3 Relationship development consists of the co-creation of value (Dziewanowska, 2016) offered by the higher education institution and expected by the enterprise, e.g. education, scientific research, experts' services considering the associated process of joint learning by representatives of the higher education institution and the enterprise in areas subject to the exchange. A long-term and strong relationship emerges as a result of the development of positive beliefs and emotions connecting exchange partners.
4 Relationship maintenance (adaptation of values to the changing circumstances of the exchange process, e.g. changing needs of the enterprise or changes in the possibilities of service rendering by a higher education institution as well as changes of objective conditions in which the exchange takes place, e.g. changes in legal regulations). If affective dimension of the relationship is treated as the basis for the ordering of concepts the bonds connecting a higher education institution and enterprises as its interested parties can be presented simply along a certain continuum starting with the false bond and ending with true relations. All the other types of relations are intermediate points along the continuum. In a false relationship, an interested party can maintain regular contacts with a higher education institution for a period but its satisfaction with the relationship remains very low. Such an attitude is the opposite of the relationship at the other end of the continuum where the interested party is openly satisfied and emotionally committed to the relationship with the higher education institution and, with time, can even become its advocate or ombudsman.
5 Termination of the cooperation (the need to stop the exchange between the parties for various reasons, which should occur in such a way that does not lead to the loss of what the parties have jointly developed and makes the potential return to the relationship possible in the future).

Another similar approach to relationship building (Dwyer, Schurr & Oh, 1987) considers the realization phase, the study and search that can be compared to the partner selection and relationship building phases presented above in the approach developed by Drapińska (2012). To develop a bond and transform it into a relationship, one needs to identify opportunities and threats to the maintenance of the relationship with the client and

conduct an in-depth analysis of the client to define what services the client needs (e.g. technological audit) (Burger & Cann, 1995). Multidimensional proximity of potential cooperating partners is vitally important at this stage as it helps build the awareness that the establishment of a relationship is beneficial to them. The development of a bond between organizations with a certain value as its object should consider assumptions promoting its durability and effectiveness from the very beginning. This stage also includes negotiations between the parties, including the evaluation of the profitability of investment in relationship development (Miller, McAdam & McAdam, 2014), i.e. the analysis of the validity of investments made by the parties in connection with relationship development as well as expected benefits and the expected level of satisfaction. As a result of this phase, the partners agree upon the terms of the exchange and clarify the value at the core of it.

According to this approach, the expansion and commitment (undertaking) phase can be compared with the phase that A. Drapińska describes as relationship development. This stage should see the strengthening of the reach and depth of the relationship as well as reinforcement of trust between partners and continuous increase in benefits gained thanks to the cooperation. As a result of the growing co-dependence of partners, their commitment to value co-creation also increases along with the scale of mutual commitments. Additionally, the gradual strengthening of the bond gives the partners such a high level of satisfaction with their cooperation and efficiency of the relationship that it would be difficult for other entities to offer similar terms of the exchange. The monitoring or the study of the quality of bonds with clients (Santouridis & Veraki, 2017) and actions (selection of the ways to act and communicate with the client, which influences the quality and depth of ties) are necessary at this stage. The last stage according to this approach, similar to the concept posited by A. Drapińska, consists of the termination of the cooperation that can be due to various circumstances but most often corresponds to a situation in which the cost of the continuation or modification of the cooperation outweighs benefits gained by partners.

While making the effort related to the building of long-term relations with interested parties, including enterprises, higher education institutions should remember about the positive first contact or the very moment when the relation is established, on the basis of which deeper relationships are built later (Rogoziński, 2006). An entrepreneur invited to the cooperation needs an opportunity to get familiar with the offer made by a higher education institution, evaluate it, express the willingness to take advantage of it and present the terms of the cooperation. After that, the value exchange occurs between the higher education institution and the enterprise, which should be advantageous and satisfactory enough to contribute to the strengthening of the relationship in the long term. The very awareness of the offer made by a higher education institution or an interest in the higher education institution and its offer does not make the relationship durable. An important thing is

that the relationship does not have to be established or strengthened at all. The enterprise can terminate it at any stage. According to Ch. Grönroos, there is a direct correlation between the depth (strength) of a relationship and its duration (Storbacka, Strandvik & Grönroos, 1994).

According to R. Furtak, there are two main ways to measure the depth of relations on the market of services (including the market of higher education services) (Furtak, 2003): firstly, by analysing the behaviour of the interested party towards a higher education institution, and secondly, by analysing other aspects of the interested party's attitude to the higher education institution (Savage, Nix, Whitehead & Blair, 1991). The source literature divides relationship depth measures into three groups (Danielak, 2012):

- quantitative measures (e.g. the number of entities, frequency of transactions);
- qualitative measures (e.g. level of trust, degree of emotional commitment to the relationship, informal contacts);
- value measures (indicating the level of costs and profits obtained from a relationship).

Measures of the depth of relations between a higher education institution and an enterprise are presented in Table 2.6.

The measure of depth of relations between a higher education institution and an enterprise should consider at least four key roles that can be assigned to enterprises in such a situation. They are presented in Table 2.7 with examples of relationship depth measures.

Table 2.6 Measures of depth of relationship between a higher education institution and interested parties

Analysis of the interested parties' behaviour on the market ("the seen")	*Analysis of other aspects of the interested party's attitude to a higher education institution ("the unseen")*
• Duration of relationship • Number and types of services offered by a higher education institution that the interested party uses • Number of higher education institutions whose services the interested party uses • Provision of positive (negative) information about the higher education institution and its offer • Recommending university services to others • Submission of complaints	• Level of the perceived quality and value of the offer • Satisfaction level of the interested party • Level of trust in the higher education institution • Degree of attachment to the higher education institution • Perception of alternative offers from the higher education service area • Behavioural intentions (the intention to continue in the relationship, to communicate the positive or negative information, to recommend services offered by a higher education institution)

Source: Furtak (2003).

Table 2.7 Measures of depth of the relationship between higher education institutions and enterprises

Relations	*Quantitative measures*	*Qualitative measures*	*Value measures*
Enterprises as clients – recipients of the value created by a higher education institution (e.g. recipients of research services)	• the number of permanent clients • the number of new clients • the number of clients returning to use services offered by a higher education institution (client retention indicator) • frequency of transactions • duration of cooperation (duration of the relationship)	• previous experience • opinions about the higher education institution issued by clients: • trust level • satisfaction level • loyalty level – level of satisfaction	• revenues obtained from the sales • costs of acquisition of sales revenues
Enterprises as suppliers of value expected by a higher education institution (e.g. suppliers of equipment for the research)	• the number of permanent suppliers • size of deliveries • duration of cooperation • the number of new suppliers	• timeliness of deliveries • quality of deliveries • opportunities to satisfy new needs of the higher education institution • loyalty of suppliers • trust of suppliers	• total costs of deliveries
Enterprises as competitors of a higher education institution (e.g. consulting companies offering research and advisory services)	• the number of potential competitors (direct, indirect) • fierceness of competition • quantity of projects executed with competitors	• evaluation of behaviour of competing entities • degree of satisfaction with current relations with competitors • level of competition tools of a higher education institution • degree of clients' satisfaction with projects executed with competitors • evaluation of the collaboration atmosphere	• sales level compared with competitors • higher education institution's share in the market compared with competitors
Enterprises as partners in activities of a higher education institution (e.g. a project consortium)	• the number of entities with which cooperation is maintained • duration of cooperation • the number of joint projects completed	• degree of satisfaction with current relations with partners (frequency and quality of contacts) • value of resources made available by partners	• the value of funding from EU programmes obtained with partners

Source: Based on Danielak (2012).

The managerial staff of the higher education institution decides which measures will be applied to measure the depth of relations. The measurement is possible both on the basis of an analysis of financial statements of the higher education institution and other documents important from the perspective of the analysed relations. In addition to financial documents, the analysis most often covers the data collected with the use of questionnaires, interviews or electronic information systems. However, the selection of measures of the depth of relations with interested parties should be adapted to individual needs and possibilities and depend on variables such as the size of a higher education institution, its profile or management style and processes related to the relationship building.

The depth of a relationship materially impacts its duration (Storbacka, Strandvik & Grönroos, 1994) just like another, related element, i.e. the profitability of relations. It is shaped by revenues from the relationship and its maintenance costs and the difference between them is the profit from the relationship. Most important sources of an increase in the profits from serving the client with whom a higher education institution has a relationship include cost reduction (streamlining the service and creation of services), time savings (strengthening of ties between the higher education institution and the enterprise shortens the service creation cycle) and risk mitigation (permanent clients minimize the risk resulting from negative consequences of market phenomena) (Gordon, 2001).

2.4 Significance of value and satisfaction in the relationship between a higher education institution and an enterprise

In addition to factors such as an appropriate choice of partners and the appropriate depth of relations between them, the method of value exchange between the parties and the value itself as the source of satisfaction with the exchange are also elements important to the building of a long-term bond (Bagozzi, 1975). The exchange is an act of receiving the desired goods (in a tangible or intangible form) from another organization or individual by offering something in return. The greater the value of the exchange for all the participants, the more it will contribute to the durability of their relationship. The following conditions have to be met for the exchange to occur between organizations (Kotler, 2001):

- at least to parties have to exist in a relationship;
- each of the parties has something of value to the other party;
- each of the parties can communicate and is able to deliver a commodity or service;
- each of the parties has an opportunity to accept or reject the offer;
- each of the parties believes that maintaining contacts with the other party is beneficial.

The fulfilment of the above conditions makes the exchange possible and, therefore, allows for the establishment of a relationship that is more and more frequently created not in a bilateral but rather in a multilateral network of links among suppliers, collaborators and clients (Mendryk, 2008). A network of links is a system of ties that can have a complex and vast form as an element of a network of other relations built by entities interacting with one another (Furtak, 2003). Exchange as a process of value creation and delivery (Furtak, 2003) occurs on the market of higher education services within the network of bilateral or multilateral links between higher education institutions and enterprises. From the dynamic perspective, the exchange is a continuum extending from individual transactions to the long-term mutual exchange of value between entities whose characteristics include durability and flexibility (Mohr, Fisher & Nevin, 1999). When it comes to the content of the exchange, it is possible to distinguish (Bagozzi, Gopinath & Nyer, 1999):

- the utilitarian exchange focusing on the object of the exchange (e.g. R&D project), i.e. on the receipt of one commodity in exchange for others or for money; with this type of an exchange, the maximization of benefits for the parties is important, which is why the functionality, availability and price of a commodity are considered;
- symbolic exchange focusing mainly on intangible values (e.g. knowledge) where the very process of the exchange is particularly important (the atmosphere, trust, joint learning possibility, e.g. at conferences);
- mixed exchange or the utilitarian exchange focused on the object of the exchange and a symbolic exchange focused on the exchange process where there is a transfer of the service value, i.e. the object of the exchange (e.g. knowledge) and values related to the quality of the exchange process, e.g. joint learning (Furtak, 2003).

The exchange of value in the course of a relationship is the essence of the bond developed between a higher education institution and an enterprise; this is why reflections on the development of relations between a higher education institution and an enterprise also need to include a closer look at the category of value. When reviewing the source literature, one can encounter the opinion that an organization should only meet the expectations of its owners or strive to increase the value without the consideration of expectation of other advocacy groups. Supporters of this proposition believe that goals of the owners diverge from goals of other interested parties (disharmony thesis), which is why the owners' expectations should be satisfied first (Blach & Wieczorek-Kosmala, 2019). According to the author of this thesis, this mismatch cannot be transferred to the area of higher education though. The concept of the corporate social responsibility is definitely closer to the author's views (Oleksiak, 2020); according to it,

the value offered by a higher education institution increases with the satisfaction of needs of all the interested parties. In other words, a higher education institution, while taking care of the interest of the widest possible group of interested parties, also fulfils its commitment to the owners (the harmony thesis). According to this concept, a higher education institution adopts a bundle of both economic and social goals and the management of such an organization considers ethical aspects in particular.

Therefore, authorities of a higher education institution have to strive to find a balance between the needs and expectations of numerous advocacy groups based on the vision of a certain social system and considering the cooperation of all the interested parties. Therefore, the value from the perspective of parties to the exchange, i.e. a higher education institution and its interested parties, is a function of own benefits resulting from the existence of the relationship and expenses related to its establishment and maintenance. The value exchange process requires expenses on the part of a higher education institution, e.g. in the form of the commitment of the academic staff cooperating with an enterprise, knowledge as well as material and financial resources and other related costs (e.g. marketing activities) related to the cooperation. Benefits for a higher education institution can include a revenue from the sale of educational, research or experts' services, an investment in the image, creation of new valuable knowledge, etc. The enterprise, in turn, incurs expenses related to the establishment and maintenance of relations with a higher education institution, e.g. costs of staff commitment to the analysis of the offer made by a higher education institution and taking advantage of it, financial contribution to joint projects. Benefits the enterprise gets from the relationship can be directly linked to the object of the exchange (e.g. results of the completed research) or to the exchange process itself (e.g. joint learning).

One can assume after K.B. Monroe and A.Y. Lee that the value for the recipient is about subjectively perceived benefits related to relationship maintenance to outlays related to the continuation of the relationship (Monroe & Lee, 1999). The net value is the difference between the total of all the perceived benefits and the total of all the perceived outlays (Lovelock & Yip, 1996). For an enterprise, value is the starting point in the process of selection of a higher education institution with which a relationship will be established that also contributes to the generation of satisfaction and, as a result, loyalty (Lovelock & Yip, 1996; Santouridis & Veraki, 2017). According to F.E. Webster, the process of value definition, development and delivery to interested parties is the basis for relationship building (Webster, 2002). However, value is a very broad term. Difficulties in defining it mainly result from the relativity of value, its subjectivity and ambiguity as well as from the multitude of existing value theories (Parker, 1957). Management and quality sciences still find it difficult to reach a consensus when it comes to

the understanding of this concept.[2] Additionally, the difficulty relating to higher education institutions appears with an attempt to indicate the main beneficiary of the value generated in this type of an organization: is this the higher education institution itself or, e.g. the academic staff participating in the co-creation of value in the cooperation with representatives of an enterprise? Therefore, value definition in organizations such as higher education institutions is definitely more complex than, e.g. for producers of consumer goods. In the light of the specificity of services offered by a higher education institution, value is more intangible and the receipt of the service by interested parties is usually more emotional than the perception of services offered by entities in other industries or tangible products. At the same time, it is worth remembering that the activity of a higher education institution covers the recognition and analysis of needs of many, often very different groups of interested parties on the one hand and the determination of requirements meeting their expectations based on the collected information. On the other hand, a higher education institution should pursue its mission with a feeling that it serves the truth and upholds high ideals of humanity, among other things, by modelling the citizenship and students' personalities, which means that the offer will not always be dictated by the interested parties. Additionally, the intangible, impermanent and varied offer of a higher education institution, often generating uncertainty among the interested parties, makes the evaluation of the value of its service difficult and, therefore, hinders the making of decisions about the choice of a partner with whom a relationship will be built. All this does not change the fact that a higher education institution should strive to recognize what constitutes value for the interested parties and continue to improve such value.

Definitions of value also point out the costs of its acquisition. According to P. Kotler, the final value for an interested party is the difference between the satisfaction with the acquisition and consumption of a service offered by a higher education institution and the actual and emotional costs incurred in connection with such an acquisition and consumption (Kotler, 2001). In other words, value is the difference between the benefits gained from the service and sacrifices made in connection with it (Zeithaml, 1988). One should also remember that the acquisition of services offered by a higher education institution often entails great risk and uncertainty (especially in the case of students). When it comes to the offer generated by a higher education institution, one can conclude that (Chlipała, 2009):

- the value of a service on the higher education market compared with the value of tangible goods is more subjective, which depends to a great degree on its perception by various advocacy groups; the subjective perception of value is also related to the intangible nature of services

offered by higher education institutions and the difficulty posed by its standardization;
- the value of some services offered by a higher education institution is more elusive than the value of tangible goods, mainly due to the elusiveness of services;
- the value of services offered by higher education institutions is much more often subjected to an individual evaluation by interested parties than is the case for the more collective evaluation of the value of a physical product; this situation occurs, in particular, in the case of the consumption of an educational service or a research and development service;
- when evaluating the value of services offered by a higher education institution, not only the usefulness of services when it comes to the satisfaction of needs and desires of interested parties is important (such usefulness can be determined by advocacy groups only after the consumption); there are also all the other factors that guarantee such usefulness, e.g. reliable information about service quality provided by university staff or opinions from individuals who have purchased the service, cooperated with the higher education institution or reviews in the media;
- contrary to physical goods, services offered by higher education create very high value added, this rule is mainly true for academic services that require great professionalism to be rendered (e.g. scientific research, analyses or experts' opinions).

With reference to the concept coined by Ch. Grönroos, one of the pioneers of the concept of relationship marketing, value can be perceived as an interaction between the interested parties and a higher education institution. In his opinion, value for various advocacy groups is generated not only by an organization; individual interested parties themselves are co-creators of such value (Grönroos, 2007). The concept suggested by Grönroos seems really valid in the case of higher education institutions. Therefore, value is multidimensional, one can even say that it is a consequence of the interested parties' behaviour in a nomological network of relations, governed by its own laws (Stańczyk-Hugiet, 2013). When it comes to the explanation of this approach with regard to the relations between a higher education institution and an enterprise, it helps to mention an example of a frequently rendered R&D service, which is usually co-created by representatives of a higher education institution and an enterprise. Among other things, its multidimensionality has to do with the joint learning of all individuals committed to the service and gaining personal benefits because of it in the form of knowledge and competence development.

Definitions of value presented in the source literature (more in: Szymura-Tyc, 2005) stress its different aspects. According to the author, it is nevertheless possible to find an element common for most of them. This element is

usefulness or such a behaviour of the interested party that involves the confrontation of the received service with previous expectations, often considering the incurred costs. The main assumption of the usefulness theory is the thesis that interested parties using services offered by a higher education institution act rationally while selecting an offer (e.g. Plichta, 2007). However, rational behaviour on the market of higher education services does not necessarily equate objectivism. A. Aldridge points out the concept of subjective rationality according to which interested parties of a higher education institution are guided by subjectively rational reasons when making a decision concerning the cooperation (e.g. Aldridge, 2006) (e.g. enterprises are driven by the commercial gain). Therefore, usefulness is a subjective concept as it equates the satisfaction felt by interested parties, or enterprises in this case, after they take advantage of the service, i.e. establish the cooperation with a higher education institution. The creation of value for interested parties, including enterprises, on the market of higher education services can be analysed at least from three different perspectives: focusing on processes, resources and relations (Table 2.8).

The analysis of value co-created by a higher education institution and an enterprise also has to consider the specificity of the rendered service (Furtak, 2003), distinguished by elements presented in Table 2.9.

Service characteristics presented above that were clarified on the example of relations between a higher education institution and an enterprise

Table 2.8 Value generation for interested parties on the market of higher education services – selected concepts

Approach	*Authors*	*Characteristics*
Process	F.E. Webster	• value generation for various advocacy groups is at the core of actions taken by a higher education institution; it includes the definition of value, its development and delivery to the interested parties
	D. A. Aeker D. McLoughlin	• value generation is the key element of the strategic management of a higher education institution
Resources	J. Barney	• value for interested parties is generated in the sphere of unique resources (e.g. human) and competencies, difficult to be copied by competitors
Relations	Ch. Grönroos	• value for individual advocacy groups is built in relations between university rendering services and the interested parties • interactions with interested parties cause value increase

Source: Own work based on Aeker and McLoughlin (2007); Barney (1991); Grönroos (2007); Webster (2002).

Table 2.9 Characteristics of services constituting the basis for value creation in relations between a higher education institution and an enterprise

Characteristics	*Description*
Intangibility	Services cannot be stored but they can be repeated according to the same or improved pattern, scope, etc. The relations between higher education institutions and enterprises can involve hybrid services (tangible and intangible goods are a part of the offer, e.g. a compiled report from the research based on research services, a created prototype of an appliance based on R&D work), services accompanied by certain tangible elements (e.g. course participants get meals, training materials, etc.) and classic services mainly consisting of the actual service (e.g. a webinar, lecture, etc.)
Heterogeneity	The process of service rendering and the satisfaction of an enterprise depend to a great degree on the action taken by employees of a higher education institution (appearance, behaviour). It is difficult to maintain a constant service quality; services have to be adapted to individual requirements. Many factors influence service quality (e.g. material environment, internal organization system of a higher education institution that renders the service, availability of the media information about the service), and many factors also depend on an enterprise (e.g. motivation, experience, personality). There is no guarantee that an enterprise will receive the service in the way the higher education institution would like it to (certain elements of the service are visible, e.g. a lecture at a conference while others are hidden, e.g. organizational activities related to the conference).
Impermanence	It is difficult to precisely gauge the demand for services or their supply; services on the higher education market cannot be returned or resold. In particular, a higher education institution needs to take actions to harmonize supply and demand, e.g. by differentiating prices in low demand periods, use non-price factors to stimulate the demand beyond peak periods, e.g. with special services and offers, services complementary to the core service or service booking systems.
Human domination	The staff in a higher education institution has an impact on the satisfaction felt by enterprises; for this reason, their selection is necessary depending on requirements of the cooperation with companies; an appropriate selection of individuals representing enterprises for the purpose of such a cooperation is also required (e.g. depending on their ability to absorb knowledge made available by higher education institutions).

Source: Own work.

materially determine not only the value of the service for the client but also the method of its rendering. From the perspective of the interest of the enterprise, it is possible to point out at least a few characteristics of a service rendered by a higher education institution that can impact the perception of the relationship; however, service quality appears to be of key importance (Johnston, 1995). Other factors influencing service quality include the following:

- attention (help) and care, i.e. real interest in the problems of the service recipient;
- service availability for the recipient;
- commitment, i.e. urgency, diligence and satisfaction with the participation in service rendering;
- method of communication with the client and politeness;
- competencies, i.e. appropriate skills and professionalism in service rendering;
- flexibility, i.e. readiness to introduce changes and a tailored approach to the recipient of the service;
- certainty, i.e. solidity, reliability, delivering on promises and integrity;
- responsibility, i.e. timely service completion, prompt response and short waiting time;
- safety, i.e. discretion, protection of data and intangible assets.

In the third decade of the 21st century, there is still no consensus among the scientists when it comes to the dimensions that comprise value. Some scientists perceive value only through the lens of benefits (Gwinner, Gremler & Bitner, 1998; Wilson & Jantrania, 1994) of a tangible or intangible nature; others can also see the materiality of investments necessary to create the relationship providing specific benefits. Certain researchers only point out the tangible aspects of a relationship (Anderson, Jain & Chintagunta, 1992; Anderson & Narus, 1990; Anderson, Thomson & Wynstra, 2000; Ulaga & Eggert, 2005) while others only notice the importance of intangible investments necessary to maintain the connection (Grönroos, 1997; Lapierre, 2000; Ravald & Grönroos, 1996). Additionally, a certain feedback is also worth noticing. On the one hand, value is the foundation on which a higher education institution building its relations with interested parties; on the other hand, beneficial long-term relations between partners are the source of value for a higher education institution. In other words, relations as one of the intangible resources of an organization have the potential to create the market value of a higher education institution. However, an activation of sources that create the value of such relations is necessary to unleash that potential. One can look for these sources in the cross-section of various dimensions of value as presented in Table 2.10.

Table 2.10 Relationship value dimensions

Authors	*Relationship value conceptualization*	
	Dimensions of benefits derived from relations	*Dimensions of expenses incurred for the relations*
Anderson, Jain and Chintagunta (1992); Anderson and Narus (1990); Anderson, Thomson and Wynstra (2000)	Four dimensions of benefits (perceived as a network of benefits): • economic benefits • technical benefits • benefits gained from services • social benefits	One dimension of sacrifices: price
Wilson and Jantrania (1994)	Three dimensions of benefits: • economic benefits • strategic benefits • behavioural benefits	Not specified
Ravald and Grönroos (1996)	Two dimensions of benefits: • benefits related to the exchange episode • benefits derived from relations	Two dimensions of sacrifices: • sacrifices related to the exchange episode • sacrifices made in connection with the relationship
Grönroos (1997)	Two dimensions of benefits: • obtained from the core of the product • obtained from additional services	Two dimensions of sacrifices: • price • cost of relations
Gwinner, Gremler and Bitner (1998)	Three dimensions of benefits: • benefits resulting from the certainty of exchange • social benefits • special treatment benefits	Not specified
Lapierre (2000)	Three dimensions of benefits: • relative benefits from the product • relative benefits from the service • relative benefits from the relationship	Two dimensions of sacrifices: • price • relative relationship-related sacrifices
Ulaga and Eggert (2005)	Five dimensions of benefits: • benefits gained from the product • benefits gained from services • benefits of know-how • benefits from timely delivery • social benefits	Two dimensions of sacrifices: • price • costs of processes

Source: Own work based on Ulaga and Eggert (2005).

The information presented in Table 2.10 shows that sources of value in relationships are to be found in the main four dimensions (Wilson & Jantrania, 1994):

- economic, related to the possibility to reduce transaction costs and/or with an opportunity to increase revenues attained from the exchange between an organization and its interested parties;
- product (including a service), related to the satisfaction of basic needs and requirements of parties to the relationship (therefore, this is a necessary condition but not sufficient to generate value of the relationship);
- behavioural, organizational, covering intangible aspects of the cooperation between partners, in particular, including relational standards, relational risk, trust, the culture of the relationship and opportunities for its further development; the organizational dimension has to do with the execution of processes related to the realization of the connection between partners (e.g. the guarantee of uniformization and synchronization of standards of exchange processes, comprehensiveness and individuation of services rendered by a higher education institution) and the flexibility of executed processes creating value added;
- strategic, founded on the opportunity to take advantage of the developed relations to strengthen competitive edge and key competencies and to create the market position.

When developing relations with interested parties, a higher education institution should strive to build a portfolio of relations with the value optimal for it in each of the advocacy groups. It is important to focus on the cooperation with those groups that can offer the higher education institution the greatest value of exchange, generating the highest satisfaction level. However, this is not an easy task due to a great number of enterprises in the environment of higher education institutions. It requires a deliberate modelling of the value offered to them. Appropriate definition of sources (more in: Piwoni-Krzeszowska, 2014) is the basis for the building of relations between higher education institutions and enterprises.

Not all the concepts presented in Table 2.8 have been meant for the service sector and definitely not for higher education institutions. However, the author believes that they are universal enough to be considered in the process of development of relations between higher education institutions and enterprises on the higher education market. The suggestions should be treated as complementary rather than substitutive. A higher education institution can use each of them to create and improve the satisfaction of interested parties. This aspect (an improvement of the interested parties' satisfaction) has been discussed by Zeithaml (1988), Woodruff (1997) and Gale & Wood (1994). They point out that the depth of relations on the higher education market is closely connected to the degree of satisfaction (or dissatisfaction) with the offer received from a higher education

institution, i.e. with a positive or negative feeling of the interested party in connection with the value received from a higher education institution as a result of taking advantage of a specific offer in a specific situation. This feeling can be a direct response to the value received in connection with the use of a single service (transactional satisfaction) or the entire reaction to a series of experienced situations (cumulative satisfaction) (Woodruff & Gardial, 1996). This issue is presented in Table 2.11.

Satisfaction is the general contentment accompanying the consumption of services and a reaction evaluating the degree of fulfilment of expectations of a service, which should be at least satisfactory. The sense of satisfaction is based on an emotional, subjective and cognitive component (Shemwell,

Table 2.11 Types of satisfaction experienced by enterprises in relations with a higher education institution

Satisfaction	
Transactional	*Cumulative*
• Determines the short duration of the enterprise's experience of the offer provided by a higher education institution, i.e. from one transaction to another (from one R&D service to another). • It is linked to the satisfaction accompanying the use of an offer (e.g. knowledge gained as a result of the use of an educational service). • Its strength is in the possibility to compare satisfaction levels of individual recipients of services offered by a higher education institution to a group of interested parties (e.g. the comparison of satisfaction felt by individual enterprises taking advantage of the offer made by a higher education institution). • It delivers the information about a new offer available from a higher education institution, products only just introduced to the market of higher education services (e.g. the monitoring of interest among enterprises in the use of a specific type of service).	• Determines the cumulative experience of an interested party related to the offer made by a higher education institution (e.g. combined experience of an enterprise related to the cooperation with a higher education institution). • It is not a transient and short-lived sense of satisfaction but rather the overall evaluation of consumption in a specific period (the satisfaction of an enterprise is measured with the use of an evaluation questionnaire in set periods). • It allows one to determine the expectations of an enterprise regarding the offer provided by a higher education institution and is an economic indicator for an organization (e.g. an analysis of needs of enterprises with which a higher education institution cooperates). • it has a direct impact on the loyalty of an enterprise and the long-term use of university services (high level of cumulative satisfaction and a great depth of relations help increase the loyalty of enterprises to a higher education institution).

Source: own work based on: Jachnis and Terelak (1998).

Yavas & Bilgin, 1998). Three models describing the satisfaction process can be distinguished (Furtak, 2003):

- expected incongruence model (the comparison of expectations with the facts, which causes negative or positive emotions or the lack of emotions; if the real satisfaction with the service is greater than expected, the service recipient will experience positive incongruence, i.e. high level of satisfaction);
- fair exchange model (when analysing the exchange, the service recipient compares expenses incurred and benefits gained with the expenses and profits of the organization providing the service; if this comparison favours the service supplier, the service recipient will feel that the exchange has been unfair);
- emotional model (it means that satisfaction is perceived as the condition in which positive emotional responses are felt and these feelings are directly impacted by the positive or negative emotional evaluation of the product).

The source literature offers many different behavioural consequences for a higher education institution, resulting from the satisfaction felt by interested parties or enterprises. Most frequent examples include the communication of the positive information about a higher education institution and its offer and positive recommendations (building the image of a higher education institution in its environment), interested parties regularly using offer provided by a higher education institution (systematic delivery of revenue from the services rendered by a higher education institution), the use of a greater number of services (an increased share of a higher education institution in the market of higher education services) and the enterprise's attachment to a higher education institution (increased loyalty to a higher education institution). It is also worth noting that the satisfaction of enterprises does not have to equate their deep and long-term relationship with a higher education institution but is necessary to attain it. Cumulative satisfaction has a very significant influence on the building of long-term relations between higher education institutions and enterprises on the market of higher education services. Therefore, it is worth remembering that enterprises should attain at least the same satisfaction with relations with a higher education institution in each situation and should never feel dissatisfied with them. Satisfaction repeatedly felt by interested parties helps build long-term relations, especially if demonstrates an upward trend (e.g. Oliver, 1980).

A higher education institution needs appropriate resources to be able to build relations with interested parties effectively on the basis of value offered. T.K. Das and B. Teng distinguish overlapping resources, i.e. resources common for various higher education institutions and non-overlapping resources that are unique for a specific higher education institution (Das, 2015; Das & Teng, 1996a; Das & Teng, 1996b; Das & Teng, 1997a; Das & Teng, 1997b; Das & Teng, 2000; Das & Teng, 2015; Hunt et al., 2006).

Depending on a situation, above groups of resources can be more or less useful to a higher education institution building value for an enterprise. According to the author, non-overlapping resources play the most important role on the higher education market as they allow a higher education institution to develop a unique offer that is difficult for competitors to emulate. Such resources should have the following attributes (Barney, 1991):

- they have to be valuable to help take advantage of opportunities and minimize threats in the environment;
- they have to be rare, with limited availability to the present and future competition;
- they cannot have substitutes in the form of other strategic resources making imitation possible;
- competitors cannot be able to copy them.

Therefore, it is up to managers of a higher education institution to choose a portfolio of enterprises with which the higher education institution established and develops relations to make an optimum use of the available resources (overlapping and non-overlapping) and, after that, to select such resources for the execution of the cooperation that are appropriate for established purposes and the planned satisfaction with the relationship.

Notes

1 As Klimas explains, some authors state that the building of inter-organizational ties occurs as an effect of mutual relations of organizations and their mutual influence, after: Klimas (2015).
2 More about the meaning of economic value: Zadora (2004); Karmańska (2009).

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3 Digital Transformation as Space to Establish and Reinforce Relations Between Universities and Businesses

3.1 Digital transformation as new challenge for organizations and their environment

Civilization changes, in particular networking and digitization, relying on faster-than-ever technical progress, nowadays apply to almost all areas, aspects and manifestations of the socio-economic life, including the organizations operating in such environments. Apart from the phenomena associated with networking such as, among others, chaos, unpredictability, no borders of organizations, promotion of intangible resources and cooperation processes among organizations (Skrzypek, 2017), it is also possible to notice very rapid absorption of technologies, in particular, digital technologies by all entities (Pieriegud, 2016). The key factors driving the development of digital economy include the following:

- Internet of Things and Internet of Everything;
- hyper-connectivity;
- cloud computing;
- Big Data Analytics (BDA) and Big Data as a Service (BDaaS);
- automation and robotization;
- multi-channel and omni-channel models of product and service distribution (Pieriegud, 2016).

Use of these factors in the socio-economic system results, among others, in development of the NBIC (nano-, bio-, info- and cogno-) technologies (Stępień, 2015), which make up a collection of components of practical and theoretical knowledge, *know-how* and methods, procedures and physical devices that make use of knowledge (Dosi, 1982) about digitization. Such technologies may also be called systematized application of scientific rules and practical knowledge (Lowe, 1995) in the area of digitization with respect to physical facts and systems. The developing digital technologies are used in organizations as the *know-how*, tools, methods or techniques, but also as a resource determining, among others, operation of machines and devices comprising production systems. For some organizations, the

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technologies are the product (value) offered to clients, while for others the process supporting their functioning (Bielińska-Dusza, 2020).

The dominant significance of information and the growing role of data flow processes in inter-organizational relations foster conditions for their most effective processing and at the same time offer a basis for the new economy, based on digitization processes (Zawiła-Niedźwiecki, 2018). One of the theories of cognition – dataism – indicates that the modern civilization relies on data which, having been entered to the management algorithms, acquire the form of information (Harrari, 2017). The reality creates data generated by machines and devices and artificial intelligence systems. Data processing with the use of algorithms leads to cognition and procurement of information as a result of which, thanks to mental processes, new knowledge is created. This process of cognition is repetitive (Sułkowski, 2005). Data and algorithms which are processed as part of flows guarantee generation of values that are expected by the recipients. This mode of operation characterizes a digital organization, i.e. an organization efficiently managing data with the use of IT modes, mechanisms and tools defined by it. From the point of view of recipients of products and services of such organization, delivery of data generating value for it is of vital importance. In turn, mere sourcing and processing of data does not generate value. Only the delivery of knowledge to the client who will be satisfied with it is a value-generating action (Cieśliński, 2020).

The term 'digitization' was used for the first time in 1971 in the context of analysis of the process of society digitization (Brennen & Kreiss, 2016). In the broadest sense, digitization is a process of instrumental use of the ICT tools to efficiently distribute knowledge among decision-makers of the organizational space (Cieśliński, 2020), and thus to unite multiple diverse domains of social and economic life around electronic communication and digital media. Digital content pertaining to text and image thanks to technical measures and software may be quickly shared; there is a possibility of reproducing it and joint interactive work on it; it becomes available for devices forming a repository of specific data, information and codified knowledge.

Digitization, relying on hardware and software, is a sequence of mutually dependent technological solutions, the manifestation of which are new technical and organizational solutions. With a guarantee of specific organizational, legal and competence environment, digital technologies support human creativity and innovation. Actions on the digital form of information not only stimulate access to knowledge and allow for the generation of new knowledge, but also have a specific cost effect (cost close to zero) and thanks to this, new conditions for innovation are created. Hence, digitization and digital transformation become a factor of innovation (Kowalczyk, 2017). Importantly, innovation understood in this way requires a cumulative learning process from producers and users (Szczepańska-Woszczyna, 2021).

Digitization has a strong value-generating context, as it does not consist in improving what already is at the disposal of an organization, but in

creating new values with efficient use of ICT technologies. Technology is one of several factors shaping the structural solutions (Klincewicz, 2016), and that is why in the case of implementation of advanced digital technologies, the organizational structure often needs to transform and become adjusted to the type and terms of using a given technology. Some researchers perceive technology as a component of an organization, i.e. as the applied mode of manufacturing or knowledge about directives of efficient operation. The representatives of this current treat technology as an element of a technological sub-system of an organization, which may be deemed strategic in reference to the progressing digitization (Leonardi & Barley, 2008).

As noted by Mazurek, digitization contributes to improved efficiency within an organization in the area of quality, consistency, precision and accuracy of implemented processes. Thanks to this – irrespective of the type of organization – better control is possible over its operational activities and results of its operation, available in real time, thanks to the integration of structured and non-structured data and a better insight into the organizational data, as well as integration of data from various sources. Better access to information had a beneficial impact on decision making and translated to an increase in productivity. Thanks to digitization, benefits related to interactions between an organization and its stakeholders, such as, e.g. shorter reaction time, reduced cost of relationship formation, better availability, etc., are also clearly noticeable (Mazurek, 2019). Digitization also changed the perspective of the recipients of products, services and knowledge who – thanks to the ICT technologies – nowadays have the possibility of choosing among so many options that they are often unable to consciously analyze them (Feldman, 2002).

The organizations see the inevitability of the breakthrough change which the development of digitization has for their operation. Wishing to meet it half-way or at least adjust to the new conditions of operation, they undergo transformation, i.e. a significant, multidimensional change of organizational and process-related nature, caused by the impact of digital technologies. Digital transformation in an organization may focus on cost reduction (Collin, Hiekkanen, Korhonen, Halen, Itälä & Helenius, 2015), improvement of efficiency (Westerman, Calméjane, Bonnet, Ferraris & McAfee, 2011), extension of communication with stakeholders and even sourcing a new group, i.e. digital consumers (Berman, 2012), as well as may – in a holistic mode – simultaneously account for four perspectives: technology, values, structure and finances (Matt, Hess & Benlian, 2014).

In a broader dimension, the digital transformation is related to an opportunity of economic development, improved quality of life, realization of democratic ideals (Śledziewska & Włoch, 2020), but it also exerts a significant impact on the functioning of an organization. For the majority of organizations, this phenomenon is often a challenge, but at the same time one of the foundations for retaining their position in the environment and

further expansion (Adamczewski, 2017). This follows from the concurrent and multidimensional impact of the digital transformation on the society and the people that make it up, assuming various roles, among others recipients of diverse products, services and other intangible values (e.g. knowledge) or their producers representing organizations of various types (e.g. public institutions, enterprises or non-governmental organizations).

From the perspective of man as an individual in the socio-economic system, the digital transformation causes significant changes in behaviour, which project on the mode of performance of social and professional roles in various types of organizations (e.g. an employee or a client). This reflects on, among others, de-materialization of goods in the form of photos and video recordings, sharing a greater volume of content, creation of image in the social media, as well as the phenomenon of dispersed memory, i.e. storage of memories on external memory media (Belk, 2013). Younger people learn technological novelties easier and quicker, while in the role of consumers they seem to be better informed, more often communicating with other consumers, notifying higher expectations with respect to digital services (Gray, El Sawy, Asper & Thordarson, 2015) and demanding that the organizations meet their expectations half-way. Such communities will become an important group of consumers or stakeholders, while their needs will come to be a greater challenge for organizations servicing them in various areas. Interest of the so-called digital consumers in the possibility of socialized co-creation of services, goods and values that are offered to them is very characteristic. They willingly assume the roles hitherto reserved for employees of organizations, i.e. advisers, testers, reviewers or client service employees (Mazurek & Tkaczyk, 2016).

Communities that have a joint interest and relational communities, relying on similar experiences that often function as virtual communities, exert a growing impact on the functioning of organizations. It may be said that skilful formation of relations within such communities, as well as relations with organizations with which they interact, is decisive for their success. Hence, organizations functioning in the digital economy should learn to read and use emotions that emerge in the virtual reality. Fundamental changes in the behaviour of individuals influence the market, social relations and become a cause for metamorphosis of both actual and virtual reality (Sułkowski & Kaczorowska-Spychalska, 2018). According to G. Mazurek (Castells, 2000; Urry, 2000), who quotes M. Castells and J. Urry, significant social transformations with which we are dealing today are caused by the networking of economy, quicker flows and virtualization of relations, as well as rapid development of many decentralized Internet networks. At the same time, in the managerial approach, this affects the transformation of organizations which develop such features as agility, responsiveness or joint value creation.

The description above testifies to the great potential and challenges generated by the development of digital technologies in organizations; however, it should definitely be treated as a tool, and not as an objective of transformation. Neither should it be overlooked that digitization, leading to multidimensional changes in organizations and, in a broader socio-economic context, which may generate a number of benefits, may also be a basis for multiple threats. In reference books, this observation has been made by, among others, Reddy and Reinartz (2017) who draw attention to such consequences of the process of digitization as the production of huge amounts of data, irreversible changes in the professional functioning of people and in daily life, growing expectations with respect to the generation of new intangible value for various groups of recipients. Without doubt, the COVID-19 pandemic was a milestone in further acceleration of the development of digital technologies. The outbreak of the pandemic and the global lockdown related to it induced and accelerated progress in the area of digitization, allowing for the use of the broadly understood technology for a radical improvement of the organizations' efficiency or their outreach (Westerman, Bonnet & McAfee, 2014). According to Rzeszewski, digital technologies entered the daily world on an unprecedented scale during the pandemic, becoming an inseparable part of many people's experience, often in an imposed and unwelcome manner. At the same time, such technologies became a cure for the current problems and a poison carrying new social challenges (Rzeszewski, 2020). Digitization allows for accomplishing many benefits and using many opportunities that are emerging, but it also causes threats and challenges which are faced by a modern organization and its environment. They are presented in Table 3.1.

As follows from Table 3.1, digitization leads to a number of changes in the functioning of organizations and stakeholders operating in their environment, including changes which may be deemed fundamental and having far-reaching effects. Digitization blurs the borders of operation of organizations as more and more processes take place outside of the structures of organizations, in an organizational space with undefined borders, often in informal networks. These new conditions of operation, caused by a dynamic development of ICT technologies, primarily the global Internet, are strongly dependant on the new methods and tools supporting the processes of managing organizations characteristic for the digital economy. Summing up, it may be concluded that the impact of digital transformation on an organization, its environment and stakeholders is realized via

- metamorphosis of an organization in the direction of adaptation of digital technologies to its operation on all possible fields of exploitation and improved efficiency in managing an organization, among others by improvement of mechanisms for monitoring its efficiency;

Table 3.1 Potential benefits and threats resulting from digitization for organizations and their stakeholders

Reference group	*Opportunities and benefits*	*Threats and challenges*
Organizations developing digital technologies, e.g. public institutions, enterprises, non-governmental organizations	Higher efficiency, performance, new methods of value creation, new possibilities of cooperation with various groups of stakeholders, new possibilities of knowledge transfer	Change or loss of existing configurations of value chains, new areas of competition, shortened product life cycles, growing demand for a new value created with the use of digital technologies, risk of failure to meet the requirements set by digital technologies
Recipients of values created by the organizations with the use of digital technologies, e.g. clients and stakeholders	Lower prices and better access to new products, services and knowledge, new impressions	Cost of adjustment to the possibility of using new products, services and knowledge related to digital technologies, cost of education, cost of searching for information, loss of privacy
Individual relying on digital technologies in professional and social life	Higher flexibility of employment, lower costs of work performance, higher degree of engagement in duties, growth of crowd-sourcing and crowd-working, easier sharing of resources, lease	Automation and other changes in work performance, digital exclusion, technological unemployment, comprehensive performance measurement, efficiency pressure, global competition at the labour market, weakening of interpersonal ties and integration at the work place, improved availability of products, services and knowledge, e.g. online education
Society	Better access to efficient and digitized administration, better quality of public sector services, greater availability of public information, higher public participation (online communication)	Changes in social communication and changes in social preferences, e.g. the mode of spending leisure time, the mode of handling transactions, digital exclusion causing marginalization of certain social groups, desire to exert greater impact on public issues by the society

Source: own study based on Mazurek (2019).

- changes in the process of product manufacturing, provision of services and offering other values at the market, e.g. knowledge;
- formation of relations with stakeholders with respect to fuller understanding of its needs, introduction of new channels to communicate with them and joint creation of values on which the stakeholders want to rely the bond with the organization;
- strengthening the organization's position in the environment, the sector or the socio-economic system based on the use of digital technologies, which have not yet been designed by the competing organizations.

Today, the digital transformation refers not only to the technological aspects of an organization's operation, but it also must encompass its entire strategy, shaping the mode of thinking and perceiving the world by the managers of such organization anew (Gregorczyk & Urbanek, 2020). Literature features the concept of digital leadership, which is used to define the leader of a team or an organization relying on digital technologies, which are also helpful in the implementation of innovations (Burmeister, Lüttgens & Piller, 2016). Digital leadership is one of the key attributes of digital (Ahlquist, 2014) organizations and these organizations which are only in the process of learning to make efficient use of digital technologies. The features of digital leadership include innovative visionary, networking intelligence, digital intelligence, digital talent scout (Klus & Müller, 2019), role model, democratic delegative leading style, employee orientation and social intelligence (Kreutzer, Neugebauer & Pattloch, 2017). Other important features include openness, ability to adapt, agility, creativity, learning from mistakes and knowledge orientation (Klein, 2020). Digital leadership not only supports internal transformation of an organization, including implementation of process or product innovations based on digital technologies, but may also play a vital role in shaping relations of an organization with its stakeholders in the digital world. Wherever leaders of digital technologies are perceived as attractive partners in cooperation and exchange of resources or values (e.g. such as knowledge), digital transformation and solidification of digital leadership may elevate an organization to a much higher level of competitiveness in its environment. Thus, formation of the competence of digital leaders is nowadays one of the key educational challenges for universities cooperating with enterprises, which necessitate such leaders.

3.2 Directions and determinants of development of digital technologies in enterprises

Technological changes are nowadays one of the key points of reference for enterprises which take innovative actions with an intention of improving the efficiency of their operation on the market, boosting competitiveness or satisfying the needs of their clients better. One of the causes for growing variability and unpredictability of market determinants in which the

enterprises are operating is the digital transformation. Mazurek defines the following key features of this phenomenon (Mazurek, 2019):

- the degree of complexity of digital transformation exceeds the level characterizing the implementation of new IT solutions;
- the effects of digital transformation and potential benefits from it are related to the crossing the classic organizational borders and contribute to the networking of an enterprise;
- the basis of the process of transformation is the digitized client and the client's experience and, to a lesser degree, infrastructure;
- links among various innovative solutions in the physical and digital space emerge as a result of coupling of effects of operation of various technologies.

The digital transformation shapes the specific environment for modern companies and determines, to a significant degree, not only their actions, but also their competitiveness. It is known as Industry 4.0, the 4th Revolution, Internet of Things or SMART, Industry Revolution 4.0 (IR 4.0). Two realities permeate in this environment: the physical reality (PR) and the Virtual Reality (VR) (Adamik & Nowicki, 2017), but it is also conducive to the intense development of the network cooperation or the virtual network. The most dynamic development refers to cyber-physical systems (CPS), big data analytics (BDA), Internet of Things (IoT), Internet of Services (IoS), Cooperation, Partnering and Team Working (Adamik, 2016), Strategic Partnering (SP), Knowledge Partnering (KP), Cooperation, but also Machine-to-Machine (M2M) Communication, Artificial Intelligence and Neural Networks (Adamik, 2018).

The majority of enterprises treat digital transformation as an inevitable necessity, while the need of facing it is dictated by the instinctive desire to retain the position in the sector, and in particular at the market serviced by the enterprise, among clients and other stakeholders to which the enterprise is related. Hence, digital transformation is used to accomplish clearly better effects of operation (McKeown & Philips, 2003), which may be understood, among others, as reduction in costs or faster performance of tasks (Kane, Palmer, Phillips, Kiron & Buckley, 2015) or improvement of operating activities (Fitzgerald, Kruschwitz, Bonnet & Welch, 2014).

According to Adamczewski, digital technologies determine organizational changes in the area of formation of relations with clients and contracting partners (better understanding of their needs, extension of communication channels) and modelling of an organization's actions within the scope of generation of products and services delivered to the market (Adamczewski, 2017). According to Mazurek, technology should offer an added value primarily to clients (Mazurek, 2019), yet it also requires focus on two supplementing activities: new formation of a value proposal for the

client and re-designing of activities with the use of digital solutions, allowing for furnishing the clients with the highest level of interaction and cooperation (Berman, 2012).

Development of the digital economy and all the consequences thereof are thus changing the modes of operation of enterprises, as well as affecting the life-cycle of various business models (among others accelerating the ageing processes of products). In other words, digitization and evolution of ICT technologies are constantly contributing to the development of applications of IT enhancement of business processes, yet enterprises should carefully think the mode of their operation through in the context of digital challenges of the future (Tapscott, 2008). From the point of view of an enterprise, technology cannot set the directions of development, but it has to be adjusted to the enterprise's strategy, its potential and to these areas that require support on the organizational level. Such support most often refers to (Adamczewski, 2016):

- technical infrastructure (hardware);
- system and communication infrastructure;
- application software;
- integration of business processes with external contractors.

Digital transformation is not only a layer of tooling, but a thorough change within the organization pertaining to management, mode of operation, values cherished or communication with stakeholders, including clients. As stated by Mazurek, the scale and extensiveness of digital transformation in an enterprise is often so great that the implementation of new business models gives rise to a number of challenges and problems with ensuring their complementarity with the ones on which the enterprise relied earlier (Mazurek, 2019).

Digitization is a process ushered by the response to the questions: "on which level of competitiveness is an organisation operating in a traditional business model?" and "whether and in which scope is it necessary to launch actions conducive to the development of organisations, the effect of which is going to be an organisational hybrid (combination of a process model with elements of digitisation) and eventually a digital model of business?" (Cieśliński, 2020). Setting and anchoring an organization in a digital environment requires its transformation and is a process that has multiple interim stages. On the level of every sector or market it is possible to indicate leaders, i.e. enterprises most active and efficient with respect to innovation, where technological changes are implemented faster than in other companies. The directions of transformation of these companies set the trails for others, which are following the leaders at a various pace. However, it must be assumed that some enterprises, due to various reasons, will never implement the process of full transformation, but will stop at some of its interim stages. This may be prejudged by numerous factors,

e.g. inner barriers for development of innovations, lack of capital or failure to change the business model. However, it may be assumed that systematically performed digitization processes allow a company to accomplish digital maturity which is conducive to the reliance of organizations on business and organizational models designated by highly advanced technologies, e.g. Industry 4.0. The development of Industry 4.0 also leads to a change in business models from product orientation to service orientation, e.g. offering the best service for performance of a given fragment of production process in a network (Gajdzik & Grabowska, 2018). The source of values is the combination of network links based on cooperation (Porter, 2006), and thus integration is of vital importance in business activities in line with the concept of Industry 4.0, i.e. an extensive range of flexible cooperation among various entities, as only cooperation among participants allows for meeting all the expectations of a recipient at a given time.

Industry 4.0 comprises digital management and production tools and tools allowing for the use of Internet and social media for the purpose of integration of smart machines, systems and introduction of changes in production processes, aimed at increasing efficiency of production and allowing the possibilities of flexible changes in the product assortment. Industry 4.0 refers not only to technologies, but also to new modes of work and people's role in an organization. Cognitive challenges pertaining to the implementation of a business model based on the Industry 4.0 concept in enterprises are presented in Figure 3.1.

The analysis of the extent and the specifics of issues comprising the business model presented above shows that the main factors allowing for the development of Industry 4.0 are access to proper data and holding tools for their analysis. Implementation of technological solutions in the area of Industry 4.0 may become an impulse for multiple beneficial changes in an enterprise, as presented in Table 3.2.

Organizational modelling of processes of embedding and anchoring of organizations in the new 4.0 business models is a process that has its onset in the procurement of data (PD) and subsequently their transformation (cognitive and/ or machine) to the form of information (I). The outcome of the process of organizational modelling is knowledge and its diffusion (DK) among the organization's stakeholders (Cieśliński, 2020). Figure 3.2 presents a model for managing the organizational modelling process from the digital perspective, using the labels described above.

According to Ciesielski, a new business model requires a linear progress: from birth, through growth, to improvement; nevertheless, an organization's reliance on new digital technologies disrupts this ordered process. Organizations which are at a stage of growth and which increase the significance of IT systems in business processes are thus shaping their core of organizational development towards digitization. A model approach to the digital transformation of an enterprise comprises stages presented in Table 3.3.

Three factors of embedding organizations in the digital business models

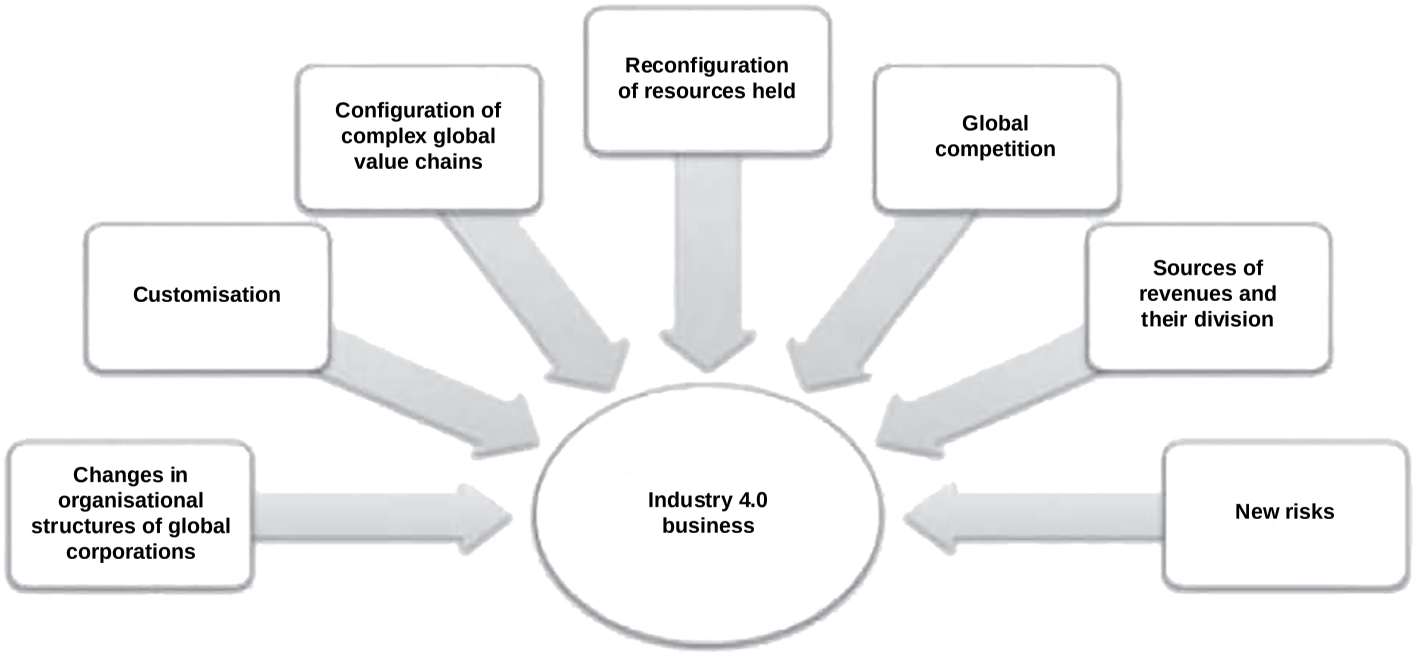

Figure 3.1 Structure of a business model based on the Industry 4.0 concept.

Source: Frankowska, Malinowska and Rzeczycki (2017, p. 103). The publication is available under the Creative Commons Attribution 3.0 Poland license.

Table 3.2 Enterprise development possibilities based on Industry 4.0

Development opportunities	*Description*
Increase in productivity	Industry 4.0 allows for optimization of the production process, shortening of downtime, better allocation of resources and creation of new products
Development of new industries	Development of new industries thanks to suppliers of Industry 4.0 solutions and companies implementing such solutions
Innovative economy	The economy becomes more innovative, also allowing for expansion of technology abroad
Attractiveness for investors	High competence of employees and buoyantly developing innovative economy with adequate mechanisms attract investors
New jobs with high-added value	There are also new jobs related to automation and IT and new sectors related to cooperation between robots and people
Reduced production costs	Improved quality of products and drop in stock reduce production costs
Efficient use of materials and energy	Rational use of materials and improved energy efficiency go hand in hand with sustainable development
Better satisfied consumer needs	Mass customization

Source: Buła & Schroeder (2020, p. 42).

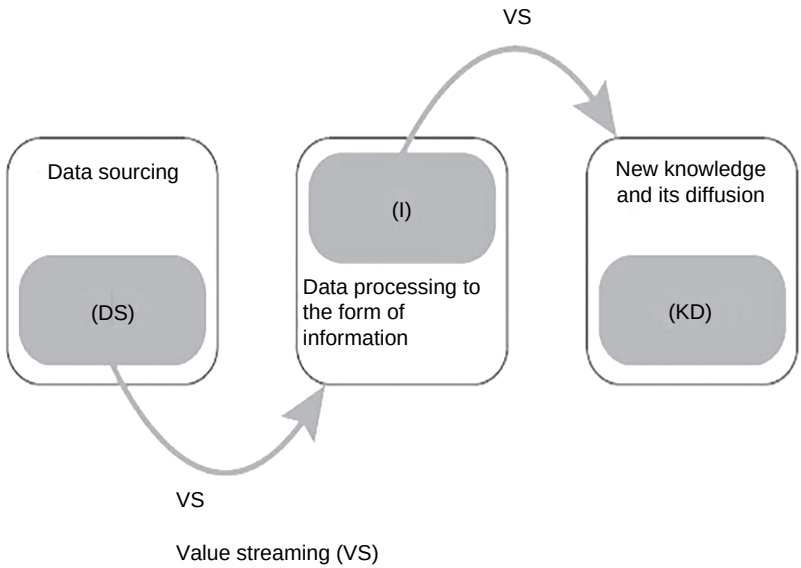

Figure 3.2 Model of managing organizational modelling from the digital transformation perspective.

Source: Cieśliński (2020, p. 320).

Table 3.3 Stages of transition of an enterprise into a business model based on digital transformation

Name of stage	*1. Virtual reality*	*2. Digital ambitions*	*3. Digital potential*	*4. Digital readiness*	*5. Digital implementation*
Description	Procurement of knowledge about digitization and analysis of clients' requirements for the purpose of creating a value chain with the participation of various stakeholders, e.g. clients, universities, etc.	Determination of digital ambitions of an enterprise and specification of a new business model based on digital transformation	Use of best available practices pertaining to digital transformation, determination of digital potential of a new business model of an enterprise and appointment of digital transformation ambassadors	Evaluation of adequacy of alignment of digital business model with respect to the fulfilment of clients' and other stakeholders' expectations, along with possibilities of meeting the designated targets	Implementation of the new business model at all areas of operation of an enterprise, development of a digital network for value creation and incorporation of business partners and other stakeholders in this process

Source: own study based on Mazurek (2019).

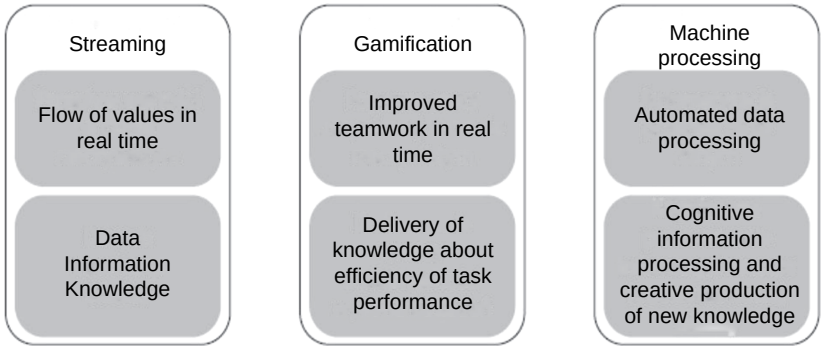

Figure 3.3 Critical factors for setting and anchoring of organizations in digital business models.

Source: Cieśliński (2020, p. 320).

are distinguished (Cieśliński, 2020). The first is the streaming of data, information and knowledge as an element allowing for the extension of value chains. Streaming consists of the use of modern technologies and Internet to manage the flow of values in an organization. The second element is gamification, which improves the efficiency of teamwork and allows for better monitoring of task performance efficiency. The last element, i.e. machine processing, influences the process of automatic, as well as cognitive data processing with respect to the inventive creation of new knowledge and its subsequent diffusion to entities making business decisions and cooperating with an organization (Cieśliński, 2020) (Figure 3.3).

A common element of all three factors used for embedding the organizations in digital business models is their relationship to knowledge, used in the process of digital transformation in many diverse dimensions and applications:

- as a resource in a process (next to data and information);
- as a basis for evaluation of process efficiency (as part of control activities);
- as a process outcome (a value that a company jointly creates together with stakeholders during the application of digital technologies).

Knowledge is the basis for the implementation of modern technologies in an enterprise, based on both own invention and good practice deriving from the environment. Hence, knowledge has a key application in the digital transformation as the resource which an enterprise contributes to the process or procures from the stakeholders cooperating with it, but also develops jointly with them, among others by joint learning. Integration of

knowledge pertaining to the business environment, familiarity with new technologies, which may support the manufacturing of products and services, and the possibility of admitting them to the new markets, are the main opportunities for an enterprise to accomplish a competitive advantage, among others on account of innovations. A great dispersion of innovations in the business ecosystems and a variety of organizations cooperating within them change the nature of the technological evolution (Iansiti & Levien, 2004). In the future, its driving force will not so much be the leading enterprises engaged in the technological race, but the inter-organizational and diverse networks of cooperation set in business ecosystems.

Digital technologies implemented by enterprises are based on digital solutions generally defined as the SMAC, i.e. social media, mobility, big data analytics and cloud computing (Adamczewski, 2017). These four pillars on which the new business models rely may be characterized as follows (Adamczewski, 2017):

1 Social: social networks levelling the barriers of information flow among people and performing the roles of platforms allowing for quick and efficient exchange of knowledge, improvement of interactions with clients, greater capacity for exchange of experiences and problem solving;
2 Mobile: mobile devices (smartphones and tablets), increasing efficiency of the companies' outreach to clients, used for online marketing, performance of transactions and any forms of communication, among others via websites and applications;
3 Analytics: analytical tools, using advanced algorithms allowing for understanding behaviour and preferences of clients that shore up client loyalty, improve product development and service provision processes, facilitate business decisions;
4 Cloud: cloud computing technology, offering tools that allow for efficient compilation of information and efficient management of organizations. Use of tools available in the cloud allows the organizations to reduce costs, overcome geographical barriers and access data at any time and place.

Next to technologies generally known as the SMAC, companies most often implement solutions in the area of automation and robotization aligned to the profile of their operation (Adamczewski, 2016), yet apart from it, it is also possible to indicate at least several dozen digital technological solutions which enjoy growing popularity among enterprises. They are presented next, together with a brief characteristic of the possibility of being used in business, with an assumption that practically each of these technologies

requires adaptation to the conditions of operation of sectors and industries, as a result of which product, process, organizational and marketing innovations are created in companies.

At the present moment, the most popular are the solutions based on automation and robotization of production. Automation consists in activities carried out independently by a machine which were or could have been previously carried out by people, but also those that are too difficult to perform by people. As a result of work automation, people only perform the supervisory and control function in reference to machines and their work. Automation may refer to the entire process of manufacturing or some of its stages that may be supplemented with people's work (Lemański, 2020). Robotization is a form of production automation which is related to the substitution of a man by a robot (Grzeszak, Sarnowski & Supera-Markowska, 2019). Apart from industrial robots which significantly relieve people in work performed in difficult conditions, mobile robotics is dynamically developing. Modern robots are characterized by diverse structures, dependant on their intended use. Intentionally, the level of autonomy is going to be raised, and in particular, the mode of thinking, movement and behaviour (Kowalczuk & Czubenko, 2015). The commonness of automation and robotization in industrial activities and in daily life leads to the development of these solutions both in simple and more complex professional activities (e.g. a humanoid robot replacing a reception desk worker at a hotel or a shop assistant, holograms offering information or advice to clients) and home activities (e.g. humanoid robots caring for the elderly or disabled persons or, e.g. smart vacuum cleaners and lawnmowers). Solutions aimed at the automation of managerial processes (e.g. servicing of electronic mail, processing of parts of financial transactions) are also implemented.

Irrespective of the industry, more and more companies are reaching for solutions in the area of cyber-security which encompass, in a broad range, technologies intended to offer better protection of the ICT networks, devices, programmes and data from hackers' attacks, damages or unauthorized access. They encompass all tools and systems preventing damages, used for protection and allowing for restoration of capacity for correct functioning of computers, systems of electronic connectivity or communication services in the cyber-space. They aim to protect the electronic communication to ensure confidentiality with simultaneous authentication of authorized persons (Górka, 2017).

Other digital solutions gaining popularity in business are based on machine learning, i.e. focused on teaching computers how to learn from data and improve along with the acquisition of experience. These technologies encompass solutions allowing the computers to perform tasks for which they have not been programmed earlier. Algorithms are created in the process of machine learning which are subsequently trained with respect to finding

models and correlations in large data sets and making the best decisions and formulation of forecasts on the basis of results of such analysis. The systems that use machine learning in the course of time are becoming more and more efficient, while better access to data leads to an increase in their accuracy (Alafif, Tehame, Bajaba, Barnawi & Zia, 2021).

In turn, big data systems allow for the use of computational potential and technologically advanced software to compile, process and analyse data which are characterized by significant volume, quick generation and value (McAfee & Brynjolfsson, 2012). They are used for sets of data which are so large, complex and deriving from diverse sources that their processing requires new technologies, such as artificial intelligence. The big data system enables very quick compilation of data (in a time approximate to real time) and their analysis and assessment for drawing new conclusions (OECD, 2017; PE 2021). Such systems also allow for broadly understood data aggregation and are used more and more often as an efficient tool supporting decision-making processes.

The technological solution of *edge computing* focuses on efficient modes of data processing, delivered in huge amounts by smart items connected to the Internet as part of the so-called Internet of Things. It allows for the initial processing of data at the so-called edges of the network, which are any computing and network resources located at the interface between the sources of data and the centres of data, e.g. in cloud computing (Shi, Cao, Zhang, Li & Xu, 2016). *Edge computing* allows for an increase in speed and safety of data processing, consisting – among others – in transfer of the computing capacity closer to the place of data generation (Satyanarayanan, 2017).

Blockchain is a dispersed database, containing a continually growing amount of information (records) grouped into blocks and combined in a way that every next block contains a time stamp of its creation and a link to the previous block which forms a coded "summary" (hash) of its content (Piech, 2016). Thanks to the application of such solution, it is much easier to document transactions, track resources and build trust (Jacobovitz, 2016), as well as securely store information based on creation and recording of the full path (chain) of data flow in an organization.

Cloud computing consists in delivery, via computing services, of, e.g. databases, networks, software, etc., to offer quicker innovations, flexible resources and economies of scale (Xun, 2012). The technology assumes storage of data, files, applications, software and IT systems in the cloud, i.e. on servers located outside of the local network held by an external supplier. This is an increasingly common and available solution, offering a number of benefits to organizations, from lower costs to guarantee of data security (Voorsluys, Broberg & Buyya, 2011).

A chatbot is an application communicating with the recipients in the form of a dialogue, whose task is to mimic an interactive conversation with any

interlocutor and to reduce the load on the administrator of the online customer service centre, as well as to assist communication in the social media (Szymański & Józwiak, 2018). Tools of this type are used for holding conversations with the use of a computer (e.g. virtual consultants offering advice or answers to questions frequently asked by clients) and they greatly facilitate work in industries where the same operations are carried out with multiple clients, in relation to which it is possible to foresee typical procedures which are entrusted to such applications.

Virtual Reality (VR) is a 3D environment created by computers, allowing the users to move and to interact, which stimulates one of the five human senses (Berbeka, 2016). VR solutions enable computer simulations which create images of physical or virtual reality, e.g. computer simulations of objects, spaces or events. They are applied, e.g. in designing, modelling of decision making or behaviour studies. In turn, augmented reality (AR) is a system used to supplement the reality with virtual, interactive elements located in it, which are an intermediate stage between the real world and the VR. In this technology, impact on the senses of sight, hearing and touch is applied, yet there are also ideas of impacting other senses (Skórska, 2017). The AR-type solutions allow for creation of computer simulations that combine the real world with computer-generated images (e.g. imposing 3D graphics in real time on a camera image).

The Internet of Things (IoT) is an ecosystem where objects may communicate among themselves via man or without man's participation (Grodner, Kokot, Kolenda, Krejtz, Legoń, Rytel & Wierzbiński, 2015). These solutions furnish the devices with smart features, e.g. by connecting them to the Internet (e.g. smart fridges where the content can be checked with the use of a smartphone app). The scope of application of the Internet of Things is extensive both in the sphere of economy and daily life. The Internet of Everything, i.e. a network connecting people, processes, data and objects, also has a great potential. The next stages of technological development, including cloud computing and big data, will allow for increasing use of this potential. At the present moment, only 1% of objects in the physical world are connected, but the potential is far greater. The Internet of Everything generates benefits not only for the enterprises and their clients, but also for countries, cities and their residents, among others due to the fact that it increases productivity and revenues of the public sector and improves the quality of public services (Kolek, 2019).

Artificial Intelligence (AI) comprises systems or machines mimicking human intelligence for the purpose of task performance and successively improving their operation based on the compiled information (Acemoglu & Restrepo, 2019). These are tools materially supporting the making of managerial decisions in various spheres of operation of organizations, including marketing, production and logistics.

Designing experiences is an interdisciplinary action comprising elements of psychology, ergonomics, art, utility, industrial design and technology. It allows for forming an enterprise's relations with various stakeholders (including clients) around a product or service (Benyon, 2019) via information systems for ordering, analyzing and evaluating the hitherto mutual experiences. The process is aimed at designing a product or a service that allow the user for intuitive use thereof. Thanks to it, the user's attention is fully devoted to the performed activity and not to thinking how to use a product to accomplish a specific objective.

The 5G technology is the most sophisticated technology in wireless communication. It is most probably going to revolutionize the entire area of wireless networks, offering a possibility of efficient and safe communication wherever wireless communication cannot be replaced (Korzeniewska, Krawczyk, Łada-Tondyra & Plewako, 2019). It forms a realm of solutions based on mobile communication with multiplied (above-standard) transfer of data and may be used in numerous spheres of life, e.g. in remote treatment of people by constant monitoring of their vitals, remote control of facilities, e.g. cars, etc.

Summing up, the enterprises of the era of digital economy have many directions and possibilities of making use of technical progress. Implementation of technologies described above requires meeting a number of requirements related to the process of digital transformation, the result of which should be accomplished by an enterprise of the highest possible level of digital maturity and development of inter-organizational relations which offer full access to knowledge indispensable in the process of innovation creation.

3.3 Multi-dimensionality of digital transformation process at universities

The phenomena taking place in the socio-economic environment affect the necessity of changes occurring both at a university and in its milieu (Chmielecka & Kraśniewska, 2019). The model of operation of a university has been subjected to ongoing transformations pertaining to, among others, digitization in the recent years. Digital transformation refers not only to the models of operation, organizational structure and human resources, but also to the technologies used for compilation of information and management thereof or models of cooperation between an organization and its environment. The source of digital transformation may be both an inner conviction of a university about the necessity of launching such process, but also impulses from the environment, among others changing expectations and behaviour of modern knowledge clients (Mazurek, 2019). Universities note that the use of digital technologies is facilitated and accelerated by a number of processes and helps adjust to the market needs better (Davis & Farrell, 2016). In turn, the leading group of university clients – young people – approach the choice

of a field of study in a more and more conscious and rational way. Studies prove that students are not satisfied with the scope of use of digital technologies at universities (Forum Akademickie, 2019). They expect both the educational offer of universities, as well as the mode of communication with students to be adjusted to the level of their digital competence, accounting for the potential offered by functioning in the ICT networks and digital and multimedia systems, offering immediate and personalized interaction (Temple & M. Shattock, 2007; McHaney, 2011; Budde-Sung, 2011). Universities are expected to have a new approach to the teaching of students in a mode preparing them for knowledge creation (Mazurek, 2019), which may also be used, among others, for better understanding of technological progress and creation and implementation of social and commercial interactions related to digital technologies.

The need of better adjustment of the market of higher education services to the conditions of digitization means that the transformation should go beyond the implementation of technological tools. It also requires a systemic change, i.e. change in the organizational culture from hierarchical to network-based, implementation of new modes of decision making based on centralized, standardized data, improvement of digital competence of all university employees, including academic teachers and scientists, application of tools that enhance and develop didactic innovations and performance of academic activities or building relations with graduates via new communication channels (Mazurek, 2019). In other words, digital transformation of tertiary education consists in improvement, extension and redefinition of services offered by universities (Sandkuhl & Lehmann, 2017), i.e. teaching, performance of research, management and additional auxiliary processes (Seres, Pavlicevic & Tumbas, 2018).

The first steps towards digital transformation of the Polish universities were made, among others, by the consortium of the Jagiellonian University, the University of Silesia, the Warsaw University of Technology and the Maria Curie-Skłodowska University, which in 2009 jointly implemented integrated university management systems, in the next years extended onto subsequent modules (CRSZ report, *online*). These activities were continued by, among others, the Jagiellonian University as part of subsequent projects.[1] The virtual learning at the university is coordinated by the Remote Teaching Centre of the Jagiellonian University[2], which also manages several platforms for remote education and communication. Similar activities were carried out by, among others, the University of Warsaw which between 2016 and 2019 implemented ten integrated front-office e-services addressed to students, PhD students, candidates for studies, course participants, pupils at Mazowsze secondary schools, as well as other public establishments (universities). The Digital Competence Centre has been operating at Warsaw University as of 1 September 2018 as a university-wide organizational unit established to offer comprehensive support for academic and didactic activities related to the development of

digital technologies. Its tasks include, among others, development of e-learning and expert services in the area of digital enterprises at the university (academic research, teaching and infrastructure). The Centre implements own projects, as well as offers support for digital enterprises of scientific and organizational units of the university.[3]

The University Study-Oriented System (USOS), greatly popular in Poland, was created at the Warsaw University, while afterwards it was developed by other universities associated in the Inter-University Centre for Informatization (MUCI). It is currently used by the administration authorities of over 50 universities in Poland. Students and academics are using the USOSweb service that contains data relying on the information compiled in the USOS databases. An example of a project popularizing the system is the USOS Cloud service, created already in 2014. It allowed other universities to use USOS, without the necessity of having own infrastructure (Mazur, 2020). Apart from the presented examples, many other Polish universities are also experiencing progressing digital transformation, yet the rate of the process is diversified (Groszyk & Krawiec, 2016). Digitization of universities is manifested in more and more common implementation of integrated IT systems or specialist software for university management. It is used, among others, to improve efficient servicing in all areas of university operation and better asset management. Application of a common database for the entire organization contributes to the uniformity of the managerial information and streamlines the internal flow of information (Ciesielska, 2019).

Activities accelerating digitization of universities in the next financial perspectives are supported by the European Union, which distributes funds for co-financing such projects among the member states. In the 2014–2020 financial perspective, as part of the Knowledge Education Development OP projects, Polish universities were offered support for, among others, reinforcement of IT tools for university management, creation of open educational resources, education in the form of e-learning, activities improving competence of university personnel in the area of innovative didactic competence, IT skills (including use of professional databases and their application in the process of education). For the 2021–2027 period, performance of subsequent projects in the area of digitization of higher education has also been scheduled (Ciesielska, 2020). The EU "Digital Europe" programme has been established, which stresses the significance of digitization of all economy sectors, changes in lifestyle, work and communication (Zbarachewicz, 2020). Similar activities are carried out not only in Poland, but also in other countries where other public funds are used to finance projects related to the digitization of universities.

On the level of strategic documents, the Directions of Strategic Activities in the Area of Computerization of Public Services were set in 2017 in Poland (GOV, 2017) while digitization was deemed a premise of modern economy already in 2016 in the "Czas na przyspieszenie. Cyfryzacja

gospodarki Polski" report (Arak & Bobiński, 2016). As far as the IT systems of higher education and science are concerned, the so-called Constitution for Science of 2018 includes references to the Integrated System of Information on Higher Education and Science POL-on (POL-on System), which encompasses several databases (Act on Higher Education and Science, 2018). The development programme of higher education and science for 2015–2030 (Ministry of Science and Higher Education, 2015) emphasizes the necessity of modern education of personnel in the direction of "creative thinking, capacity for generation of new knowledge, innovative technical and organizational solutions and new cultural content", yet digital transformation was mentioned only indirectly (among others, investments in personnel expert in technology, improvement of qualifications of academic teachers pertaining to the use of modern solutions and technologies in teaching, establishment of virtual research institutes).

Development of digital technology has already greatly increased the potential of universities in the area of education, performance of research and creation and popularization of knowledge, yet these processes have been progressing at a various rate in the recent years. It was only the COVID-19 pandemic in 2020 that became the catalyst for the accelerated implementation of digital technologies at the majority of universities. Faced with such force majeure, rapid digitization of universities has turned out to be a condition for retaining operation at the market of tertiary education services and only in a further perspective a basis for building a competitive edge. During the pandemic, and primarily during the lockdown, universities focused on technological solutions that allowed for and facilitated remote education, as well as virtualization of basic administrative and managerial processes. Next, actions were taken for the sake of continuing research or maintaining international contacts, among others as part of the implemented projects. After over a year of operation of universities in such conditions, a reflection on the necessity of intensifying education in the area of digital technologies is emerging, along with the necessity of development of primary and application research, related to application in various sectors, as well as promotion of best practice, pertaining to the digitization of the public, commercial and social sphere, which may contribute to the minimization of various types of barriers related to the implementation of innovations based on technologies. A sudden necessity of a university's transition from the off-line operation to the online mode, both as far as classes, academic and organizational work is concerned, has shown delays in hitherto digitization of universities and the possibilities of flexible adjustment to a radically different mode of operation (Mazur, 2020). At the same time, a very dynamic development of digital economy, driven by the pandemic, has made the academic sector one of these where the rate of digital transformation has grown the most.

The global pandemic has accelerated the digital transformation of universities and confirmed expectations in this respect, both on the side of

academic personnel and students. The studies have shown that the universities that do not introduce online teaching will lose 5% of students on a yearly basis for the sake of these units that offer such formula of study. The employers are also looking for employees who are experts in the VR (Polish National Agency for Academic Exchange, 2020). In "The Future of Higher Education: Digital Transformation Is Critical to Learner and Institution Success" report, the universities that are currently using at least some digital technologies were divided into two groups: "digitally determined" and "digitally dispersed" (Polish National Agency for Academic Exchange, 2020). The "digitally determined" universities have a digitization vision and strategy, they develop digital skills of employees and introduce other changes related to it, among others in the organizational culture, procedures, internal policy, etc. They treat digitization as a profitable investment. They note that thanks to the new approach, they have recorded an increase in revenues from new or already existing products, they have sourced or retained clients and increased.

Digitization of tertiary education is increasingly related to the modernization and development of innovative directions and fields of study which offer education in the area of integrated IT systems and modern technologies based on digital solutions in various aspects of their use (Hejduk, 2018). In April 2021, the GovTech Poland Centre announced launch of a pilot programme "Academy of Innovative Digital Applications" (AI Tech), used for preparation and offering of second-cycle studies on artificial intelligence (AI), machine learning and cyber-security at selected universities. As part of the classes, students will have a possibility of taking part in lectures and classes offered by specialists from all over the world. The project also includes three study visits in Poland and abroad, foreign internships and international conferences.[4]

Universities also develop e-services for students and academic personnel and other stakeholders. The most frequently implemented modules include e-applications, e-Office, e-payments, e-internship, internship, voluntary work, e-courses, e-consultations, e-laboratory, etc. e-contact with lecturers and university employees.[5] An interesting type of e-service are e-exemptions in reference to students who do not hold another title for health insurance and whom the university authorities report to the ZUS. In case of sickness, a student receives an e-document which is acknowledged by the university in relation to absence at classes (Ciesielska, 2019).

Digital transformation of a university is also manifested by a transfer of operation to the so-called cloud. The forecasts say that by 2022, there will be 6.2 million positions requiring cloud technology expertise at the market, while by 2030, 77% students will need new technological skills (Microsoft, online). For the clients from the tertiary education sector, Microsoft launched a "University in the Microsoft Cloud" programme, which distinguishes and associates universities that make model use of tools and technologies of this company in educational, administrative and research activities. These

universities are making use of the path of digital transformation, "Education Transformation Framework" prepared by Microsoft, through which they strive for improvement of work and implementation of state-of-the-art work tools and optimum use of data. This network of cooperation includes the Jagiellonian University, the SGH Warsaw School of Economics and the Łódź University of Technology (Microsoft, online).

Without doubt, the COVID-19 pandemic forced the universities primarily to intensify the processes of digitization of educational services, yet the beginnings of e-learning date back to 2000. The first activities in this respect were carried out by the Polish Virtual University, the Maria Curie-Skłodowska University and the Warsaw University of Technology. Oftentimes, these were grassroots initiatives, popularized by technology buffs who started to experiment with the *open-source* Moodle platform at universities and taught classes with the use of it. Polish academic teachers who travelled to the United States or Great Britain acquired experience from those who offered more advanced e-learning (Focus on business, 2020). Before the pandemic, the Polish law allowed for blended learning, i.e. combination of traditional classes with remote ones, yet it did not tackle the issues related to the standards of material preparation or liability for the learning outcomes in this formula (Focus on business, 2020). During the pandemic, universities most willingly developed remote education, making use of the free Moodle platform (Bąk, Fic, Pytel, Skutnik, Sujkowska-Sobisz & Zygmunt, 2020), Microsoft Teams, which combines functions of holding a video-conference, audio calls, chat, a virtual meeting space and file sharing (Bąk, Fic, Pytel, Skutnik, Sujkowska-Sobisz & Zygmunt, 2020), but also such platforms as Zoom, ClickMeeting or Google Meet.

The most frequently used tools for remote teaching, aimed at summaries and verification of knowledge, include Kahoot (https://kahoot.com/), Quizizz (https://quizizz.com), Forms (https://www.office.com), Testportal (https://www.testportal.pl/), Socrative (https://socrative.com/), Classmarker (https://www.classmarker.com/) and Google Forms (https://www.google.pl/intl/pl/forms/about/). The most popular tools of remote teaching used for group activation are Mentimeter (https://www.mentimeter.com/), Padlet (https://padlet.com/), Miro (RealtimeBoard) (https://miro.com/app/dashboard/), Scriblink (http://www.pearltrees.com/u/704293-scriblink-online-whiteboard) and Mindomo (https://www.mindomo.com/). In turn, the tools used the most frequently for remote teaching that facilitates the management of the didactic process include: Planner (https://support.microsoft.com/pl), Trello (https://trello.com/pl) and Doodle (https://doodle.com/en/). The platforms used most frequently for the accumulation of educational resources and substantive materials include Google Drive (https://www.google.com/drive/), OneDrive (https://www.office.com/), closed groups on Facebook (https://www.facebook.com/) and Screencast-O-Matic (https://screencast-o-matic.com/).

The pandemic has also greatly affected the internationalization of universities, including mobility, as in 2020 and 2021 the universities practically ceased to operate in the traditional form. In relation to this, a new form of academic mobility has come into being: virtual mobility, which the Polish universities had to implement rapidly in order to carry on with the international exchange and continue the teaching of students. Earlier, Polish universities had no great experience in implementing this form of mobility, yet a number of actions were taken to provide the students with a possibility of continuous education as part of exchanges, in spite of the restrictions applicable during the pandemic. The virtual mobility is not only remote teaching, but many other possibilities of engaging the students in inter-cultural cooperation and online interaction with partners from various cultural contexts or geographical areas. Three trends pertaining to virtual mobility have emerged: *pre-mobility* (the period when the students are engaged in interaction with the accepting university before physical mobility), *blended mobility* (periods of online cooperation between classes before physical mobility for the purpose of implementing a project at a partner university) and *course integration* (cooperation of students online as supplementation for actual courses). Effective virtual mobility should meet three basic terms: not compete with physical mobility, but supplement it; require special trainings for academic teachers; form an integral part of the study programme (Polish National Agency for Academic Exchange, 2021; https://www.facebook.com/; https://screencast-o-matic.com/). At the present moment, the Polish National Agency for Academic Exchange (NAWA) offers scholarships for virtual internship for students and academic employees of accredited universities of the CEEPUS member states (Polish National Agency for Academic Exchange, 2021).

The universities that are professionalizing educational services, research and implementation and expert services are also tightening cooperation with suppliers of technology and equipment (e.g. services offered by Microsoft, among others Microsoft Teams or Google, e.g. Google Classroom and Google Meet) and contractors of technological services (e.g. video-conference services). There is a range of services dedicated to tertiary education, e.g. Electronic Platform of Academic Services, Edu web360. The services offered by Cisco Webex and Zoom are also popular. Proposals of other tools for remote teaching were also presented by the Ministry of Education and Science. They include a list of tools for remote teaching,[6] access to the free NAVOICA educational website and the MOOC foreign offer of courses and classes (GOV, 2020), as well as open educational resources for universities.[7]

Universities are also looking for commercial analytical and managerial tools such as, e.g. HMS Solution (HMS Network, *online*) which is used by approximately 40 universities in Poland. In their research and development activities the universities, depending on the profile, use various dedicated tools relying on statistical methods (e.g. SPSS software or SAS). Usually, external suppliers offer specialist licenses for software for universities,

academic teachers and students, e.g. Office 365 Education. Digital transformation has also revolutionized scientific communication and activities aimed at promotion of universities. Social media have come to be an important channel allowing for reaching out to a broad group of potential students and informing them about accomplishments of university employees and processes taking part within them. Apart from commercial programmes, many universities also use their own e-learning platforms where open-source software, e.g. Moodle, is applied. Furthermore, the offer of universities also features teaching programmes and initiatives encompassing teaching about solutions available on the open-source basis, e.g. the ability to programme in languages such as Python, which allows for becoming independent from commercial license solutions (Mazur, 2020).

Digital transformation has also changed the processes related to the processing of data and information, the analysis of which is the basis for scientific studies. Access to huge amounts of data and changes in the mode of analysing them (the so-called big data) affected the approach to the research techniques; at the same time, a trend has been observed that is related to limited access to such data and information, in particular when they are held by the competitors. To facilitate access to them for the scientists, the European Commission is trying to enter into alliances with corporations pertaining to specific sectors. At the beginning of March 2020, an agreement was entered into between the European Commission and Airbnb, Booking, Expedia Group and TripAdvisor, which is going to contribute to the sharing of data pertaining to short-term lease and tourism. At the present moment, a number of large corporations collectively known as the Big Tech are carrying out their own activities in the area of data sharing, e.g. a repository of data sets set up by Microsoft; sets of data shared by Amazon Web Services; tools and sets of data used to develop artificial intelligence, shared by Facebook; data set search service developed by Google which allows for browsing through thousands of repositories. Such initiatives were also taken also in the period of the pandemic, e.g. Google decided to share data pertaining to the users' mobility, while Facebook - data about their location. The purpose of such activities is to support scientists trying to determine the significance of impact of limitations in movement on the spread of coronavirus (Mazur, 2020).

An impulse for the establishment of cooperation between science and economy in the area of joint studies on new digital technologies is a possibility of financing or co-financing them by the EU institutions (among others, the Horyzont 2020 programme, COSME, Erasmus Plus, the International Visegrad Fund, etc.), as well as domestic ones (among others, programmes of the National Centre for Research and Development such as Infostrateg or the so-called 'quick path' of financing from the Smart Growth Operational Programme 2014–2020). An example of scientific cooperation between a university and an enterprise in the area of digitization are projects pertaining to the Digital Innovation Hubs which were

selected in 2019 (Platforma Przemysłu Przyszłości, 2019). This area of cooperation in development of digital technologies is one of the most promising, as studies show that until 2020 probably approximately 60% of companies implemented new digital solutions, while the expenses of companies on systems supporting digital transformation in 2019 approximated USD 431 billion (NNT DATA, 2019).

Among European research initiatives related to digitization, special attention should be paid to the European Institute of Innovation and Technology (EIT) (EU, https://europa.eu/european-union/about-eu/agencies/eit_pl), which supports innovation by reinforcement of cooperation between companies, research and educational institutions as part of the so-called communities of knowledge and innovation. One of the areas of the EIT activities is EIT Digital, focusing on digital products and services. Universities and enterprises may also commence joint research projects in the area of digitization via the Joint Research Centre. It promotes independent research studies pertaining to the subjects of key importance for the European integration (Mazur, 2020). In turn, as part of the European Research Area (2020), the following initiatives are available: CORDIS (website with information about research projects financed by the European Union and their results), OpenAIRE (website that forms a network of generally accessible repositories, magazines and archives) and EU Open Data Portal (databases shared by the EU institutions to be used for research and commercial purposes) (Mazur, 2020).

Notes

1 As part of the HAZARD project, the university has harmonized such systems as University Student Servicing System, Electronic Enrolment, Repository, Integrated IT System on Educational Offer, while as part of the "ZintegrUJ – Kompleksowy Program Rozwoju Uniwersytetu Jagiellońskiego" project, financed as part of the Knowledge Education Development Operational Programme, the implementation of which ends on 31 December 2021, the development of IT tools for management and education purposes is under way [online] https://www.sapiens.uj.edu.pl/crsz_projekty [Accessed 15 July 2021].

2 Tasks: offering online training, instruction on the use of university remote teaching platform, design of an online service devoted to e-learning, website designs, methodological consultations for teachers who are using the Internet in teaching, preparation of e-learning programmes, preparation of materials and teaching aids. [online] https://czn.uj.edu.pl/strona-glowna/o-czn/ [Accessed 15 July 2021].

3 The implemented e-services are characterized by a high degree of responsiveness; they rely on cloud computing and mobile applications and have been fully adjusted to the WCAG 2.0. standards and Regulation on the National Interoperability Framework. The project shortened the time needed for handling student affairs, improvement of recruitment and development of innovative educational services. [on-line] https://kampus.come.uw.edu.pl/ [Accessed 15 July 2021].

4 Marszycki [online]. As part of the pilot programme, the following fields of study and study specializations were prepared: machine learning, artificial intelligence, trusted artificial intelligence systems, cyber-security, [online] https://wwsi.edu.pl/pg.php/arth/projekt_wdrozenie_e-uslug_dedy__/1177/ [Accessed 15 July 2021].

5 The "e-UW: Development of e-services of the Warsaw University Related to Education" project: https://euslugi.uw.edu.pl/ [Accessed 15 July 2021]; project "Implementation of e-services dedicated to the WWSI academic milieu" at the Warsaw School of Computer Science (WWSI) co-financed from the funds of the Regional Operational Programme of the Mazowsze Province for years 2014–2020, https://wwsi.edu.pl/pg.php/arth/projekt_wdrozenie_e-uslug_dedy__/1177/ [Accessed 15 July 2021]; project of the WSPiA University of Rzeszów pertaining to the implementation of a modern e-service platform for students and academic and administrative employees of the university, assisting communication and education of students and services which may be used by all residents of the region. The project was also used to tighten the cooperation with economy and public institutions and improve access to knowledge resources. The project was co-financed from the Regional Operational Programme of the Podkarpackie Province 2014–2020, http://wspia.eu/uczelnia/aktualnosci/7610,nowoczesna-platforma-e-uslug-edukacyjnych-wspia.html [Accessed 15 July 2021].
6 Asseco for University – free Asseco, OCHK and Google initiative; Blackboard Learn Ultra; Revas Industry Business Simulation; Business Simulation – interactive online platform for universities and schools; Cloud Academy; CloudLabs; Coursairs – Mobile Education Platform for Universities; CyberSkiller; EDU web360; eTutor; Google for universities; IMGW-PIB – classes devoted to weather phenomena; INSPERA; KROTON Q4U – programme for remote examination; Lerni; MERIDIAN PRIME – multimedia online platform; Universality; WEBINARIA PŁ – lecture platform; WIKAMP PŁ – remote teaching platform; WIRTUALNA EDUKACJA.
7 Open AGH e-resources, Physics for tertiary schools in 3 volumes; Open Educational Resources of the Wrocław University of Technology – video lectures and online courses on mathematical analysis and physics; Open Educational Resources of the Warsa Open AGH e-textbooks University of Technology Open Educational Resources of the Łódź University of Technology; Wszechnica.org; Biblioteka Otwartej Nauki; Biblioteka Nauki; Otwórz książkę; CeON, Agregator CeON; POLONA National Digital Library; Open Resources; Pomorze Digital Library; Laboratories in Spain.

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4 Digital Technologies in the Process of University–Enterprise Relation Formation – Research Results

4.1 Research process methodology

My research was conducted in the interpretative[1] methodological stream for this thesis. For this purpose, the general method of incomplete numerical induction was used, as well as the specific method of interview[2] aiming to obtain in-depth and comprehensive results concerning the formation of long-term relations with enterprises by universities in Poland, an integrated research approach was applied, using direct positivist and interpretive research procedures (Figure 4.1). In choosing the two procedures, the author was guided primarily by the fact that the knowledge gained through the triangulation effect is complete than if only one of the research procedures is applied. The triangulation allows a holistic view of the research problem and provides a coherent empirical basis for conclusions (Biesta, 2010).

The formulation of the research problem is the starting point for the development of the research concept, i.e. the analysis of the problem in the light of the literature on the subject, the determination of the sources of necessary data and research methods and the adoption of necessary assumptions, hypotheses and theses. The research problem of this study can be reduced to the question: how to shape long-term relations between universities and enterprises based on value, the source of which is knowledge about digital technologies. It will require recognition of both the conditions of relations between Polish universities and enterprises (which has already been discussed in chapters 1, 2 and 3), as well as identification of the mechanism and main components of the process of establishing long-term relations on the market of higher education services (which will be presented in this chapter and in chapter 5).

To realize the objectives of the study and to verify the hypotheses (presented in the introduction to the book), we had to use information not only from secondary sources (analysis of the literature and found data in the first stage of the research) but above all to conduct our research - primary research (IDI[3], CATI[4] and FGI[5]– second stage), the results of which will be discussed in this chapter.

The conducted independent research comprised a set of objectives focused on identifying if the value, the source of which is the knowledge

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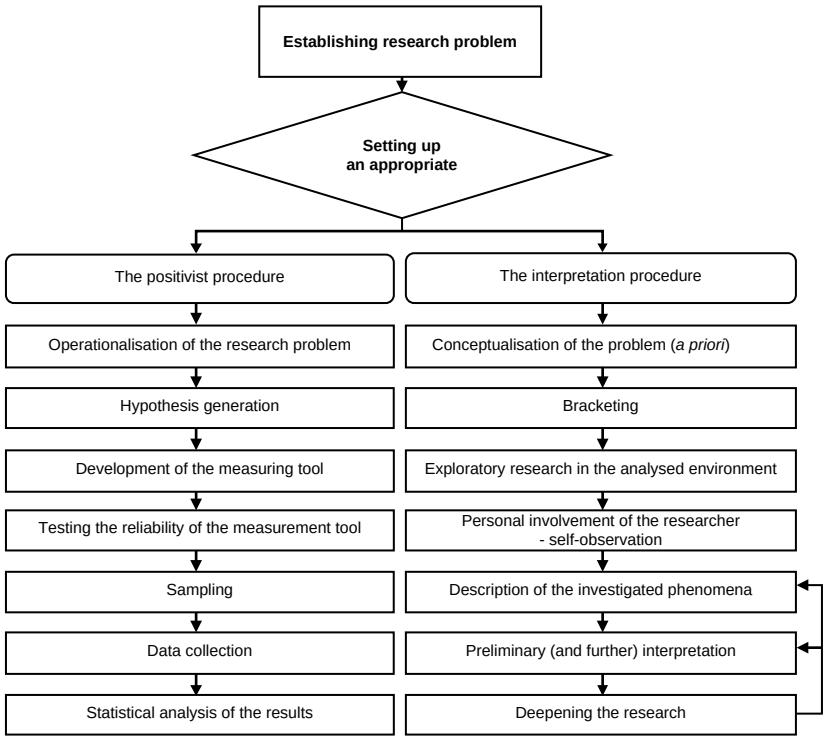

Figure 4.1 Stages in the research process.

Source: Own study based on Sagan (1998, p. 17).

about digital technologies, can be an essential factor in shaping relations between universities and enterprises. An important research aspect was to extend the previous theoretical findings with conclusions resulting from empirical research. Thanks to the use of various research methods and techniques, the mechanisms of functioning of higher education institutions (HEIs) in Poland were also identified. Based on the conducted primary research, which was implemented from December 2019 to September 2020, it was possible, among other things, to develop a model – a scheme of conduct enabling universities to form long-term relations with enterprises. The structure of the conducted primary research, based on positivist and interpretive research, is presented in Figure 4.2.

Research methodology, in general, indicates how to build a theory, whereas, in specific terms, it concretizes the rules of research procedure concerning objects researched by a given discipline. Therefore, one of the areas of interest of methodology is also research methods, according to which certain schemes of individual research activities (Stachak, 2006; Sosenko, 2008; Apanowicz, 2000) are carried out. The scheme of the research procedure,

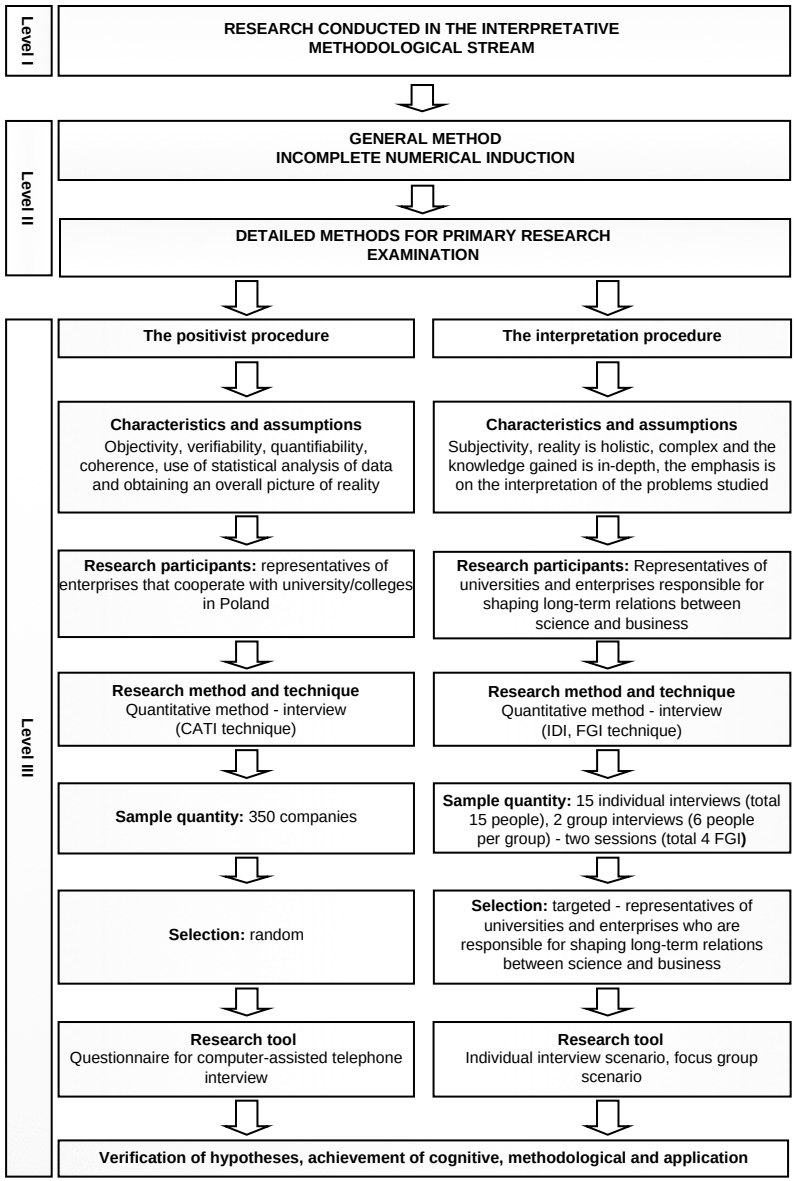

Figure 4.2 The structure of conducted empirical studies.

Source: Authors' elaboration based on the literature on the subject.

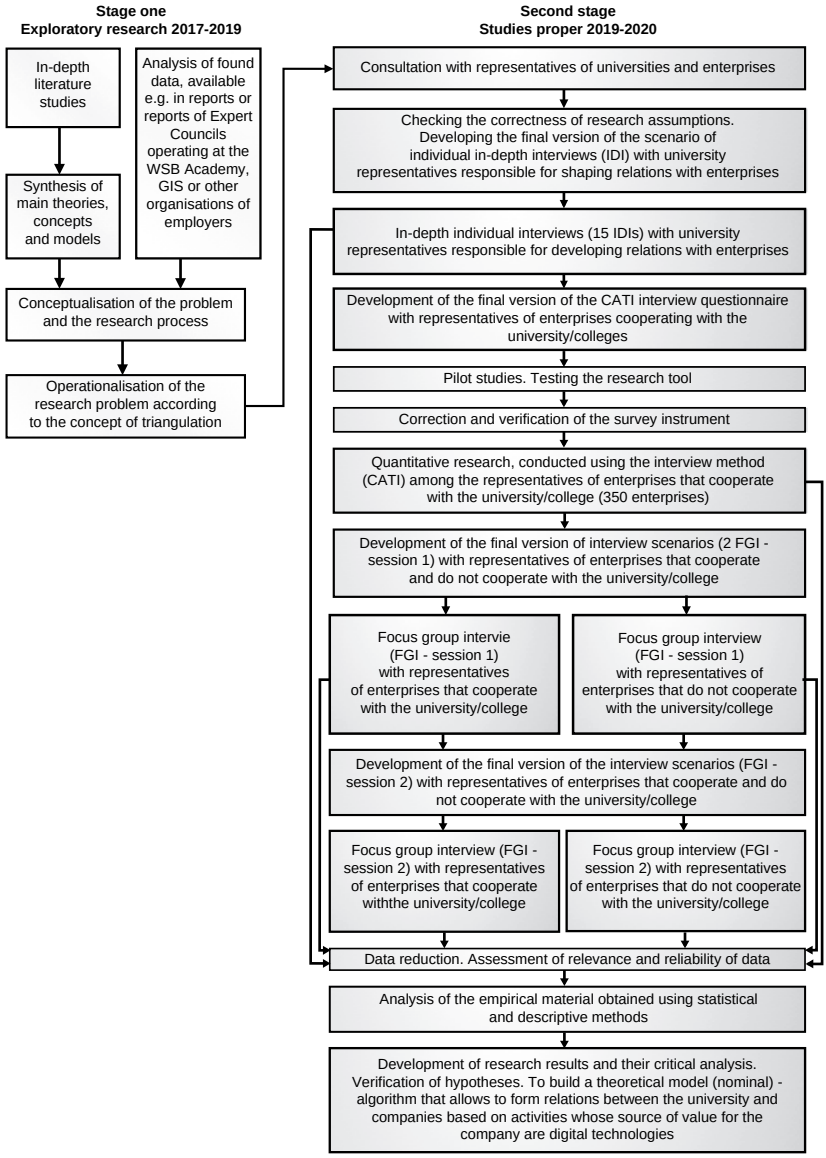

Figure 4.3 Research proceedings scheme.

Source: Authors' elaboration based on research assumptions.

which the author carried out for this paper, is presented in Figure 4.3. The research was carried out in two stages: the first (preliminary) of an exploratory nature (2017–2019) and the second (2019–2020), which included proper research using the interview method and statistical-descriptive methods.

The research proceedings began with in-depth domestic and foreign literature studies from management and quality sciences, economics or computer science. The literature search allowed to identify the research area, determine the thematic scope, establish definitions relevant to the topic research methods, acquire and consolidate information on knowledge management, relationship management, digital technologies or the functioning of the market of higher education services in Poland. The in-depth literature analysis provided a basis for synthesizing the main theories, concepts and models of shaping long-term relations between universities and enterprises. Moreover, it showed that the problem of shaping relations between HEIs and a group of institutional stakeholders such as enterprises (based on activities, the source of value for an enterprise is the knowledge on digital technologies) is very poorly recognized. At the same time, exploratory research was conducted, consisting of analysis of found data – available solutions in the area of knowledge management or relationship management, in particular, shaping long-term relations between universities and enterprises. In particular, it was an analysis of data collected in reports, studies of the Ministry of Science and Higher Education in Poland (currently the Ministry of Education and Science), the National Centre for Research and Development, universities in Poland, as well as selected organizations of employers (e.g. Regional Chamber of Commerce).

The literature studies and the analysis of the data provided enabled the operationalization of the research problem, as well as the development of the research procedure, appropriate both from the point of view of the process of forming long-term relations between universities and enterprises, and the specificity of digital technologies. The research process included IDIs, CATIs and FGIs.

Firstly, research was conducted using the interview method in the form of IDI with 15 experts – representatives of universities, who were directly involved in shaping relations between universities and institutional stakeholders (enterprises)[6]. Basic information about the conducted IDI interviews is presented in Table 4.1.

The interview scenario contained eight questions (in-depth open questions). The interviews (IDI) were conducted between May and June 2020. The research was preceded by consultations with various HEIs' employees responsible for shaping relations between universities and enterprises. The purpose of the consultations was to check the validity of the research assumptions and test the prepared research tool. Discussions in relevant groups allowed the final version of the IDI scenario to be refined, as a result of which the actual research could begin.

The information obtained from the IDI interviews made it possible to verify some of the research hypotheses and was also the starting point for the development of a questionnaire for CATI, which was used by the author in the quantitative research (i.a. the most important components of digital technology activities that may be applied in HEIs in the process of

Table 4.1 Basic information about the conducted qualitative research (IDI)

Specification	*Research*
Research method	Interview
Research technique	Individual in-depth interview (IDI)
Research tool	IDI scenario
Sampling	Purposeful (representatives of HEIs directly involved in the cooperation of HEIs with institutional stakeholders, in particular in the cooperation between science and business)
Sample size	15 persons
The spatial scope of the survey	Silesian voivodeship
Date of survey	May–June 2020

Source: Own research.

forming long-term relations with enterprises were defined, as well as the components, which were used by the author to define the factors determining the enterprise's inclination to establish or strengthen bonds with the HEI).

The next stage of direct research was quantitative research, carried out using the interview method. The research was conducted among representatives of enterprises that cooperate with universities. Enterprises were recruited for the research, whose representatives declared that the business entity they represent undertakes at least one of the following activities:

- welcomes students for work placements;
- looks for employees or volunteers in HEIs;
- gives its opinion on the educational programmes of an HEI;
- conducts joint education with a university (e.g. within the framework of organized courses, trainings, postgraduate studies);
- takes part in meetings and conferences organized at universities;
- cooperates with universities as a partner in projects, e.g. research and development projects;
- uses the expert knowledge of the academic staff;
- uses the results of research conducted at universities;
- gets involved in charity actions and other social activities organized by universities;
- participates in advisory bodies operating at universities, e.g. in the board of experts.

The research was carried out using the CATI technique in June, July and August 2020 on a sample of 350 enterprises cooperating with universities. The representatives of the surveyed enterprises, while answering the questions of the standardized interview, expressed their opinions on the researched areas of

the broadly understood cooperation between the university and the enterprise, in particular they commented on the importance and impact of particular activities of the university (related to the ongoing digital transformation) on the process of shaping relations between the university and the enterprise. Opinion surveys, despite the fact that they provide less objective information than real, observable and quantifiable quantities, are a widely recognized and used method of researching phenomena in management and quality sciences. Due to the lack of a complete sampling frame (list of all enterprises in Poland which cooperate with universities[7]), it was decided to use a specially prepared database of enterprises that undertake various forms of cooperation with universities and to draw lots from this database[8]. In order to prepare it, the author identified, verified, aggregated (combined) and then used several potential sources (databases) on business entities (enterprises) cooperating with universities. First, information was obtained from the websites of HEIs in Poland. Then, other sources were reviewed and critically analysed, including the available innovation rankings, such as the daily newspaper "Rzeczpospolita", the weekly magazine "Newsweek", the company Deloitte, the competitions "Laur Innowacyjności" (Federation of Science and Technology Associations NOT) or "Polski Produkt Przyszłości" (Polish Agency for Enterprise Development), as well as numerous lists and catalogues of Polish *start-ups*.

The listed data sets were prepared manually, based on information available on the Internet. In addition, the author obtained access to databases of the Industrial Development Agency (suppliers and recipients of technologies within the "Open Innovation Network") and beneficiaries of the Operational Programme Intelligent Development (as of the beginning of May 2020, narrowing down to economic entities). In addition, publicly available databases of enterprises were used, which were limited to industries with a particularly high probability of cooperation with universities. Due to the fact that the prepared database contained contact details of enterprises, it was decided to use the interview method, using the CATI technique. This technique is currently one of the more frequently used quantitative market research techniques. The quantitative research used a standardized interview questionnaire consisting of four parts: recruitment questions (3), introductory questions (2 control questions), factual questions (15) and metrics (3 questions), making a total of 23 questions. The author entrusted the technical implementation of the CATI survey (data collection) to the research agency Lokalne Badania Społeczne [Local Social Research] (LBS) based in Warsaw[9]. A total of 26 LBS agency tele-analysts worked on data collection (carried out under the supervision of the author). The average duration of the interview was 20 minutes. Prior to the actual research, the questionnaire was subjected to a trial study (pilot) in order to eliminate possible errors of the research tool and to assess its correctness and usefulness in achieving the objectives of the research. Basic information about the quantitative research conducted is presented in Table 4.2.

Table 4.2 Background information on the quantitative surveys carried out

Specification	*Research*
Research method	Interview
Research technique	Computer-assisted telephone interview (CATI)
Research tool	Standardized interview questionnaire
Sampling	Random (companies cooperating with universities were drawn from a database prepared by the author)
Sample size	350 companies
The spatial scope of the survey	Polish territory
Date of survey	June–August 2020

Source: Own research.

The main objective of the study was to obtain data related to the formation of long-term relations between HEIs and enterprises. The study focused mainly on determining the impact (its direction and strength) of the offer of HEIs, whose source is knowledge related to digital technologies, on the inclination of companies to establish and then strengthen ties with the university.

Factual questions were formulated mainly in the form of closed cafeteria questions. An ordinal scale (seven-point Likert scale) was also used for some questions. All questions were strictly subordinated to the aims of the study. The metric questions made it possible to analyse the results obtained in the research cross-sections and allowed to characterize the research sample (Table 4.3).

The sample was dominated by enterprises from the Masovian (18.86%), Silesian (11.14%), Greater Poland (9.43%) and Lesser Poland (8.86%) voivodeships. These were mostly small (55.71%) or medium-sized enterprises (30%), most often in IT (21.14%) or manufacturing (19.43%). Persons representing the surveyed companies (interviewees) were mainly middle management representatives (37.14%), as well as HR (15.43%) and marketing employees (11.71%).

The collected empirical material was analysed using statistical and descriptive methods such as correlation analysis, factor analysis and structural equation modelling (SEM). The analysis enabled the verification of hypotheses, as well as the development of a normative (optimization) model – a scheme of conduct enabling the shaping of long-term relations between HEIs and enterprises on the basis of knowledge on digital technologies.

The final stage of direct research was to conduct four FGIs. The interviews were divided into two thematic sessions carried out in parallel in two groups – with representatives of companies that cooperate (group one) and do not cooperate (group two) with universities. Session one was conducted online in October 2020 via the Zoom platform. Six experts participated in the interviews in each group – managers, employees co-responsible for making decisions regarding the company's development. Only persons representing entities employing at least 10 employees were recruited for the interview; in each group there were persons representing entities employing

Table 4.3 Characteristics of the surveyed sample (N = 350)

Specification *Voivodeship*	*Count*	
	#	*Industry* # *in %*
Masovia	66	18,86
Silesian	39	11,14
Greater Poland	33	9,43
Lesser Poland	31	8,86
Lower Silesia	28	8,00
Pomeranian	24	6,86
Lodzkie	22	6,29
West Pomeranian	19	5,43
Kuyavian-Pomeranian	17	4,86
Subcarpathia	14	4,00
Lublin	13	3,71
Lubusz	11	3,14
Swietokrzyskie	9	2,57
Warmia-Masuria	9	2,57
Opole	8	2,29
Podlaskie	7	2,00
Company's annual revenue	**#**	**in %**
PLN 1 million or less	49	14,00
PLN 2–10 million	74	21,14
PLN 11–100 million	46	13,14
over 100 million	13	3,71
refusal, no answer	168	48,00
Position in the company's internal hierarchy	**#**	**in %**
middle management (e.g. head of department)	130	37,14
personnel officer (human resources, HR)	54	15,43
marketing employee	41	11,71
PR officer (public relations, communications)	39	11,14
President, Board Member, Director	18	5,14
owner or co-owner of a company	15	4,29
other position	53	15,14
Company size (number of employees)	**#**	**in %**
micro-business (1–9)	15	4,29
small company (10–49)	195	55,71
medium-sized company (50–249)	105	30,00
large company (250 and more)	35	10,00
Industry	**#**	**in %**
IT (information technology)	74	21,14
manufacturing	68	19,43
health care, pharmaceuticals	29	8,29
general industry, mining, quarrying, metallurgy	29	8,29
finance, banking, insurance	19	5,43
transport, logistics	18	5,14
advisory, consulting, market research	14	4,00
energy, fuels, electricity, gas and water supply	13	3,71

(*Continued*)

Table 4.3 (Continued)

Specification *Voivodeship*	*Count*	
	#	*Industry* # *in %*
construction	12	3,43
marketing, sales	12	3,43
HR industry, education, training	11	3,14
media, advertizing, PR	10	2,86
real estate	9	2,57
trade and repairs	8	2,29
gastronomy, hotel industry, tourism	6	1,71
other sector	18	5,14

Source: Own research.

more than 50 employees, these were representatives of enterprises based in the area of Masovian, Silesian and Świętokrzyskie voivodeships. Session two (repeated group interviews) also taking place in October 2020 (Zoom platform) involved the same people who participated in session one. The basic characteristics of the qualitative FGI study are presented in Table 4.4.

Four research tools were developed for the FGI study – a separate scenario for each of the four interviews. All scenarios consisted of the following parts: introduction, warm-up, main part of the research (6 factual questions) and summary. The average duration of the interview was 80 minutes. The group interviews enabled the results of the quantitative CATI research, which was conducted from June to August 2020 with companies cooperating with universities, to be deepened. The main problems occurring in the process of forming relations between the university and the enterprise were also defined. Directions of actions from the area of relationship management were

Table 4.4 Basic information about the conducted qualitative research (FGI)

Specification	*Research*
Research method	Interview
Research technique	Focus group interview (FGI)
Research tool	FGI scenario
Sampling	Target ies) Group 1 (representatives of enterprises which cooperate with universities) Group 2 (representatives of enterprises which do not cooperate with universities)
Sample size	2 FGI × Group 1 (6 people) 2 FGI × Group 2 (6 people)
The spatial scope of the survey	Masovian, Silesian and Świętokrzyskie voivodeships
Date of survey	October 2020

Source: Own research.

also defined, which may be helpful in the process of forming long-term relations between universities and enterprises.

4.2 Relations between universities and enterprises in the light of quantitative research results

Referring to the author's earlier findings, the basis for shaping relations between the university and enterprises should be found in value, the sources of which may be found, among others, in knowledge on digital technologies. The value for institutional stakeholders of the university such as micro, small, medium and large enterprises is of key importance in the process of choosing the school above, with which the enterprise will establish and strengthen ties, and also contributes to the creation of satisfaction and, as a result, loyalty. As F.E. Webster states, the basis of marketing activity of an organization (including an HEI) is the process of defining, developing and delivering value to customers (HEI stakeholders) (2002). Therefore, it is worth taking a closer look at how the respondents perceive the cooperation between an enterprise and a university, what is a source of value for enterprises cooperating with universities, as well as how the relations existing between those entities are assessed.

As part of a CATI interview with representatives of 350 enterprises cooperating with universities, the respondents were asked to comment on nine statements regarding their perception of the activities of universities. The average ratings of the respondents broken down into micro (black line), small (red), medium (blue) and large enterprises (green) are presented in Table 4.5. What is very important for the process of forming long-term

Table 4.5 Perception of universities by surveyed representatives of enterprises cooperating with universities (the black line stands for micro, red for small, blue for medium and green for large enterprises)

No.	Statement (variable) (To what extent do you agree or disagree with the content of the following statements)	Averaged ratings on a scale of 1 to 7 (Where 1 means strongly disagree and 7 means strongly agree)
1	The university has a strong influence onthe socio-economic development of its surroundings	4,5 5,0 5,5 6,0
2	The university uses modern technologies in education and science	
3	University educates highly qualified graduates	
4	The university creates innovative solutions for society and economy	
5	University promotes modern technologies	
6	The university is committed to the digital transformation of society and the economy	
7	The university promotes social inclusion and cohesion	
8	The university engages in socially useful activities	
9	The university is committed to environmental protection	

Source: Own research.

relations between universities and enterprises, for each of the statements (with one exception, where the average was 4.5) the average on the seven-point scale was between two categories: "rather agree" (5) and "I agree" (6), so the level of acceptance of the presented beliefs is high. The highest ratings were given to statements referring to the broadly understood involvement of universities in the environment and the quality of education. The causative power of universities, understood as the influence on the socio-economic development of the commune, city or region, raises the greatest doubts.

The information presented in Table 4.5 shows that the evaluations of respondents representing micro, small, medium and large enterprises do not differ significantly. This is important information, because in the further part of the book (subchapter 4.3), the results of factor analysis and SEM analysis will be presented in relation to all companies (without distinction in terms of company size expressed in the number of employees).

In one of the questions of the CATI interview questionnaire, the researched enterprises' representatives were asked to indicate how many HEIs their organizations cooperate with. Nearly 90% of the surveyed enterprises cooperate with three or less universities, 69.7% of entities declare cooperation with one university only – these are mostly medium and small enterprises (Table 4.6).

Over 66% of enterprises maintain relations with universities in the period of 2–5 years; in the case of another 17% the period of cooperation is longer, while only 6% of enterprises cooperate with universities for a year or less. Therefore, in most cases we can talk about a longer history of cooperation. Medium enterprises most often cooperate with universities for 1 year or less, micro and small companies cooperate with universities for 2 to 3 years, whereas large economic entities cooperate with universities for 6 to 9 years (Table 4.6).

The information presented in Table 4.7 shows that the researched enterprises most often undertake simple forms of cooperation, which do not require very high involvement in the process of developing long-term relations with universities. The most common form of cooperation between enterprises and universities is taking students on internships – 66% of the surveyed entities declare such activity. Micro enterprises are least interested in this kind of cooperation (40%). Equally 32% of the researched entities look for employees or volunteers at universities – in particular it concerns large enterprises, of which over 51% undertake this form of cooperation. The companies least frequently (6% of the researched entities) decide to participate in advisory bodies operating at universities (e.g. expert councils issuing opinions on educational programmes). What is particularly important for the discussed subject, only every tenth researched organization is inspired by innovations from the area of digital technologies, which are disseminated by the university. At the same time, however, according to the representatives of the researched entities, it is this form of cooperation that fosters the creation of strong relations between the university and the enterprise. Therefore, the author's assumption that it is necessary to determine the mechanism and

Table 4.6 Basic information on cooperation between companies and universities

No.	*Specification*	*Company*									
		Micro N=15		*Small N=195*		*Medium N=105*		*Large N=35*		*Total N=350*	
		#	%	#	%	#	%	#	%	#	%
Number of universities with which the surveyed enterprises cooperate											
1	1 university	10	66,7	136	69,7	82	78,1	16	45,7	244	69,7
2	2–3 universities	5	33,3	37	19,0	12	11,4	11	31,4	65	18,6
3	4–5 universities	0	0,0	8	4,1	5	4,8	2	5,7	15	4,3
4	6 universities or more	0	0,0	2	1,0	1	1,0	3	8,6	6	1,7
5	don't know/ difficult to say	0	0,0	12	6,2	5	4,8	3	8,6	20	5,7
Total		15	100	195	100	105	100	35	100	350	100
Cooperation period											
1	1 year or less	0	0,0	9	4,6	11	10,5	1	2,9	21	6,0
2	from 2 to 3 years	9	60,0	69	35,4	20	19,0	6	17,1	104	29,7
3	from 4 to 5 years	6	40,0	73	37,4	40	38,1	11	31,4	130	37,1
4	from 6 to 9 years	0	0,0	16	8,2	14	13,3	11	31,4	41	11,7
5	10 years or more	0	0,0	12	6,2	4	3,8	3	8,6	19	5,4
6	don't know/ difficult to say	0	0,0	16	8,2	16	15,2	3	8,6	35	10,0
Total		15	100	195	100	105	100	35	100	350	100

Source: Own research.

Table 4.7 The most frequent forms of cooperation between an enterprise and a university/universities

No.	*Form of cooperation of a company with university(ies)*	*Company*									
		Micro N=15		*Small N=195*		*Medium N=105*		*Large N=35*		*Total N=350*	
		#	%	#	%	#	%	#	%	#	%
1	Admission of students for internships	6	40,0	134	68,7	66	62,9	25	71,4	231	66,0
2	Search for staff or volunteers at universities	3	20,0	51	26,2	40	38,1	18	51,4	112	32,0
3	Providing opinions on the educational programmes of higher education institutions	0	0	39	20,0	21	20,0	13	37,1	73	20,9
4	Conducting joint learning modules, courses, training	0	0	30	15,4	22	21,0	12	34,3	64	18,3
5	Participation in meetings and conferences organized at universities	3	20,0	42	21,5	32	30,5	12	34,3	89	25,4
6	Cooperation with universities as a partner in projects, e.g. research and development	0	0	51	26,2	25	23,8	11	31,4	87	24,9
7	Utilizing the expertise of academic staff	0	0	48	24,6	27	25,7	11	31,4	86	24,6
8	Use of university research results	3	20,0	32	16,4	24	22,9	9	25,7	68	19,4
9	Involvement in charities and other social activities organized by universities	9	60,0	60	30,8	12	11,4	6	17,1	87	24,9
10	Participation in university advisory bodies	0	0	14	7,2	3	2,9	4	11,4	21	6,0
11	Taking inspiration from innovations that are disseminated by the university, e.g. new technologies	2	13,3	19	9,7	9	8,6	5	14,3	35	10,0
12	Inviting the university as a partner in organized events, actions, etc.	1	6,7	28	14,4	5	4,8	5	14,3	39	11,1

Source: Own research.

components of the model that enables forming long-term relations between the university and enterprises based on value, the source of which is digital technologies, is very justified. Figure 4.4 presents an average score relating to the strength of relations occurring between universities and enterprises using a five-point scale (where 1 means that enterprises and university/colleges have very weak relations, while 5 means very strong relations). The white bars in Figure 4.5 indicate the willingness to further strengthen the relations between the enterprise and the university(ies) (based on a given form of cooperation)

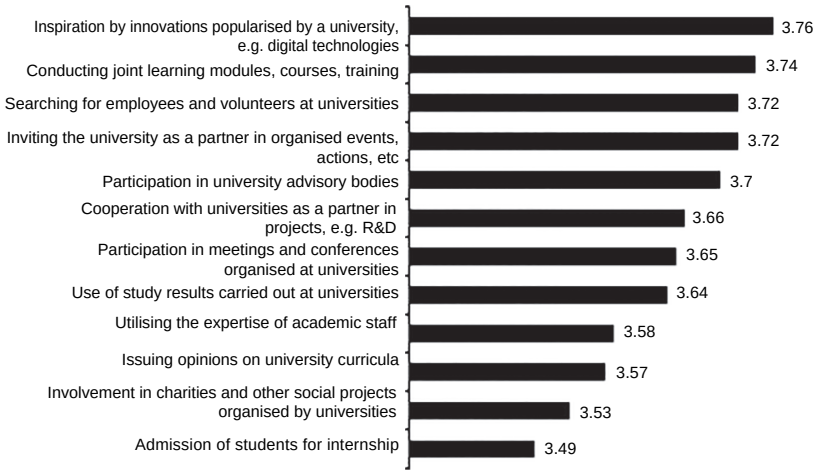

Figure 4.4 Relations between companies and universities according to the surveyed entities.

Source: Own research.

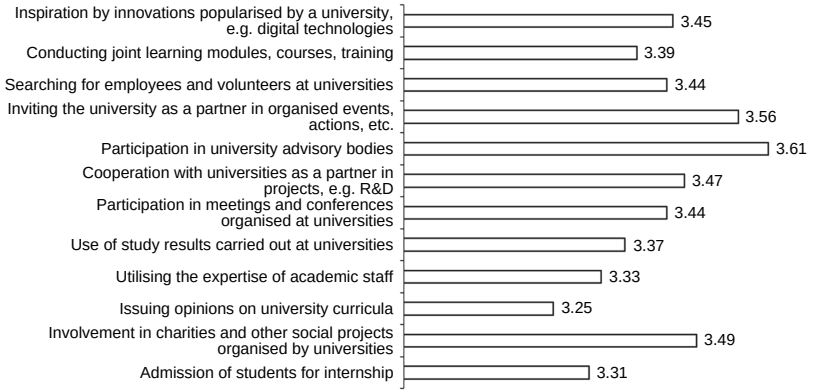

Figure 4.5 Willingness to further strengthen relations between the company and the university(ies)

Source: Own research.

in the future (where 1 means that strengthening of relations is very undesirable, while 5 means that strengthening of relations is very desirable).

The averaged evaluations presented in Figure 4.4 indicate that the strongest relations were noted among the surveyed enterprises that undertake the following forms of cooperation with universities:

- being inspired by innovations that are disseminated by the university, e.g. new digital technologies;
- running joint learning modules, courses, training;
- looking for staff or volunteers at universities;
- inviting the university as a partner to organized events, actions, etc.;
- participating in advisory bodies attached to the university.

In turn, the weakest relations with universities were noted among entities involved in charity and other social activities organized by universities, as well as those accepting students for internships.

An in-depth analysis of the collected material additionally revealed that half of the respondents assess their companies' relations with universities as strong, a similar group assesses them as neutral or ambivalent, while maintaining weak relations is declared by only 3% of people. The overall average on the scale of 1–5 is 3.49, which means that the declared strength of relations with universities is located between the ambivalent (3) and moderately positive category of answers (4). It is noteworthy that the obtained opinions are to a small extent polarized, which means that moderate assessments prevail over extreme ones (positive or negative). Based on the data, it can also be concluded that the strength of relations is positively influenced by the size of the organization (number of employees), the length of cooperation and the number of universities with which a given enterprise cooperates.

The data presented in Figure 4.5 show that entities that undertake advanced forms of cooperation with universities are most interested in strengthening relations with universities – they participate in advisory bodies operating at universities (assessment 3.61), and also invite universities as partners of organized projects, actions, etc. (assessment 3.56). The in-depth analysis of the collected data also shows that nearly 66% of the respondents would like their relations with universities to be "neither strong nor weak" within the next few years, while 30% expect stronger relations (mostly moderately strong). Increased strength of relations is expected first of all by representatives of enterprises, who assess the existing relations as strong (52% in this group, average score is 3.6), cooperate with 2–3 universities (45%), as well as maintain relations with universities for 4–5 years (38%).

The representatives of the surveyed enterprises were also asked whether they were satisfied with the cooperation with universities so far – the distribution of answers by micro, small, medium and large enterprises is presented in Table 4.8.

Table 4.8 The level within which representatives of the surveyed enterprises are satisfied with cooperation with university(ies)

No.	*To what extent are you satisfied with the cooperation between your company and the university(s)?*	*Company*									
		Micro N=15		*Small N=195*		*Medium N=105*		*Large N=35*		*Total N=350*	
		#	%	#	%	#	%	#	%	#	%
1	very satisfied (5)	5	33,3	89	45,6	30	28,6	19	54,3	143	40,9
2	fairly satisfied (4)	8	53,3	94	48,2	66	62,9	15	42,9	183	52,3
3	neither satisfied nor dissatisfied (3)	2	13,3	11	5,6	7	6,7	1	2,9	21	6,0
4	rather dissatisfied (2)	0	0,0	1	0,5	1	1,0	0	0,0	2	0,6
5	very dissatisfied (1)	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
6	don't know/difficult to say	0	0,0	0	0,0	1	1,0	0	0,0	1	0,3
7	SATISFIED (4+5)	13	86,7	183	93,8	96	91,4	34	97,1	326	93,1
8	DISSATISFIED (1+2)	0	0,0	1	0,5	1	1,0	0	0,0	2	0,6
Total		**15**	**100,0**	**195**	**100,0**	**105**	**100,0**	**35**	**100,0**	**350**	**100,0**
Arithmetic average		**4,2**		**4,39**		**4,2**		**4,51**		**4,34**	

Source: Own research.

The data presented in Table 4.7 show that the degree of enterprises' satisfaction of the cooperation with universities is high (a total of 93.2% of respondents marked very satisfied and fairly satisfied answers), of which 40.9% indicated the highest possible grade (5 – on a scale from 1 to 5, where 1 means very dissatisfied and 5 means very satisfied). Interestingly, a significantly higher degree of satisfaction (98%) was recorded in the group of entities that undertake more advanced forms of cooperation with a university/universites, e.g. conducting joint educational modules, courses or trainings. A vast majority of respondents believe that benefits from cooperation between the enterprise and the university are distributed equally to both parties (Table 4.8). This view is mostly shared by representatives of small enterprises, employing 10–49 employees (88.2%). Equally 8% of the researched believe that the beneficiaries of the cooperation between enterprise and university are primarily enterprises – most often these are persons declaring maintaining strong relations with universities (11%), as well as those expecting their strengthening in the next few years (12%). (Table 4.9)

A university, which aims at forming long-term relations with enterprises, should constantly monitor the expectations of both current and potential relationship partners. Therefore, business representatives were asked about the most desirable and undesirable resources of the "ideal" university (Table 4.10).

The information presented in Table 4.10 shows that answers of representatives of micro, small, medium and large enterprises do not differ significantly. The representatives of the surveyed enterprises most often indicated the following as the most desirable features of an "ideal" university: possession of modern technology and infrastructure, high education level, maintaining strong relations with the local community, shaping organizational culture based on knowledge and maintaining high availability of education, e.g. through e-learning. The last two places in the ranking were occupied by issues related to the participation of universities in co-creating public policies, both at regional and national level.

One of the main objectives of the study was to develop a model for the formation of long-term university–enterprise relationships under digital transformation; therefore, the respondents were asked about the most desirable university resources needed by the enterprise during the digital transformation process. The respondents' averaged ratings on a scale of 1 to 7 (where 1 means very undesirable resources and 7 means very desirable) are presented in Table 4.11.

Respondents considered the university's resources related to content knowledge and broader social competencies, as well as the ability to build relationships as desirable in the digital transformation process. The top positions in the ranking were occupied by issues related to universities' possession of specialist knowledge and competences, as well as some features of the so-called organizational culture, such as flexibility and openness to changes. Once again the assessments of the representatives of micro, small, medium and large enterprises did not differ significantly. Next, the

Table 4.9 The side that benefits more from university–enterprise cooperation

No.	*Who benefits more from university–enterprise collaboration?*	*Company*									
		Micro N=15		*Small N=195*		*Medium N=105*		*Large N=35*		*Total N=350*	
		#	%	#	%	#	%	#	%	#	%
1	universities	0	0	3	1,5	4	3,8	3	8,6	10	2,9
2	enterprises	1	6,7	14	7,2	8	7,6	5	14,3	28	8,0
3	both equally	13	86,7	172	88,2	84	80,0	27	77,1	296	84,6
4	don't know/difficult to say	1	6,7	6	3,1	9	8,6	0	0,0	16	4,6
Total		**15**	**100,0**	**195**	**100,0**	**105**	**100,0**	**35**	**100,0**	**350**	**100,0**

Source: Own research.

Table 4.10 University resources desired by enterprises (the black line stands for micro, red for small, blue for medium and green for large enterprises)

No.	Statement (variable) (What should be the "ideal" university with which your company would like to cooperate in the future. What resources should such an "ideal" university have?)	Averaged ratings on a scale of 1 to 7 (Where 1 indicates a highly undesirable resource and 7 a highly desirable resource)
1	High level of education	3,5 4,0 4,5 5,0
2	Creation of or participation in consortia and networks, e.g. clusters, economic organisations	
3	Training leaders of change, building staff for the economy and society of the future	
4	Transfer of modern technologies to the society and economy	
5	Expert services, consulting, e.g. running a think tank	
6	Provision of useful services for business	
7	Provision of useful services for public administration	
8	Provision of useful services for non-governmental organisations	
9	Conducting and supporting socially responsible activities	
10	Possessing modern technology and infrastructure	
11	Issuing opinions on important legal acts and legislative changes	
12	Co-production of public policies, e.g. strategic and programme documents	
13	Maintaining high accessibility of education, e.g. through e-learning	
14	Involvement in the process of digital transformation of society and economy	
15	Providing interdisciplinary education	
16	Maintaining strong relations with the local community	
17	Maintaining strong international relations	
18	Maintaining cooperation with many partners	
19	Developing a knowledge-based organisational culture	

Source: Own research.

respondents were presented with a set of 18 solutions from the area of digital technologies, solutions, which the representatives of the surveyed entities would like to learn more about or apply in their enterprises within the next 5 years. The interviewed persons provided answers using a seven-point scale. Most of the interviewees (depending on the statement: 57–79%) expressed interest in using the presented solutions, while 7–21% of respondents expressed a different opinion. Average ratings by micro, small, medium and large enterprises are presented in Table 4.12.

The CATI interviews conducted show that representatives of the surveyed companies would mainly like to learn about or implement in their organizations' solutions aimed at better protection of IT networks, devices, programmes and data from hacker attacks, damage or unauthorized access, i.e. those related to cyber security (a total of 79% of positive answers, the

Table 4.11 Desirable university resources needed for digital transformation (the black line stands for micro, red for small, blue for medium and green for large enterprises)

No.	**Statement (variable)** (Which resources are desirable and which are undesirable for a university to be a valuable partner to the enterprise in digital transformation)	**Averaged ratings on a scale of 1 to 7** (Where 1 indicates a highly undesirable resource and 7 a highly desirable resource)
1	Management competences in the context of university development, including digital transformation	4,5 5,0 5,5 6,0
2	Teaching competences of university staff providing practical education in the context of digital transformation	
3	Scientific and research competences of university staff in the context of developing research on digital transformation	
4	Ability to cooperate with the socio-economic environment of the university	
5	Ability to motivate the academic community to engage in the digital transformation process	
6	The university's ability to use the resources of other organisations involved in the digital transformation process	
7	Use of market-applied technologies and solutions in the area of digital transformation	
8	Possession of social competences, e.g. effective communication and relationship building with others	
9	High level of ethics	
10	Expertise in the area of digital transformation	
11	Ability to simultaneously compete and co-operate with other academic units involved in the digital transformation process	
12	Dissemination of innovative solutions in the area of digital transformation	
13	Flexibility, adapting to the needs of an environment undergoing digital transformation	
14	International cooperation in the context of digital transformation	

Source: Own research.

average score is 5.63). An equally high proportion of positive responses, i.e. 79%, was given to solutions for IT systems enabling the collection, analysis and management of information from a wide variety of distributed sources, e.g. big data (average score 5.46). On the other hand, 77% of the surveyed would like to learn about or apply in their enterprises' solutions aimed at automation of management processes, e.g. e-mail handling, processing of a part of financial transactions, i.e. process automation, robotization (mean score of 5.35) – most often these are large enterprises (89%) and entities cooperating with at least six universities (100%). Nearly 75% of the respondents are interested in solutions enabling them to strengthen relations between their organizations and clients by means of IT systems organizing, analysing and evaluating previous mutual experiences, i.e. designing new experiences (mean score of 5.40). The research also shows that 74% of the representatives of enterprises would like to learn about or apply solutions enabling secure storage of information based on creating and recording the full path (chain) of data flow, i.e. blockchain (average score of 5.39) – most often these are entities cooperating with six or more universities (100% in this group of entities). The same share of positive indications was also given to the solution concerning IT systems supporting

Table 4.12 Interest of the surveyed companies in digital technology solutions (the black line stands for micro, red for small, blue for medium and green for large enterprises)

No.	Statement (variable) (Would you like to familiarise yourself with or apply these solutions in your company over the next five years?)	Averaged ratings on a scale of 1 to 7 (Where 1 means definitely no and 7 means definitely yes)
1	Information systems to support decision-making in an organisation, e.g. marketing (artificial intelligence)	3,25 4,0 4,75 5,5 6,25
2	Information systems for collecting, analysingand managing information from a wide range of distributed sources *(big data)*	
3	Solutions aimed at automation of management processes (e.g. e-mail service, processing of a part of financial transactions) (process automation, robotisation)	
4	Solutions for strengthening the relationship between organisations and their customers through systems for the IT organisation, analysis and evaluation of mutual experiences	
5	Solutions to increase the speed and security of data processing by, among other things, moving computing power closer to the data originator *(Edge Computing)*	
6	Solutions for secure information storage based on creating and saving the full path (chain) of data flow *(blockchain)*	
7	Solutions for storing data, files, applications, software or information systems on the servers of an external provider	
8	Solutions to better protect IT networks, devices, programs and data from hacker attacks, damage or unauthorised access	
9	Computer-assisted conversational systems (e.g. virtual advisors providing advice or answers to customers' questions, *chatbots*)	
10	Solutions that replace people in simple professional activities (e.g. holograms providing information or advice to customers)	
11	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)	
12	Solutions that replace people in simple household tasks (e.g. smart hoovers, lawn mowers)	
13	Solutions that replace humans in more complex domestic activities (e.g. humanoid robots caring for elderly or disabled people)	
14	Solutions based on mobile communication with multiplied (beyond standard) data transfer (e.g. remote treatment of people by continuous monitoring of their vital signs)	
15	Solutions that give smart features to appliances by, among other things, connecting them to the internet (e.g. smart fridges whose contents can be checked via a smartphone app)	
16	Solutions aimed at so-called machine learning (e.g. enabling a computer to perform tasks for which it was not previously programmed, machine learning)	
17	Computer simulation solutions that create images of real or artificial reality, e.g. computer simulations of objects, spaces or events	
18	Solutions allowing computer simulations combining the real world with computer generated images (e.g. superimposing real-time 3D graphics on a camera image)	

Source: Own research.

decision-making in the organization, e.g. marketing, based on artificial intelligence – the highest result was recorded among small companies, employing 10–49 employees (79%).

The information presented in Table 4.11 shows that the interest in digital technology solutions is related to the size of the enterprise measured by the

number of employees. In general, it can be stated that the lowest interest in digital technologies was observed in the group of micro-enterprises. Such an observation is not surprising, as the smallest entities have specific needs and limited potential for implementing some of the presented technological solutions.

University managers, who care about establishing and strengthening the links between HEIs and enterprises, should identify to what extent potential partners are willing to engage in the process of shaping long-term relations in the market of higher education services. They should identify the willingness of micro, small, medium and large enterprises to establish and strengthen links. Following this assumption, the representatives of the surveyed enterprises were asked to respond to 14 statements (developed based on previous IDI interviews), which describe the propensity of the surveyed enterprises to establish or strengthen ties with the university. Averaged results in relation to micro, small, medium and large enterprises are presented in Table 4.13.

From the information presented in Table 4.13, a conclusion can be drawn that the researched representatives of small, medium and large enterprises show a very similar – high – inclination to establish and strengthen

Table 4.13 Interest of the surveyed enterprises in cooperation with universities (the black line stands for micro, red for small, blue for medium and green for large enterprises)

No.	Statement (variable) (To what extent do you agree or disagree with the content of the following statements)	Averaged ratings on a scale of 1 to 7 (Where 1 means strongly disagree and 7 means strongly agree)
1	I would like to find out more of what the university has to offer	4,0 4,5 5,0 5,5 6,0
2	I recommend or will recommend cooperation with the university to my business partners	
3	I engage or would like to engage the university as a partner in our actions or social campaigns	
4	I would like to participate in conferences or other meetings organised by selected universities	
5	I would like to use modern technologies provided by selected universities	
6	I would like to use the results of research conducted by selected universities for business development	
7	I would like to benefit from the expertise and advice of selected universities	
8	I would like tobecome involved in expert or advisory institutions at selected universities	
9	I would like to have an influence on the educational offer, faculties and curriculum of selected universities	
10	I would like to create joint business ventures with selected universities	
11	I would like to create joint research and development ventures with selected universities	
12	I would like to create joint international projects with selected universities	
13	I would like to benefit from the transfer of knowledge and innovation from selected universities to my company	
14	I would like my company to undergo a digital transformation with the support of selected universities	

Source: Own research.

bonds connecting them with universities. For each of the 14 statements, an average score of between 5 and 6 was recorded, which places it between two categories: "rather agree" and "agree" and indicates a high level of acceptance of the beliefs. Slightly lower ratings were recorded for micro-enterprises. However, the black line presented in the figure, referring to the responses of representatives of micro-enterprises, is shifted in relation to the red line (small enterprises), the blue line (medium enterprises) and green line (large enterprises) by approximately one unit, which is why the author decided that despite this difference, further in-depth analysis (factor analysis and SEM, which will be conducted in the next subsection) can be conducted on all enterprises jointly.

The analysis of information presented in Table 4.13 allows us to state that the representatives of the researched entities most often prefer simple forms of cooperation with universities related to using the university's offer, e.g. in the area of expert knowledge or conducted research. To a large extent, this kind of indication can be considered a willingness of enterprises to establish ties with universities. More advanced forms of cooperation requiring greater enterprise involvement were preferred slightly less frequently. Cooperation, which builds mutual trust and good recognition of the partner's potential, may be considered a sign of willingness to strengthen or deepen the relationship with the university/universities.

4.3 Impact of knowledge about digital technologies on establishment and reinforcement of bonds between universities and enterprises

Moving on to the determination of impact that knowledge exerts on individual digital technologies (which are "relayed" by the Polish universities) on the enterprises' inclination to establish and to reinforce bonds with universities, it was necessary to define the components of such technologies that are the most important in the process of forming long-term relations. These components, adopting a form of adequately selected statements, could be applied in the studies of relations between universities and enterprises. The statements were defined by the author based on the information received from university representatives, who were directly engaged in cooperation between a university and an enterprise.[10] A total of 18 statements were prepared (Table 4.14), which were used to measure the force of impact of knowledge about individual digital technologies in the process of formation of long-term relations between universities and enterprises. The statements were aligned to a seven-degree Likert scale, ranging from the "strongly disagree" (1) to "strongly agree" (7) answers. The basic descriptive statistics for all 18 statements are presented in Table 4.14.

The enterprises' (which cooperate with universities) inclination to establish or to reinforce bonds with universities was measured with the use of 14 statements prepared by the author (similarly to the previous case) based

Table 4.14 Basic descriptive statistics for statements pertaining to digital technologies

No.	*Statement (variable) (Would you like to learn or apply these solutions in your enterprise in the next 5 years?)*	*Statistics*	*Value*	*Standard error*
1	IT systems supporting decision-making in an organization (e.g. artificial intelligence) [P11a]	Average	5.1343	0.06678
		Median	5.0000	-
		Variance	1.561	-
		Standard deviation	1.24928	-
		Skewness	−0.513	0.130
		Kurtosis	0.242	0.260
2	IT systems allowing for compilation, analysis and management of information deriving from multiple diverse dispersed sources (*Big Data*) [P11b]	Average	5.4343	0.06985
		Median	6.0000	-
		Variance	1.708	-
		Standard deviation	1.30679	-
		Skewness	−0.960	0.130
		Kurtosis	0.818	0.260
3	Solutions focused on automation of managerial processes, e.g. e-mail handling, processing of financial transactions (process automation, robotization) [P11c]	Average	5.3600	0.07487
		Median	6.0000	-
		Variance	1.962	-
		Standard deviation	1.40061	-
		Skewness	−1.013	0.130
		Kurtosis	0.845	0.260
4	Solutions allowing for reinforcement of relations connecting organizations with clients via IT systems of ordering, analysis and evaluation of mutual experiences (design of new experiences) [P11d]	Average	5.3600	0.07595
		Median	6.0000	-
		Variance	2.019	-
		Standard deviation	1.42092	-
		Skewness	−0.715	0.130
		Kurtosis	−0.077	0.260
5	Solutions enabling an increase in speed and safety of data processing consisting - among others - in transfer of the computing capacity closer to the place of data generation (*edge computing*) [P11e]	Average	5.3057	0.07764
		Median	6.0000	-
		Variance	2.110	-
		Standard deviation	1.45248	-
		Skewness	−0.899	0.130
		Kurtosis	0.431	0.260
6	Solutions allowing for safe storage of information, relying on creation and saving a full path (chain) of data flow (*blockchain*) [P11f]	Average	5.3000	0.07896
		Median	6.0000	-
		Variance	2.182	-
		Standard deviation	1.47714	-
		Skewness	−0.855	0.130
		Kurtosis	0.326	0.260
7	Solutions allowing for storage of data, files, applications, software or IT systems on external supplier's servers (*cloud computing*) [P11g]	Average	5.2743	0.07907
		Median	6.0000	-
		Variance	2.188	-
		Standard deviation	1.47924	-
		Skewness	−0.769	0.130
		Kurtosis	0.086	0.260

(*Continued*)

Table 4.14 (Continued)

No.	*Statement (variable) (Would you like to learn or apply these solutions in your enterprise in the next 5 years?)*	*Statistics*	*Value*	*Standard error*
8	Solutions aimed at better protection of IT networks, devices, programmes and data from hackers' attacks, damages or unauthorized access (cyber-security) [P11h]	Average	5.5543	0.08105
		Median	6.0000	–
		Variance	2.299	–
		Standard deviation	1.51636	–
		Skewness	−1.096	0.130
		Kurtosis	0.665	0.260
9	IT systems enabling computer-assisted conversations, e.g. virtual consultants offering advice or answering questions of clients, *chatbot* [P11i]	Average	5.0086	0.08569
		Median	5.0000	–
		Variance	2.570	–
		Standard deviation	1.60316	–
		Skewness	−0.698	0.130
		Kurtosis	−0.121	0.260
10	Solutions that replace people in simple professional activities, e.g. holograms offering information or advice to clients [P11j]	Average	4.8914	0.08874
		Median	5.0000	–
		Variance	2.756	–
		Standard deviation	1.66015	–
		Skewness	−0.658	0.130
		Kurtosis	−0.304	0.260
11	Solutions that replace people in more complex professional activities, e.g. a humanoid robot replacing a reception desk assistant in a hotel or a shop assistant [P11k]	Average	4.7057	0.09114
		Median	5.0000	–
		Variance	2.907	–
		Standard deviation	1.70511	–
		Skewness	−0.500	0.130
		Kurtosis	−0.586	0.260
12	Solutions that replace people in simple household tasks, e.g. smart vacuum cleaners, smart lawnmowers [P11l]	Average	5.0257	0.08906
		Median	5.0000	–
		Variance	2.776	–
		Standard deviation	1.66609	–
		Skewness	−0.733	0.130
		Kurtosis	−0.195	0.260
13	Solutions that replace people in complex household chores, e.g. humanoid robots taking care of elderly or disabled persons [P11m]	Average	4.6543	0.09356
		Median	5.0000	–
		Variance	3.064	–
		Standard deviation	1.75029	–
		Skewness	−0.548	0.130
		Kurtosis	−0.559	0.260
14	Solutions based on mobile communication with multiplied (above-standard) data transfer, e.g. remote treatment of people by monitoring their vitals, remote control of facilities, 5G [P11n]	Average	4.9314	0.08755
		Median	5.0000	–
		Variance	2.683	–
		Standard deviation	1.63798	–
		Skewness	−0.708	0.130
		Kurtosis	−0.114	0.260

(*Continued*)

Table 4.14 (Continued)

No.	*Statement (variable) (Would you like to learn or apply these solutions in your enterprise in the next 5 years?)*	*Statistics*	*Value*	*Standard error*
15	Solutions providing the devices with smart features, e.g. by connecting them to the Internet, e.g. smart fridges where the content can be checked the use of a smartphone app (Internet of Things, IoT) [P11o]	Average	4.9914	0.08934
		Median	5.0000	-
		Variance	2.794	-
		Standard deviation	1.67141	-
		Skewness	−0.701	0.130
		Kurtosis	−0.243	0.260
16	Solutions focused on the so-called machine learning, e.g. allowing a computer to perform tasks for which it has not been programmed before, machine learning [P11p]	Average	4.9029	0.08462
		Median	5.0000	-
		Variance	2.506	-
		Standard deviation	1.58313	-
		Skewness	−0.763	0.130
		Kurtosis	−0.002	0.260
17	Solutions that enable computer simulations which create images of physical or virtual reality, e.g. computer simulations of objects, spaces or events (virtual reality) [P11r]	Average	4.9457	0.08725
		Median	5.0000	-
		Variance	2.665	-
		Standard deviation	1.63238	-
		Skewness	−0.807	0.130
		Kurtosis	−0.035	0.260
18	Solutions that enable computer simulations that combine the real world with computer-generated images, e.g. superimposing real-time 3D graphics on a camera image, augmented reality [P11s]	Average	4.9600	0.08417
		Median	5.0000	-
		Variance	2.480	-
		Standard deviation	1.57473	-
		Skewness	−0.819	0.130
		Kurtosis	0.061	0.260

Source: Own research.

on the completed IDI with university representatives (Table 4.15). The statements were aligned to a seven-degree Likert scale, ranging from answers "strongly disagree" (1) to "strongly agree" (7). Basic descriptive statistics for all 14 statements are presented in Table 4.15.

A combination of exploratory and confirmatory statistics was applied in the analyses. First of all, the normality of distribution was checked with the use of the Shapiro–Wilk and Kolmogorov–Smirnov test, yet – in line with the expectations – no satisfactory results were obtained, which is a typical observation in the case of questions with a seven-degree (or more extended) scale. Given the above, the Q–Q plot visual verification (quantile–quantile plots) was used to assess the analytical utility of the applied tools. On this basis, all variables were qualified for further analyses.

Next, in reference to the variables from the digital technology area, exploratory factor analysis was carried out with the use of the method of

Table 4.15 Basic descriptive statistics for statements pertaining to the inclination to establish and reinforce bonds between a surveyed enterprise and university

No.	*Statement (variable) (To which degree do you agree or disagree with the content of the statements below?)*	*Statistics*	*Value*	*Standard error*
1	I would like to learn more about the university's offer [P7j]	Average	5.0229	0.06267
		Median	5.0000	-
		Variance	1.375	-
		Standard deviation	1.17253	-
		Skewness	−0.280	0.130
		Kurtosis	0.436	0.260
2	I recommend or will recommend cooperation with the university to my business partners [P7k]	Average	5.5943	0.05810
		Median	6.0000	-
		Variance	1.182	-
		Standard deviation	1.08703	-
		Skewness	−0.567	0.130
		Kurtosis	0.187	0.260
3	I engage or I would like to engage a university as a partner in our social actions or campaigns [P7l]	Average	5.4371	0.05851
		Median	6.0000	-
		Variance	1.198	-
		Standard deviation	1.09455	-
		Skewness	−0.524	0.130
		Kurtosis	0.073	0.260
4	I would like to participate in conferences or other meetings organized by selected universities [P7m]	Average	5.4200	0.06198
		Median	6.0000	-
		Variance	1.345	-
		Standard deviation	1.15956	-
		Skewness	−0.647	0.130
		Kurtosis	0.282	0.260
5	I would like to use modern technologies popularized by selected universities [P7n]	Average	5.4600	0.06156
		Median	5.0000	-
		Variance	1.326	-
		Standard deviation	1.15173	-
		Skewness	−0.558	0.130
		Kurtosis	0.430	0.260
6	I would like to use the results of studies carried out by selected universities for the sake of enterprise's development [P7o]	Average	5.4057	0.06004
		Median	5.0000	-
		Variance	1.262	-
		Standard deviation	1.12332	-
		Skewness	−0.507	0.130
		Kurtosis	0.142	0.260
7	I would like to use expert knowledge and counselling of selected universities [P7p]	Average	5.5171	0.05675
		Median	6.0000	-
		Variance	1.127	-
		Standard deviation	1.06170	-
		Skewness	−0.688	0.130
		Kurtosis	0.750	0.260

(*Continued*)

Table 4.15 (Continued)

No.	*Statement (variable) (To which degree do you agree or disagree with the content of the statements below?)*	*Statistics*	*Value*	*Standard error*
8	I would like to be engaged in the activities of expert or consulting institutions operating by selected universities, e.g. expert committees, patronage councils or university councils [P7r]	Average	5.4371	0.05948
		Median	6.0000	-
		Variance	1.238	-
		Standard deviation	1.11273	-
		Skewness	−0.625	0.130
		Kurtosis	0.415	0.260
9	I would like to influence the educational offer, directions of teaching and curricula at selected universities [P7s]	Average	5.2114	0.07408
		Median	5.0000	-
		Variance	1.921	-
		Standard deviation	1.38592	-
		Skewness	−0.793	0.130
		Kurtosis	0.584	0.260
10	I would like to create joint business projects with selected universities [P7t]	Average	5.3657	0.06607
		Median	5.0000	-
		Variance	1.528	-
		Standard deviation	1.23603	-
		Skewness	−0.659	0.130
		Kurtosis	0.389	0.260
11	I would like to create research and development projects with selected universities [P7u]	Average	5.3657	0.06705
		Median	6.0000	-
		Variance	1.574	-
		Standard deviation	1.25443	-
		Skewness	−0.823	0.130
		Kurtosis	.945	0.260
12	I would like to create joint international projects with selected universities [P7w]	Average	5.3514	0.06770
		Median	6.0000	-
		Variance	1.604	-
		Standard deviation	1.26647	-
		Skewness	−0.710	0.130
		Kurtosis	0.385	0.260
13	I would like to make use of knowledge and innovation transfer from selected universities to my company [P7x]	Average	5.4743	0.06198
		Median	6.0000	-
		Variance	1.345	-
		Standard deviation	1.15957	-
		Skewness	−0.741	0.130
		Kurtosis	0.724	0.260
14	I would like my company to undergo digital transformation with support from selected universities [P7y]	Average	5.3286	0.06754
		Median	5.0000	-
		Variance	1.597	-
		Standard deviation	1.26357	-
		Skewness	−0.749	0.130
		Kurtosis	0.619	0.260

Source: Own research.

Table 4.16 Results of the KMO test and Bartlett's Test of Sphericity for variables related to digital technologies

Kaiser–Meyer–Olkin measure of sampling adequacy		*0.946*
Bartlett's Test of Sphericity	Approx. Chi-Square	5792.870
	df	153
	Sig.	0.000

Source: Own research.

principal component and the Varimax orthogonal rotation with the use of SPSS (Aczel & Sounderpandian, 2017). The analysis was preceded by the performance of the Keiser–Mayer–Olkin (KMO) test and Bartlett's Test of Sphericity. The operation of this type was used to make sure that the factor analysis is justified. The KMO measure adopts values from 0 to 1. The closer the value to 1, the more justified it is to carry out the factor analysis. If the KMO adopts a value lower than 0.7, this may be caused by, e.g. too low number of respondents as compared to the number of questions, incorrect structure of test items or too uniform structure of the sample. Additionally, Bartlett's Test of Sphericity was also carried out, which verifies the hypothesis about the individual correlation matrix. If it is significant, it means that the factor model is adequate for the analysed variables, i.e. the aforementioned variables are significantly statistically linked. Both tests offered results that justify the performance of a factor analysis (Table 4.16).

For the specified set, the KMO measure amounts to 0.946, which is a very satisfactory result, hence a significant reduction of redundancy of the input set of 18 statements may be expected. The result of Bartlett's Test of Sphericity for the surveyed set is on the B = 5792.87 level (df = 153, p-value = 0.000), which means rejection of the proposed zero hypothesis. Hence, it may be concluded that the use of the factor analysis was justified.

Given the specific nature of the applied tools, the distributions of answers received for the questions referring to the knowledge about digital technologies remained dispersed. In the case of each of these questions, factors were distinguished from a large number of occurring variables. In other words, the operation consisted in combining the mutually related variables and – in consequence – a significant reduction of their number. In this way, a definitely smaller number of generalized, synthetic groups of variables known as factors were created. The variables which are correlated with individual factors to the greatest degree have the greatest share in their creation.

The data set created during the analysis may be interpreted as a coordinate system. A statistical procedure was performed on this input set, consisting in performance of a variance maximizing rotation (*varimax*). This mode of rotation allowed for receiving results that facilitate identification of every variable with the use of a single factor to the greatest

degree. The analysis of relations between variables and factors (factor loads) was pictured in the form of the so-called Rotated Component Matrix. It shows the force with which individual variables affect the structure of every factor.

A total of 18 variables (cf. Table 4.14) were taken into account in the factor analysis. As a result of the performed analysis, three factors were identified that significantly clarify the variety observed in the input data set. The three distinguished factors account for almost 74.1% of variability of the input data set. This means that reduction of the 18-dimension set to the 3-dimension set described with the distinguished factors results in a loss of only approx. 25.9% of full information from the input set. Some variables (5) were rejected due to no possibility of assigning a given variable to a specific factor (similar values of loads in the case of both components). Using the Varimax orthogonal rotation, the final distribution of factor loads is presented in Table 4.17.

It follows from the results contained in Table 4.17 that 13 out of 18 input variables were assigned to three factors. The variables are moderately strong and strongly bound to each factor. The following factors have been distinguished:

- factor 1: interest in solutions in the area of process monitoring and automation – the factor comprises knowledge related to monitoring and automation and replacing people in household and professional activities;
- factor 2: interest in data integration and big data analytics – solutions comprising knowledge related to compilation, integration and processing of large sets of data as support in the decision-making process;
- factor 3: interest in cyber-security and protection of data – issues related to knowledge on network protection, e.g. from a hacker's attack or another unauthorized access.

Similarly to variables in the area of digital technologies in reference to variables describing the enterprises' willingness to establish and to reinforce bonds with a university, an exploratory factor analysis was carried out with the use of the principal component method and orthogonal Varimax rotation with the use of SPSS. All the assumptions remained unchanged. In effect, the KMO sampling adequacy ratio reached 0.933. The Bartlett Test of Sphericity for the studied set is on the B = 3818.933 level (df = 91, p-value = 0.000) – Table 4.18.

Hence, it may be stated with absolute certainty that the use of the factor analysis is justified. The received results indicated their adjustment to data – none of the used scale items were eliminated from the analysis. Taking into account the degree of clarification of the variability of the initial data set, two factors were detected explaining 67.4% information for the full set of 14 observable variables. The variables are bound in a

Table 4.17 Distribution of factor loads for variables in the area of digital technology. Factor distinguishing method – principal factors. Rotation method – Varimax with Kaiser normalization a. Rotation was convergent in three iterations

Statement (variable)	*Factor*		
	1 Process automation and monitoring	*2 Data integration and big data analytics*	*3 Protection and cyber-security*
Solutions that replace people in complex professional activities, e.g. a humanoid robot replacing a reception desk assistant in a hotel or a shop assistant	**0.834**		
Solutions that replace people in complex household activities, e.g. humanoid robots taking care for elderly or disabled people	**0.832**		
Solutions that enable computer simulations which create images of physical or virtual reality, e.g. computer simulations of objects, spaces or events (virtual reality)	**0.784**	0.405	
Solutions that replace people in simple household tasks, e.g. smart vacuum cleaners, smart lawnmowers	**0.751**	0.301	
Solutions that enable computer simulations that combine the real world with computer-generated images, e.g. superimposing real-time 3D graphics on a camera image, augmented reality).	**0.738**	0.458	
Solutions based on mobile communication with multiplied data transfer, e.g. remote treatment by monitoring the vitals, remote control of facilities, 5G technology	**0.730**	0.389	
Solutions aimed at the so-called machine learning, e.g. allowing a computer to perform tasks for which it has not been programmed before, machine learning	**0.722**	0.398	
Solutions furnishing the devices with smart features, e.g. by connecting them to the Internet, e.g. smart fridges where the content can be checked the use of a smartphone app, Internet of Things	**0.713**	0.327	0.360
Solutions substituting people in simple professional activities, e.g. holograms offering information or advice to clients	**0.679**		0.533

(*Continued*)

Table 4.17 (Continued)

Statement (variable)	*Factor*		
	1 Process automation and monitoring	*2 Data integration and big data analytics*	*3 Protection and cyber-security*
IT systems supporting decision-making in an organization (e.g. marketing, artificial intelligence)		**0.817**	
IT systems allowing for compilation, analysis and management of information deriving from many diverse dispersed sources (Big Data)		**0.798**	
Solutions allowing for reinforcement of relations between organizations and clients via IT systems of ordering, analysis and evaluation of mutual experiences (design of new experiences)	0.330	**0.696**	0.356
Solutions aimed at better protection of IT networks, devices, programmes and data from hackers' attacks, damages or unauthorized access (cyber-security)		0.444	**0.743**

Source: Own research.

Table 4.18 The results of the KMO test and the Bartlett Test of Sphericity for variables pertaining to enterprises' inclination to establish and reinforce bonds with universities

Kaiser–Meyer–Olkin measure of sampling adequacy		0.933
Bartlett'sTest of Sphericity	Approx. Chi-Square	3818.933
	df	91
	Sig.	0.000

Source: Own research.

moderately strong way to every factor. Some variables (7) were rejected on account of:

- no possibility of assigning a given variable to a specific factor (similar values of loads in the case of both components);
- insignificant or difficult to interpret statements in the context of establishment or reinforcement of bonds.

Thanks to the performed statistical procedure, it is possible to determine the degree to which the aforementioned variables (factors) are responsible for the inclination to establish or reinforce bonds with a university. Using the

Table 4.19 Distribution of load factors for variables pertaining to enterprises' inclination to establish and reinforce bonds with universities. Factor distinguishing method – principal factors. Rotation method – Varimax with Kaiser normalization a. Rotation was convergent in three iterations

Statement (variable)	*Factor*	
	1 Reinforcement of bonds	*2 Bond establishment*
I would like to create joint international projects with selected universities	**0.810**	
I would like to create research and development projects with selected universities	**0.781**	0.398
I would like to influence the educational offer, directions of teaching and curricula at selected universities	**0.764**	0.305
I would like to create joint international projects with selected universities	**0.744**	0.392
I would like to use expert knowledge and counselling of selected universities		**0.775**
I would like to use the results of studies carried out by selected universities for the sake of enterprise's development	0.368	**0.754**
I would like to use modern technologies popularized by selected universities	0.409	**0.728**

Source: Own research.

Varimax orthogonal rotation, the final distribution of factor loads is presented in Table 4.19.

It follows from the data presented in Table 4.19 that seven out of fourteen input variables were assigned to two factors which may be described in the following manner:

- factor 1: willingness to reinforce a bond with a university, focused on close cooperation and implementation of joint projects, requiring engagement of both parties, good recognition of the mode of organization and processes, relations based on trust and mutual impact of both entities (universities and enterprises);
- factor 2: willingness to establish bonds with universities, encompassing simple forms of cooperation and use of expert university knowledge, not requiring significant engagement on the part of the enterprise and advanced cooperation.

The results of the performed factor analysis show that it was possible to generate three factors referring to the knowledge on digital technologies (1: Monitoring and process automation; 2: Data integration and big data

analytics, 3: Protection and cyber security), as well as two factors which clearly correspond to the "Establishment of bonds" and "Bond reinforcement" components, used to measure the force of impact of knowledge on digital technologies in the process of forming long-term relations between universities and enterprises at individual stages of such process. The factor loads assume values testifying to moderately strong correlation between the observable input variables and the reduced factors.

Next, an analysis of reliability of the components (factors) scale from the area of digital technologies and components pertaining to the enterprises' inclination to establish and to reinforce bonds with a university was carried out (Aczel & Sounderpandian, 2017). Scale reliability may be understood as its accuracy in the role of a measurement tool. It provides information about the degree to which the items forming a part of a given scale are similar to one another, i.e. measure the same phenomenon, the same mental construct.[11] The analysis was carried out with the use of SPSS and the *Reliability analysis* module. The Cronbach's Alpha model of internal consistency was selected as the analytical model, relying on average correlation among scale items.[12] This coefficient was most often applied to evaluate the reliability of the measuring tool.[13] The accepted values are values of the coefficient exceeding the level of 0.7 – in all of the analysed cases, the Cronbach's Alpha coefficient turned out to be very high (Table 4.20), which allowed for commencement of the next stage of path model preparation.

To estimate the impact of knowledge pertaining to individual solutions in the area of digital technologies on an enterprise's inclination to establish and to reinforce bonds with a university, all the latent variables were placed in two models of structural equations (SEM), where observance of the layout of variables and independent factors and change of the dependant factors was preferred.[14] The IBM AMOS (version 22) software was used for the construction of models. The SEM analysis was carried out on the basis of the factor model, estimated with the principal factor method in correspondence to the received results and adopted assumptions (prepared on the basis of the conducted IDI with 15 university representatives). The research models prepared by the author comprised factors generated as a result of the performed analysis (simultaneously constituting stages in the process of formation of long-term relations between universities and enterprises), which correspond to the "Bond Establishment" and "Bond Reinforcement"

Table 4.20 Scale reliability analysis

Component	*Cronbach's Alpha*	*Number of variables*
Process automation and monitoring	0.956	9
Data integration and big data analytics	0.868	3
Bond establishment	0.885	3
Bond reinforcement	0.888	4

Source: Own research.

component, as well as components pertaining to knowledge about digital technologies, such as: "Monitoring and process automation", "Data integration and big data analytics", "Protection and cyber security".[15] A path model was adopted in the research model determining how the components in the area of digital technologies influence the establishment and subsequent reinforcement of bonds between universities and enterprises (institutional stakeholders).

For the sake of the study, three research hypotheses were formulated:

- H1: The universities' knowledge about digital technologies exerts a stimulating (positive) impact on the enterprises' inclination to establish bonds with universities;
- H2: The universities' knowledge about digital technologies exerts a stimulating (positive) impact on the enterprises' inclination to reinforce bonds with universities;
- H3: Long-term relations between universities and enterprises may be shaped on the basis of a value which has its source in knowledge about digital technologies (all the factors distinguished by the author which bring together the university's knowledge on digital technologies exert a stimulating, i.e. positive, impact on the enterprises' inclination to establish and to reinforce bonds with a university).

To verify the above hypothesis and to confront the theoretical construct with the empirical models, the CATI was carried out in a group of 350 Polish enterprises cooperating with universities. The parameters of the first model, showing the impact of knowledge about digital technologies on the enterprises' willingness to establish bonds with universities, are presented in Figure 4.6.

Figure 4.6 presents the impact of individual variables (from questions P7 – statements referring to the enterprises' inclination to establish and to reinforce bonds with universities, as well as P11 – statements referring to solutions in the area of digital technologies) on the selected factors, as well as the impact of such factors on the enterprise's inclination to establish bonds with a university (black arrows pointing from factors selected on the basis of variables of the P11 question to the factor constructed on the basis of the variables from the P7 question). The arrows between the factors created on the basis of variables from question P11 (dotted line) show the mutual correlations among latent variables, which were taken into account during the calculation of the force of impact of a university's knowledge about digital technologies on the inclination to establish bonds with a university. At the stage of model preparation, a possibility of occurrence of correlations among factors was admitted (based on the model's author's arbitrary decision). In the model, only one connection between the latent variable and the variable was recorded, which was not statistically significant (it was left on account of marginal level of regressive weights). The results presented in Figure 4.6 show that the enterprise's willingness to establish

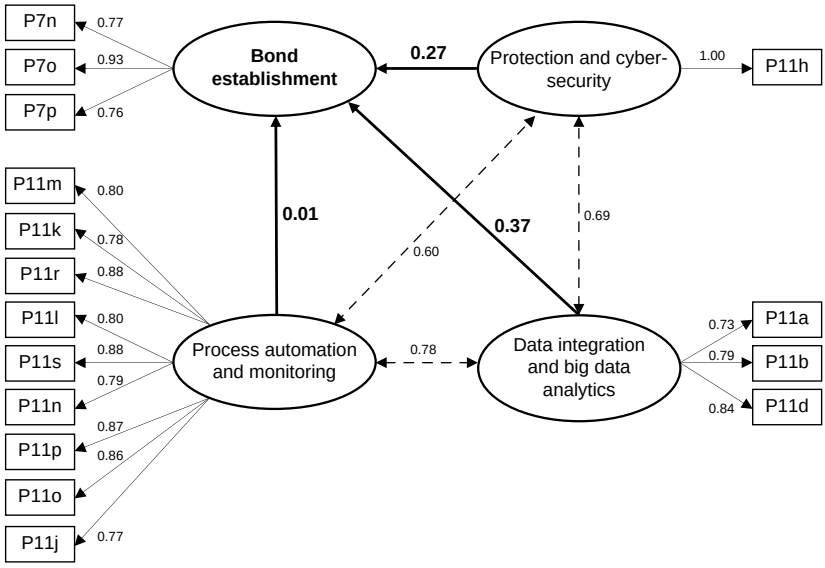

Figure 4.6 The first model (bond establishment) – impact of the university's knowledge on digital technologies on the enterprise's inclination to establish bonds with a university.

Source: Own research.

bonds with a university is affected most strongly by the interest in knowledge related to solutions encompassing integration and analysis of data (the standardized regression coefficient amounts to 0.37), and subsequently by the interest in knowledge related to solutions in the area of cyber-security and protection of IT systems (0.27). No significant impact was recorded with respect to the interest of the surveyed enterprises related to the solutions in the area of data monitoring and process automation (0.01) on the inclination to establish bonds with the university. An important stage of verification of the theoretical construct was evaluation of the goodness of fit of the model. The results of evaluation of the goodness of fit of the first model (bond establishment) are presented in Table 4.21.

The holistic results for the research model (presented in Table 4.21) testify to good fit of the model to the empirical data. The model adequately implies the actual structure of the variance/co-variance matrix among the analysed construct elements. Simultaneously, to assess the impact of the university's knowledge on individual solutions in the area of digital technologies on the enterprises' inclination to reinforce bonds with universities, all latent variables were placed in the second model of structural equations. The parameters of the second model (reinforcement of bonds) are presented in Figure 4.7.

Table 4.21 Indices used to assess the goodness of fit of the first research model (establishment of bonds)

Name of index	*Brief characteristics of index*	*Value of index*
CMIN/df	Quotient of chi-square and the number of degrees of freedom; acceptable level of measure testifying to good model fit: below 5.0.	2.151
CFI	Relative fit index; acceptable level of measure testifying to good fit of the model: above 0.9	0.979
NFI	Standardized model fit index - adopts values from 0 to 1, where 1 means a perfect fit model; acceptable level of measure testifying to good model fit: above 0.9	0.962
RMSEA	Element of chi-square error of approximation; acceptable level of measure testifying to good fit of the model: below 0.08	0.057

Source: Own research.

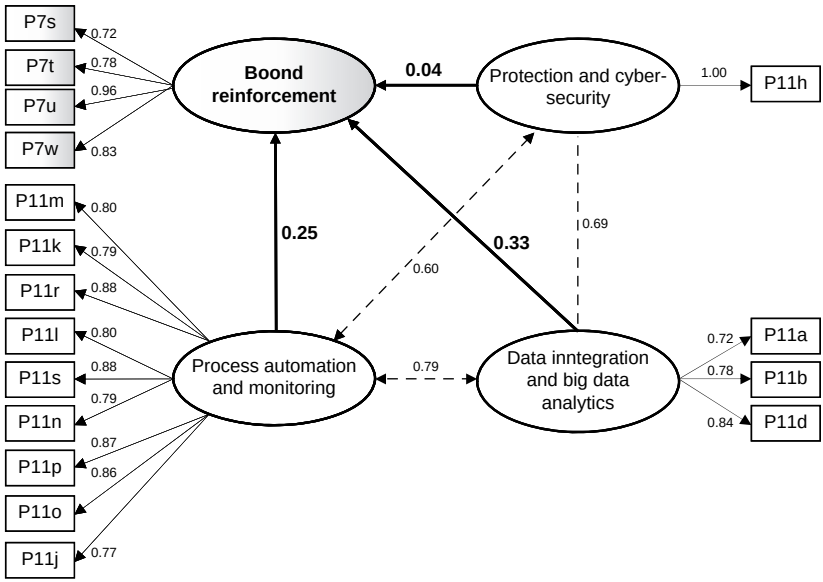

Figure 4.7 Second model (bond reinforcement): impact of the university's knowledge about digital technologies on the enterprise's inclination to reinforce bonds with a university.

Source: Own research.

It follows from the information presented in Figure 4.7 that the enterprise's inclination to reinforce bonds with a university is affected most strongly by interest in knowledge related to integration and analysis of data (standardized regression coefficient amounts to 0.33), as well as data

monitoring and process automation (0.25). On the other hand, no significant impact of the university's knowledge pertaining to cyber security and protection of IT systems has been recorded (0.04). Analogously to the first model (bond establishment), the black arrows pointing from the factors selected on the basis of variables of P11 question to the factor constructed on the basis of variables of question P7 show the impact of such factors on the inclination of the analysed enterprises to reinforce bonds with a university. The arrows among the factors created from variables from question P11 (dotted line) show the mutual correlations among latent variables.

The last stage of verification of the theoretical construct was evaluation of goodness of fit of the model. The results of evaluation of goodness of fit of the second model (bond reinforcement) are presented in Table 4.22.

The holistic results for the research model (presented in Table 4.22) testify to good fit of the model to the empirical data. Similarly to the first model, the second model adequately implies the actual structure of the variance/co-variance matrix among the analysed construct elements.

Estimation of the parameters of the first model and the second model show that all components (factors) comprising the university's knowledge in the area of digital technologies are possible to apply by universities in the process of forming long-term relations with enterprises, as they have a unilateral, positive (stimulating) impact both on establishment and reinforcement of bonds. In other words, along with an increase of actions of universities aimed at improvement of models distinguished in the model and related to the knowledge on digital technologies, the enterprises' inclination to establish and to reinforce the bonds with universities is growing.

Interpretation of the study results allows for venturing a conclusion that the know-how in the area of solutions related to data integration and big

Table 4.22 Indices used to assess the goodness of fit of the second research model (bond reinforcement)

Name of index	*Brief characteristics of index*	*Value of index*
CMIN/df	Quotient of chi-square and the number of degrees of freedom; acceptable level of measure testifying to good model fit: below 5.0.	1.973
CFI	Relative fit index; acceptable level of measure testifying to good fit of the model: above 0.9	0.981
NFI	Standardized model fit index - adopts values from 0 to 1, where 1 means a perfect fit model; acceptable level of measure testifying to good model fit: above 0.9	0.962
RMSEA	Element of chi-square error of approximation; acceptable level of measure testifying to good fit of the model: below 0.08	0.053

Source: Own research.

data analytics, solutions encompassing compilation, integration and processing of large data sets as support in decision-making processes play a crucial role for the universities in the process of formation of long-term relations with enterprises (both at the stage of establishing and reinforcement of bonds). The received result confirms the results of prior quality studies, which were carried out with the use of individual in-depth interview on a group of 15 university representatives who were responsible for shaping relations with enterprises. The interviewed university representatives concluded that the know-how related to data integration and big data analytics is very often sought by the business entities at the market of tertiary education services. It should also be emphasized that at the stage of bond reinforcement, the impact (significance) of knowledge in the area of monitoring and process automation, solutions encompassing actions related to monitoring and automation and replacement of people in household and professional activities is on the rise. It is interesting to note that at the stage of bond reinforcement (in the process of long-term relation formation), the university's knowledge related to cyber-security and data protection and issues related to network protection, e.g. from the attacks of hackers or other unauthorized access, ceases to be important for the enterprises. This probably results from the fact that at this stage of the process of forming relations, the enterprise is already strongly bound to a university, while the know-how of the university related to cyber-security and data protection is already held by a significant portion of business entities cooperating with universities. At this stage of relationship formation, solutions that are more difficult to implement in enterprises, solutions relying on artificial intelligence or replacing people both in simple and in complex professional and household activities are of importance.

When commenting on the final results from the performed SEM analysis and referring them to the research hypotheses that were put forward, it should be concluded that all three research hypotheses were confirmed[16], and thus:

- The universities' knowledge about digital technologies exerts a stimulating (positive) impact on the enterprises' inclination to establish bonds with universities (positive result of verification of H1 hypothesis).
- The universities' knowledge about digital technologies exerts a stimulating (positive) impact on the enterprises' inclination to reinforce bonds with universities (positive result of verification of H2 hypothesis).
- Long-term relations between universities and enterprises may be shaped on the basis of the value which stems from knowledge on digital technologies (all the factors distinguished by the author which bring together the university's knowledge on digital technologies exert a stimulating, i.e. positive impact on the enterprises' inclination to establish and to reinforce bonds with a university (positive result of verification of H3 hypothesis)).

Summing up the received study results, it should be stated that the value which stems from the knowledge on digital technologies positively affects the establishment and subsequently reinforcement of bonds between universities and enterprises. Hence, it may be assumed that such knowledge (in particular solutions in the area of digital technologies, focusing on monitoring and process automation, data integration and big data analytics, as well as data protection and cyber-security) may find application in the process of formation of long-term relations between universities and enterprises.

4.4 Major problems in the process of formation of relations between universities and enterprises in the light of quality study results

4.4.1 Perspective of interviewed university representatives

In the opinion of the interviewed representatives of universities, the cooperation between a university and an enterprise results primarily from the necessity of transfer of knowledge and technology (including digital technologies), which are subsequently developed in enterprises in the course of the process of commercialization of goods and services. The majority of respondents concluded that thanks to the formation of long-term relations both with micro, small, medium-sized and large enterprises, additional value is created, which is significant both for the enterprise and the university. It is important to note that the formation of relations between universities and enterprises was defined by the respondents as the process of exerting impact by the universities on the enterprises' inclination to establish and reinforce bonds with a university. At the universities, such process most often requires proper management of cooperation agreements (e.g. within the scope of admission of students for internship), science-business consortia, as well as transfer of knowledge and digital technologies.

In the case of enterprises, actions initiating cooperation with universities primarily consist, in the respondents' opinion, in taking up tasks that lead to an increase in innovation and competition in such entities, based on the results of research and development work carried out at universities. Enterprise managers are aware that faster development of organizations may be accomplished by combining resources of enterprises and universities. On the other hand, according to the respondents, the universities that wish to carry out breakthrough research should reach for the enterprises' funds. The interviewed university employees also concluded that the university's initiative aimed at establishment of cooperation with enterprises generates a push strategy: pushing the offer and the results of studies pertaining to digital technologies towards the market. On the other hand, the enterprises, when looking for scientific partners, are applying the pull strategy. They "pull" the study results, boosting their rank, which increases the

attractiveness of universities at the market of tertiary education services. Simultaneously, the interviewed university employees who are responsible for the cooperation between science and business concluded that the best partners for cooperation are medium-sized enterprises. Business entities from the sector of medium-sized enterprises manifest both significant interest in cooperation with scientific centres, as well as have proper financial, market, structural, personal, intellectual and social resources for commissioning studies pertaining to new technologies, as well as implementation of their results. Simultaneously, resources of medium-sized enterprises are not sufficient to allow such entities to independently carry out research and implementation work.

The respondents drew attention to the fact that one of the basic modes of cooperation of a university and an enterprise is design of study curricula with the use of actual operation of business entities as a supplement or extension of the scope of knowledge acquired at a university. Students and young scientists, by actively joining the work of enterprises, gain practical skills of using the knowledge learnt at universities. In turn, such knowledge has special value if it may offer a direct effect for an enterprise which accepts students and graduates for work. The cooperation between universities and enterprises often also adopts a form of the so-called academic entrepreneurship. Setting up technology and entrepreneurship incubators and subsequently start-ups of students and university graduates (based on knowledge and study results procured in academic centres) is an important element of cooperation between universities and micro, small, medium-sized and large enterprises. According to the respondents, support for the so-called spin-off companies and thus popularizing the study results via academic entrepreneurship should be a priority activity that unites universities and enterprises.

During the IDI interviews, the respondents were asked about main factors that are a barrier in the process of shaping long-term relations between universities and enterprises. The received responses may be assigned to one of four categories of barriers, such as (Kaczmarek, online):

- structural barriers, resulting primarily from the specific nature of economy sectors and science, as well as lack of worked-out strategies or pursued policies (these barriers are often reinforced by inadequate allocations of EU funds, low level of competence of public administration) (Matusiak & Guliński, 2010a; Guliński, online);
- system barriers related primarily to excessive regulations, too many legal acts not adjusted to the challenges related to, among others, digital transformation, solutions hindering development of academic entrepreneurship or technological incubators (Matusiak & Guliński, 2010a, 2010b);
- awareness-cultural barriers pertaining to lack of trust, perpetuation of stereotypes, lack of awareness and low social acceptance for innovative stances, with concurrent high self-esteem of participants of relations between universities and enterprises (Matusiak & Guliński, 2010a);

- competence barriers, referred primarily to the public administration, authorities and administrative bodies of universities and personnel and management boards of companies. The problems related to digital technologies, intellectual property, pro-innovative services or establishment and reinforcement of bonds between universities and enterprises often exceed the competence of the participants of the relationship formation process (Matusiak & Guliński, 2010b).

Among the main structural barriers hindering the formation of long-term relations of universities and enterprises, the interviewed university representatives included:

- excessive engagement of university employees in the didactic process;
- excessive formalization at universities;
- lack of flexibility and adaptation of a significant portion of universities to market requirements;
- low efficiency of business environment entities at universities;
- lack of specialist personnel at universities and in enterprises responsible for the formation of relations between universities and enterprises;
- a 'grey zone' of contacts of the sector of science and economy.

Among the main barriers of systemic type, the respondents included the following factors:

- imperfection and lack of stability of the system of work assessment and scientific promotion;
- lack of regulations and agreement templates regulating various forms of cooperation between universities and enterprises;
- insufficient expertise in the area of law among academics, especially in the realm of public aid and protection of intellectual property;
- excessive bureaucracy.

The main awareness and cultural barriers include:

- conservative stances in the sector of science manifested by, among others, unwillingness of some academics to cooperate with business representatives;
- passivity during creation of the offer for business and commercialization of intellectual property;
- too high self-esteem of some members of the academic personnel;
- conviction of authorities of some universities that the university is not an entrepreneur or a trader and should not transform in this direction.

On the other hand, among the major competence barriers the respondents included:

- lack of compatibility between the frequently petrified university authorities and dynamic market and the needs of a flexible entrepreneur;
- problems with assessing the value of knowledge pertaining to solutions in the area of digital technologies;
- insufficient knowledge of academics about technology transfer and knowledge commercialization mechanisms;
- the majority of academics focus exclusively on didactic or scientific activities related to publications and the general model of academic promotion (at universities, credits for publications and number of quotations are primarily at play, not years of work in business or familiarity with actual economic or technical problems of enterprises);
- low activity and slight experience of academics in contacts with university environment.

4.4.2 Perspective of interviewed enterprise representatives cooperating and not cooperating with universities

According to the interviewed representatives of universities, the key issue that affects the inclination to establish or to reinforce bonds between an enterprise and a university/universities is the category of value, the feeling of mutual benefits which should be measurable and perceptible for the partners. However, some of the interviewed representatives of enterprises not cooperating with universities had negative experiences from cooperation with universities: "A university sends students for internship, they want to complete it as quickly as possible and the company does not create any sustainable value in this mode […], benefits are only on the other side …" An analogous argument was voiced by persons representing business entities cooperating with universities. Meanwhile, it is the relation based on mutual benefits that is the source of satisfaction deriving from cooperation of this type. In other words, a unilateral model of benefits discourages the entrepreneurs from establishment of bonds with universities, as well as negatively affects the level of satisfaction and puts them off from reinforcing it. Another important aspect is durability and extended perspective of cooperation which - according to the respondents - should not be activity-based or ad-hoc, while the desired model is building cooperation in a systemic mode (via process activities divided into stages, aimed at formation of long-term relations). According to the representatives of economic practice covered by the study, an important link between enterprises and universities are university graduates. The respondents decided that these are the relations uniting the graduates (employed in enterprises) and universities

that are very often a starting point for the process of formation of relations between enterprises and universities.

According to the representatives of enterprises cooperating with a university/universities, the party initiating the cooperation between a university/enterprise is most often the entrepreneur (simultaneously, the respondents expect a change of this state of affairs). According to the interviewed entrepreneurs cooperating and not cooperating with universities, universities do not initiate the establishment of bonds as they do not have proper organizational units or persons delegated to perform tasks of this type. The structure of a significant portion of universities (in particular large public universities) also seems opaque and ill-adjusted to the specifics of cooperation with business entities. The respondents representing entities cooperating and not cooperating with universities believe that universities function in a completely different logic, totally divergent from the mode of operation of commercial entities, which focus on practical aspects and accomplishment of market success. In relation to this, in the process of formation of long-term relations between universities and enterprises, there are both structural and awareness-type barriers (pertaining to, e.g. the set of shared values). In the respondents' opinion, the worked out mechanisms for cooperation of this type are missing (the so-called good practice) related to the creation of a possibility of meeting and exchange of experience between business practitioners and the academic environment. It is particularly important that the value underlying the knowledge on digital technologies may, according to the respondents, be the key element of the model of establishing and subsequent reinforcement of bonds between a university and an enterprise. According to enterprise representatives, both cooperating and not cooperating with universities, business entities willingly establish and reinforce bonds with universities which:

- educate business personnel and are focused on practical teaching;
- manifest initiative in contacts with enterprises (greater openness to relations with the external world, 'reaching out');
- are focused on solving real problems of enterprises;
- become engaged in studies that are being prepared and implemented jointly with enterprises;
- prepare expertise, advisory services for socio-economic environment (according to the respondents, services of this type should be tailored and thus adjusted to the individual needs of enterprises, identified on the basis of an in-depth diagnosis);
- popularize digital technologies (this aspect was mentioned, among others, in the context of current business needs, related to the necessity of functioning in a remote mode during the COVID-19 pandemic);
- maintain good relations with graduates;
- are engaged for the sake of the local community.

The representatives of business practice covered by the study also defined the main barriers which form an obstacle for the enterprises in the process of forming long-term relations with universities (Table 4.23).

The representatives of enterprises not cooperating with universities consider taking up simple, elementary forms of cooperation with universities in the near future. It follows from the performed studies that this is related to the fact that, among others, at the stage of establishing bonds, the cooperation of an enterprise with a university consists primarily in reliance on the potential of a university, use of the educational offer or expert knowledge of its employees (service provider – service recipient relation). The results of quality studies carried out with the use of the

Table 4.23 Main barriers limiting the process of formation of long-term relations between enterprises and universities (according to the interviewed representatives of enterprises cooperating and not cooperating with universities)

Entities not cooperating with university/ universities	*Entities cooperating with a university/ universities*
• Negative experiences from the past, e.g. lack of benefits, cooperation fails to generate an added value for an enterprise; • The university fails to treat an enterprise as an equal partner; • No initiative on the part of university to establish a bond; • Inefficiency of cooperation (too high outlays in reference to the accomplished benefits); • Lack of information (knowledge) about benefits, possibilities of development offered by cooperation of an enterprise with a university/universities; • Lack of adequate organizational units at universities or specially delegated employees responsible for forming relations between an enterprise and a university; • Lack of university's openness to cooperation with business; • Lack of university flexibility ('petrified organizational structure'); • Limitations resulting from the specific nature of the industry in which an enterprise is operating ('there is simply no need for cooperation')	• Negative experiences from the past, e.g. lack of benefits, cooperation fails to generate an added value for an enterprise; • Ill adjustment of a university to business needs (also the labour market); • No initiative on the part of university to establish a bond; • Lack of adequate organizational units at universities or specially delegated employees responsible for forming relations between an enterprise and a university; • Lack of university flexibility ('petrified organizational structure'); • Low quality of teaching at some universities or fields of study (transfer of outdated, impractical knowledge); • Low level of knowledge about the possibility of more advanced cooperation with a university/universities; • An enterprise's focus on simple cooperation, not requiring excessive effort.

Source: Own research.

FGI methods correspond well with the results of quantitative studies (CATI), in line with which the enterprises focus on searching for simple forms of cooperation (primarily due to the fact that they do not have knowledge how and in which areas they could reinforce bonds with universities).

The representatives of organizations covered by the study which cooperate with universities have different experiences. Even though the respondents also declared that at the initial stage of the process of relation formation, the enterprises represented by them mainly took up simple forms of cooperation with universities, yet over the course of time such cooperation became more in-depth and intense – it consisted in, e.g. preparation and performance of joint research and development projects. It is interesting to note that tighter cooperation (at the stage of bond reinforcement) was definitely better assessed by the respondents than the cooperation at the initial stage - the establishment of bonds. In spite of the barriers in the process of forming long-term relations (Table 4.23), according to the respondents, the enterprises cooperating with universities manifest a need and inclination to reinforce bonds with universities based on the value underlying the knowledge on digital technologies.

The representatives of enterprises from both surveyed groups appreciate the substantive competence of such universities (their employees), as well as note a significant change in the mode of functioning of a major part of universities in a long-term perspective, related to a clear improvement in the area of infrastructure (e.g. pool of facilities, equipment, fittings). It follows from the performed studies that in the past, the universities were perceived by business representatives as obsolete organizations, ill adjusted to the market requirements, while at the present moment this mode of perception is clearly evolving (to the benefit of the universities). In particular in some sectors (e.g. ICT, medical), access of such organizations to specialist equipment or digital technologies is appreciated. The persons with whom FGIs were carried out also perceive an important change in views pertaining to the cooperation between science and business in the academic milieu (greater openness of academics to cooperation is also noticeable). According to the respondents, this is directly related to the progressing generation change at universities. The fact that enterprises both cooperating and not cooperating with universities manifest great interest in the knowledge from the area of digital technologies is of significance for the subject matter of the paper. Simultaneously, in spite of appreciating the weight of these solutions (related to, e.g. online work, cyber-security or robotization or automation of processes), the respondents believe that "not everything may be replaced by technology." However, this does not mean that the process of formation of long-term relations between universities and enterprises cannot be implemented on the basis of the value underlying the knowledge about digital technologies.

Notes

1 While choosing a research methodology appropriate for studying the process of forming long-term relations between HEIs and institutional stakeholders (especially with enterprises), one should, first of all, choose the leading methodological stream or, to be more precise, choose the dominating methodological paradigm. According to the author, the interpretative paradigm should be the basic premise, which should guide the research effort to identify the process of forming long-term relations between the university and the enterprise. Conclusions resulting from the statements constructed in this way will have an analytical character and require following specific recommendations and procedures. Therefore, it is in this methodological stream, following the pattern of research proceedings, characteristic of the interpretative methodological paradigm, that the research was conducted for this book's purposes. More on this topic in: Lisiński (2016).
2 Each research problem, in addition to the adoption of an appropriate research methodology at the highest level (level I), also requires the selection of an appropriate general method, specific methods (level II) and research techniques and procedures (level III) that result from them. Taking into account the specificity of management and quality sciences, their very practical character, it is assumed that in solving the problems of this discipline it is most appropriate to use the following general scientific methods: induction, hypothetico-deductive method and deduction. In the management and quality sciences, which also include knowledge or relationship management, the aim is to formulate empirical laws that aim to establish the probability of events. This very often entails a quantitative empirical study that should provide a statistical picture of the reality under study. For this reason, the research process in the area of management and quality sciences, in the author's opinion, will require in most cases the use of a primarily reductive method, such as the induction method, which is carried out on the basis of measurements carried out. A properly organized and conducted measurement provides the basis for the verification of the research hypotheses. Therefore, in this book, the method of incomplete numerical induction is used as a general method. It is an inductive reasoning whose premises do not exhaust the whole universe of objects to which the general law expressed in the reasoning conclusion applies. The premises are detailed phrases, while the conclusion is a general sentence, and each of the premises follows logically from the conclusion. It is a method in which a general rule is derived from a limited number of particulars. More on this subject in: Apanowicz (2002), Hajduk (2012) and Lisiński (2016).
3 IDI (individual in-depth interview) is a focused interview, which means that the conceptualization of the research is already at an advanced level, because the issue to be investigated is not a "problem desert" and therefore posing the right questions is not a problem.
4 CATI (computer-assisted telephone interview) is a computer-assisted telephone interview used to collect information in the quantitative market and public opinion research. In research conducted using this technique, the respondent is interviewed over the telephone, and the interviewer reads out questions from the questionnaire and takes notes of the answers obtained, using a special computer script.
5 FGI (focus group interview) is a technique of qualitative research that consists of a moderator leading, according to a predetermined scenario, a discussion of a group of purposively selected respondents (from 6 to 12 people). The assumption of FGI is that a group discussion introduces data of a new quality, which we are not able to obtain in the case of an individual interview.
6 The IDI interviews were attended by university representatives directly involved in the university's cooperation with enterprises. A total of 15 persons.
7 Since there is no single, universally valid definition of cooperation between business entities and universities, we can talk about various manifestations or forms of this

cooperation. Thus, there is no comprehensive database, which could serve as a sampling frame. In other words, there is no data on the structure of the population of enterprises cooperating with universities (regardless of the definition adopted), so the sample selection criteria had to a large extent to be adopted arbitrarily and purposefully. The key parameter was to undertake at least one form of cooperation with the university (defined by the author); moreover, the size of the enterprise was controlled in the sample, measured by the number of employees (it was assumed that at least 40% of the realized sample would consist of medium and large enterprises, additionally one-man companies with no employees were excluded from the study). The sample includes enterprises, the registered offices of which are located in all 16 provinces of Poland. The structure of the sample with regard to voivodeships was established on the basis of proportions taken from the national register of business entities REGON. Additionally, companies were recruited in such a way that they were as diverse as possible in terms of the industry they represented. Therefore a lot of effort was made to ensure that the structure of the surveyed sample reflected as closely as possible the structure of Polish enterprises co-operating with universities.

8 An enterprise from the prepared base was randomly selected to participate in the survey and contact with it was attempted. In the case of an impossibility to conduct an interview (e.g. due to refusal, difficulties in arranging the time of the survey or repeated failure to answer the phone), an attempt was made to establish a connection with another company from the base, and then the drawing procedure was repeated, and the measurement was conducted until the assumed effective sample size was reached (350 companies). At this point, it is also worth referring to the effectiveness of conducting telephone surveys. In standard research on samples of individuals or households, an efficiency of approximately 25% is assumed. This means that four attempts must be made for every one effectively completed interview. In surveys conducted on the B2B (business to business) market, the response rate is considerably lower (usually 8–10 attempts must be made to obtain one effective interview). In the case of this study, the effectiveness was very low. This was due to the specific nature of the survey, the complex research topic, the difficult recruitment and – above all – the average duration of the interview, which was 20 minutes (very high number of refusals and interrupted interviews). The effectiveness of implementation, i.e. the response rate did not exceed 0.05, which means that for one effective interview there were approximately 20 contact attempts with representatives of business entities that could potentially meet the assumed recruitment criteria. Thus, 350 interviews required contact attempts with over 7000 businesses.

9 Since 2001, the Local Social Research Agency has conducted over 1200 quantitative and qualitative studies. The team of researchers is affiliated with the Institute of Sociology, University of Warsaw, the Theory of Social Change Laboratory and the Solidarity and Social Movements Research Centre. More about the research contractor can be found on the website: www.lokalnebadania.com (accessed 15.07.2021).

10 The IDI were carried out in May and June 2020 with 15 university representatives.

11 However, scale reliability should not be mistaken with its accuracy: the accuracy of a tool refers to a discussion whether it measures what it should measure, while reliability is the measure of measuring precision.

12 This is the most frequently used reliability coefficient of survey questionnaires, understood as the internal tool consistency, cf: Timm (2002).

13 However, scale reliability should not be mistaken with its accuracy: the accuracy of a tool refers to a discussion whether it measures what it should measure, while reliability is the measure of measurement precision.

14 The described models are path models – these are theoretical constructs (determined on the basis of a priori knowledge or on the basis of arbitrarily adopted premises) which are tested on the compiled data.
15 In the management and quality sciences, the research models play a very important role as – on the one hand – they deliver a special picture of the reality and on the other allow for performance of empirical studies in a specific methodological regime. From the perspective of quantitative studies, the research models adopted a form of hypothetical and deduction models, where – based on deduction – dependencies between variables describing an examined phenomenon are explained, with an attempt at proving the hypothetical dependencies among them. At the same time, it must be emphasized that science in essence does not prove anything. It only makes assumptions and verifies them. Scientific knowledge is a set of continually renewed working hypotheses pertaining to reality. More about it in: Krzakiewicz (2014), Czakon (2015) and Czakon (2016).
16 The tested zero hypotheses (H0) were rejected for the sake of alternative hypotheses (Halt. – H1, H2, H3).

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5 New Approach to Developing University and Business Relationships – Modelling

5.1 Assumptions underlying the design of the model

Research in social sciences, the same as in any other discipline, is often based on certain models, such as theoretical, conceptual, research or statistical models. However, the very concept of a model has not as yet been clearly and unequivocally defined. In management and quality studies, the model has a number of different and even contrasting definitions (Szarucki, 2011). This ambiguity is caused by the fact that the word "model" is used to signify any of the following: description, structure, means, scheme, abstraction, theory, etc. (Sztoff, 1971) (Table 5.1).

The definitions listed in Table 5.1 suggest that a model is a hypothetical construct, i.e. a set of assumptions and concepts and their mutual dependencies through which a certain aspect of reality can be roughly described (Gospodarek, 2009). Models in management and quality studies (also the models the author presents in chapters 4 and 5) are a certain form of cognition that plays, on the one hand, a theoretical function of presenting a specific image of reality and, on the other hand, a practical function, serving as a tool in empirical studies (Szarucki, 2011). Although many researchers are against understanding a model as a theory,[1] the literature identifies three main links between a model and a theory:

- a model complements a theory by supporting a paradigm or theory ontologically, semantically or syntactically;
- a model simplifies too complex a theory – treated as a template, i.e. the projected object;
- a model as a paradigm or preliminary theory – understood as projection, i.e. an object that projects a real object (Gospodarek, 2009).

Zakrzewska-Bielawska notes that the relation between a model and a theory is iterative and cyclical and it depends on the research approach (2018), as is synthesized in Figure 5.1.

In the context of management and quality studies, models that are regarded as a specific type of theory (2018) or projection (Trzcieniecki, 1970)

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Table 5.1 Selected definition of the model

No.	*Author*	*Definition of the model*
1	R.L. Ackoff	A model is a representation of a state, object or event. A model is very simple compared to reality as it only presents those features of reality that are relevant to a given case.
2	P. Eykhoff	A model is a representation of the essential aspects of an existing system (or a system to be constructed) which presents knowledge of that system in usable form.
3	W. Findeisen, E.S. Quade	A model is a process, device or thinking scheme applied to prognosticate some results.
4	T. Gospodarek	A model is a coherent or exhaustive system of verbal arguments or logical sequences of deducting mathematical equations or computing rules that reflect a conceptual prototype of an object or event that the model describes.
5	G. Gordon	A model is a set of information about a system collected in order to examine that system.
6	E.V. Krick	A model is something that describes the nature or behaviour of a certain original. This (projection) is described by means of words, numbers, symbols, schemes or charts or by means of objects that look or behave in a similar way as the original.
7	F. Liptak	A model is a simplified presentation of an object (phenomenon or process) that is either real or imagined that exists in reality or imagination only with the same basic properties as that object.
8	E.Z. Majminas	A model is a projection of certain characteristics of an object done in order to examine that object.
9	Z. Martyniak	A model is a scientific theory, a pattern and projection that serves the purpose of understanding the actual state and behaviour of an object.
10	S. Nowak	A model is a description of an object in terms of certain components and the relationship between them or a set of connections and dependencies between the properties of that object that meets the requirements of an adequate explanation of the property or set of properties that is being examined.
11	T. Pszczołowski	A model is a complex (and abstract object) that projects, for cognitive and practical purposes, a more complex real object or fragment of reality.
12	W. Pytkowski	A model is a formal expression of a theory or relationship that we treat as a generalization.
13	A. Rapoport	A model, in its broadest sense, can be regarded as an abstraction of reality, the goal of which is to bring conceptual order to a complex environment.

(*Continued*)

Table 5.1 (Continued)

No.	*Author*	*Definition of the model*
14	W. Sztoff	A model is a system that can be thought or physically created and, by reflecting or reproducing the object of examination, is capable of replacing the object so that its examination yields new information about the object.
15	J. Trzcieniecki	A model is a real or artificial object that is to some extent convergent with the examined object, being able to replace it at certain stages of cognition, the examination of which yields information that can be empirically verified.
16	J. Zieleniewski	A model is a theory constructed in such a way that its component variables can be operatively manipulated.

Source: Own work based on: Ackoff (1969, p. 142); Findeisen & Gutenbaum (1985, p. 116); Gospodarek (2009, p. 78); Machaczka (1999, pp. 11–12); Trzcieniecki (1979, pp. 93–94); Zieleniewski (1981, p. 45).

are mostly developed using the hypothetico-deductive method.[2] According to Zakrzewska-Bielawska (2018), such models are characteristic of quantitative research (Bamberger & Ang, 2016). The same approach was applied in the computer-assisted telephone interviews research that the author conducted in a group of 350 businesses that collaborate with the university/universities. In the first place, the author explored the theoretical

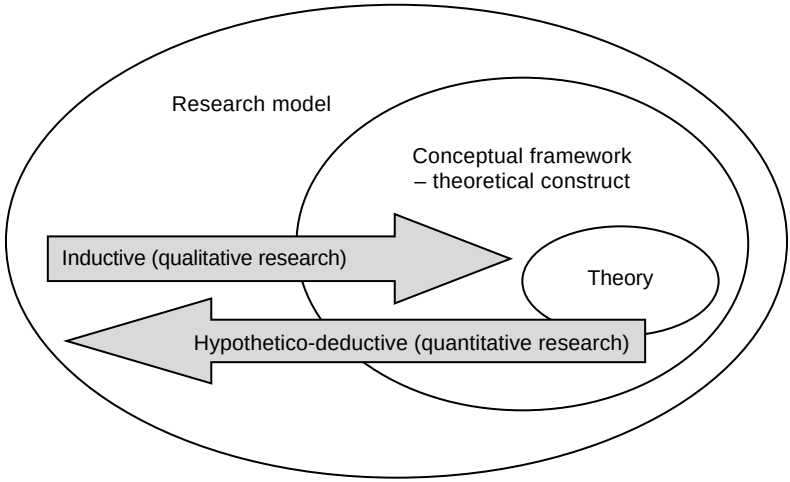

Figure 5.1 Research model depending on whether the research is quantitative or qualitative.

Source: Zakrzewska-Bielawska (2018, p. 12).

foundations by reviewing and critically analysing the relevant literature. On this basis, the author determined the conceptual framework of the research (in the form of a theoretical construct of phenomena that cannot be directly observed) (Czakon, 2015[3]) – e.g. the analysis served to identify the factors that were used to describe the research problem. Such construct served as the basis for operationalization of the examined phenomenon, meaning that the author was obliged to determine the scope of variability relevant to the purpose of the research and the degree of precision of variable measurements, to clearly define the values of variables and the dependencies between them and to choose the right level of measurements (Babbie, 2004). Having developed a hypothetico-deductive model (or, in fact, two separate models – the first "Establishing bonds" and the second "Strengthening bonds" – Section 4.3 see of the book), it was possible to determine dependencies between the variables (the identified factors) that were subject to analysis. According to Stachak, hypothetico-deductive models share the following four properties (Stachak, 2006):

- isomorphism and isofunctionalism with respect to the modelled object or fragment of reality;
- simplification, i.e. disregarding less important properties;
- a model usually has different proportions than its object;
- a model represents existing objects.

Qualitative research is based on a different approach and mostly uses inductive models (Figure 5.2). In such models, instead of assuming *a priori* a certain image of reality, the researcher poses a research question and makes general conclusions on an empirical basis. Such conclusions may take the shape of uncertain concepts, explanation frameworks or proposals, the most important process being the transfer from the chaos of the observed reality to those general conclusions (Czakon, 2006).

The model presented in subchapter 5.2 of this book combines the typical features of positivist quantitative research and interpretive qualitative research. This is in line with the observation made by Sułkowski, namely that in order to solve a key research problem, it is worth using models from different approaches and disciplines, i.e. applying a "methodological pluralism" (Sułkowski & Lenart-Gansiniec, 2021[4]). Denzin, the author of methodological triangulation also proposes that researchers use different, mutually verifying or at least mutually complementing methods (2009). Accordingly, the author started with developing two hypothetico-deductive models, which he then tested and verified (see subchapter 4.3). The results obtained through assessment of the parameters of the first model "Establishing bonds" and the second model "Strengthening bonds" served as an input for a more precise inductive model (see subchapter 5.2), which, the author believes, contributes to theory – making it possible to apply existing knowledge in a new area. The link between research models and

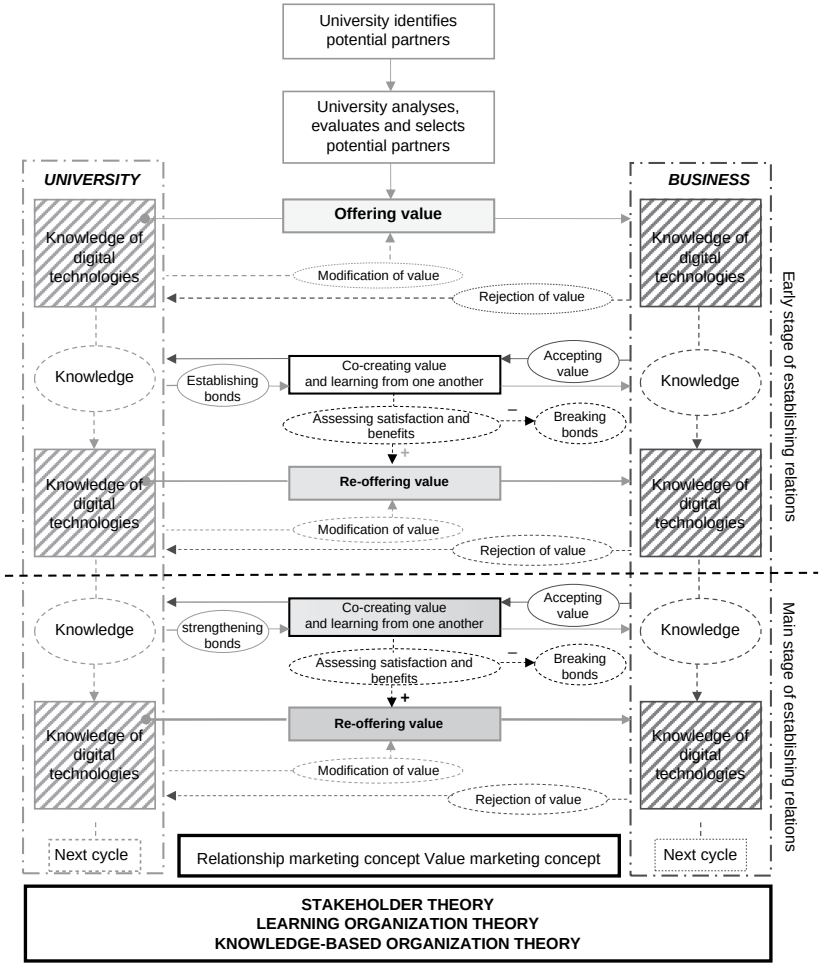

Figure 5.2 Model of establishing relationship between universities and businesses in the context of digital transformation.

Source: Own elaboration based on research.

theory is often iterative and cyclical, as shown in Figure 5.1. The arrows in the figure show the dependencies, from positivism and deductive approach, where research starts with a theory, to the interpretive concept and inductive approach, which starts with observing reality in order to make generalizations and by this to modify and expand an existing theory or develop a completely new one.

In management and quality studies, which are practical in nature, models are used both to design a new theory, to project the economic phenomena in a market and to define optimal and realistic means to achieve the goals of

organizations, also of universities. For many universities in Poland, the goal is now to build long-term (and mutually beneficial) relationship with businesses in order to co-create a value based on new technologies and increase the knowledge of both partners. Thus, the model developed by the author is a normative and optimizing model that will enable university managers to focus on activities that are the most important for developing long-term relationship with businesses in the market of university services. The most vital effect of long-term relationship in that market developed using the aforementioned model will be the loyalty of business partners and their engagement in partnership, resulting in knowledge growth both for the university and for the business. The model is based on a number of marketing concepts and management theories and, because of the nature of the model approach, it is a very simplified scheme. However, the author is fully aware that even the best scheme cannot fully reflect the dynamic dependencies and interactions. Thus, it is important to constantly monitor and take into account the impact of internal (e.g. the university's potential to use knowledge of digital technologies in the process of establishing long-term relations, the organization's learning capacity and the partners' potential and ability to exchange in order to co-create values) as well as external factors related to changes in the market, especially the market of university services in the context of digital transformation. It should be noted then that the changes that take place may necessitate modification of the current model to provide for, in particular, new digital technology services that the university can offer to businesses.

5.2 The process of establishing long-term relationship between universities and businesses in the context of digital transformation

To manage a university, it is necessary to successfully and efficiently establish long-term relationship with businesses. These relationships need to be long term because it takes a long time for a university to pass the subsequent stages of the process of establishing relationship through the cyclical co-creation of values with business (see subchapter 2.3, Figure 2.4) in order to increase the added value of knowledge growth for both partners (cf. Zink, 2007). Literature studies, results of direct research and assessment of the parameters of the two hypothetico-deductive models of the impact of knowledge of respective digital technologies on business willingness to establish and strengthen bonds with universities (see subchapter 4.3) were the starting point for designing a normative model. The model was a flowchart representing, in a simplified manner, the process of establishing long-term relationship between universities and businesses in the context of digital transformation. The author believes that the following stages, as

listed in Figure 5.2, should be observed in establishing relationship between universities and businesses:

- identifying businesses, especially those that rely on digital technologies for their development and use them in economic practice (divided into regional, supra-regional and international businesses);
- analysing and diagnosing the identified business as regards their usefulness for university development;
- proposing potential benefits for businesses of partnership with universities – the added value of knowledge of digital technologies;
- co-creating the value that leads first to establishing and then to strengthening the bond between a university and a business.

Figure 5.2 suggests that the process of establishing long-term relationship between universities and businesses in the context of digital transformation has very solid and complex foundations that comprise both the main assumptions of the relationship marketing concept and value marketing concept as well as the stakeholder theory, the learning organization theory or the knowledge-based organization theory.

The author believes that the process of establishing long-term relationship between universities and businesses ought to be founded on the relationship marketing concept. This concept is founded on the assumption that it is necessary both to create bonds with new businesses that have not cooperated with a university before and to strengthen bonds with the university's existing business partners. However, in the context of digital transformation (which means, among other things, that businesses very quickly develop and implement state-of-the-art technologies), it is difficult to consider the relationship marketing context without also taking the value marketing concept into consideration. Long-term, synergistic and mutually beneficial relationships between universities and businesses create for both partners the added value of knowledge growth. In other words, new knowledge is generated through repeated cycles of co-creation of value in university and business partnership (its source being digital technologies) – and it should be regarded as an integral component of both the value marketing component and the relationship marketing component and as the goal pursued by a university. This means that university and business relationship should be built through inclusion and permanent commitment of businesses to value creation, yielding knowledge growth for both partners as well as their mutual loyalty and satisfaction.

Meanwhile, the stakeholder theory analyses, among other things, the nature of bonds between a university and a business in the context of their potential benefits. This theory is founded on understanding the stakeholders' attitudes, which, *de facto*, is the basis to interpret the idea of corporate social responsibility in practice. This means that knowledge growth resulting from a long-term relation may help, among other things, find useful practical solutions that will benefit not only the partners but also

other stakeholders linked to the university and business. This theory is also used by scholars to explore the ways of building relationship with institutional stakeholders, including businesses, which have a major impact on the development of such organizations as universities. The literature asks, and tries to answer, the following question: what is the goal of organizations (including universities and businesses)? In order to answer this question, managers of both universities and businesses need to explain the sense of the common values they co-create and to identify what it is that unites the partners – in this case, it is knowledge of digital technologies. This, in turn, drives organizations to generate innovative solutions and outstanding achievements, such as, for example, new knowledge or new areas of its practical application, and their market financial indicators.

This also means that changes in organizational knowledge triggered by value co-creation and learning processes, which add to, transform and expand organizational knowledge, contribute to its dissemination and use. Partners accumulate experience, learn lessons and aggregate knowledge in organizational knowledge banks (it is becoming popular to regard an organization as a repository of accumulated knowledge). Thus, it can be concluded that organizations are shaped through a set of learning processes that combine current experiences with past lessons learned through collaboration with partners. Yet, it should also be noted that the point of a learning organization is to change the way people think and to voluntarily learn and create new knowledge. In a learning organization, partners must not only learn to adapt in order to survive in a dynamic and turbulent market in the era of digital transformation but also be strongly driven and honestly willing to learn from each other and look for new solutions in order to expand creative possibilities (cf. Senge, 2000). According to the theory of knowledge-based organization, knowledge is most often accumulated in specific environments and rooted in organizations (e.g. universities or businesses) that work on certain specific problems (e.g. digital technologies). Because of the sources of knowledge that are located in the university environment, it is necessary to establish multiple relationships with that environment and develop inter-organizational bonds and establish long-term relationship with university stakeholders, including businesses, which is a challenge that can be seen both as an opportunity and a threat.

5.3 Identification, analyses and selection of potential university partners

In the process of developing their strategies, businesses look for partners in order to set new directions for development in the context of digital transformation. Universities, being aggregates of knowledge of digital technologies, frequently become their strategic partners. Also, universities search for businesses in order to co-create value based on knowledge of digital technologies and thus enlarge their aggregated knowledge of digital

technologies (helping them to strengthen their position in the market of university services). This does not mean, however, that a university should strive to establish and strengthen bonds with all businesses that are potentially interested in partnership. Because of limited human, financial, material and information resources, a university must identify, analyse and evaluate businesses that are potentially interested in knowledge of digital technologies and select the most "valuable" partners to collaborate with. Thus, in order to establish relationship in the market of university services in the context of digital transformation, it is necessary to define the target market, i.e. identify and select businesses interested in knowledge of digital technologies that are capable of co-creating value with a university and whose development needs can be met by a university in a long-term horizon.

The most important goal of identifying potential university partners is to select a group of crucial businesses, so-called target stakeholders – a group of special interests (identify businesses that are potentially interested in knowledge of digital technologies owned by a university). The starting point in that process may be the geographic range of impact of a university. Scientific centres may have regional, supra-regional and even international impact. This means that university personnel responsible for establishing long-term relationship with businesses should be perfectly aware of the market (spatial) range of the impact of their organization and the possibilities for its expansion. The process of establishing long-term relationship between universities and businesses in the context of digital transformation.

By building purposeful and planned relationship with businesses in the market of university services, universities may establish and strengthen bonds with businesses in the regional, supra-regional and international dimensions. The author believes that if universities limit their offer to regional businesses only, they will experience multiple limitations and threats caused by various obstacles that limit the growth (aggregation) of knowledge of digital technologies, thus blocking the development of both the university and the business. If partnership is limited to regional businesses only, there may be major delays in the transfer of the latest knowledge of digital technologies to the university, given that such knowledge, being of practical nature, develops and becomes outdated at a high pace. Universities that so far have only established long-term relationship with local businesses should at this stage look for new business partners who have no or limited history of collaboration with a university. The authors believe that focusing only on local businesses as potential university partners is a mistake as it does not trigger knowledge growth in the long term.

Fast development of information technologies, globalization and internationalization of university service market requires universities to take a much broader look at partnership with businesses. The author believes, however, that a vast majority of Polish universities, especially the ones with a low level of internationalization, are not ready to use the chances offered by globalization, which, for them, seems to be more of a market threat and less of an

opportunity. The ability to establish and strengthen relationship with supra-regional businesses is often a test for the quality of a university's knowledge of digital technologies. A large number of a university's supra-regional business partners represents the actual attractiveness of the university as a partner in the process of digital transformation. It also makes the university an important academic centre that attracts businesses from outside its own region.

Long-term partnership between universities and foreign businesses (in the international market) should be founded on the university's strong international brand, which often entails a very narrow field of expertize, e.g. in digital technologies. This strategy is mostly used by the oldest and biggest academic centres with a sound international position. The university can also establish relationship with international businesses through an expansive marketing policy that uses modern methods of marketing communication and may be supported by existing business partners, the municipality or the region where the university is based. The point is to use a network of the university's connections in order to create a new relationship with international businesses. This strategy requires a partnership approach and a far-reaching synergy of the actions of the university and its existing business partners as well as the municipality and the region in the process of initiating collaboration with foreign businesses. This means that the parties need to jointly define goals both in the context of university strategy, whose main goal is to increase internationalization and aggregate knowledge of digital technologies, and with a view to the strategies of business partners and the policies of municipal and regional development. Universities that see an opportunity for rapid and dynamic development in the latest knowledge obtained through collaboration with foreign businesses that lead the way in the application of new technologies should use this approach.

A university, having determined the geographic range of its impact, decides (through an in-depth analysis of its potential) whether to build relationship in the regional, supra-regional or international dimension (or perhaps in the three dimensions and the same time – which the author believes to be the best option) and then analyses, evaluates and selects specific businesses to establish and develop bonds with. The goal of those actions is to determine the hierarchy of importance of businesses, mainly in terms of their potential and capacity to co-create value with a university – to generate new, useful knowledge, in the broad meaning of the term. This means that individuals responsible for the creation of long-term relationship between the university and business should regularly evaluate the impact of the respective businesses on university development. The starting point is, of course, the mission of both higher education in general and a university in particular. As a next step, university workers should make a preliminary list of micro, small, medium and large (regional, supra-regional and foreign) companies, both existing and prospective partners.

At this stage of a search for potential partners, the university's existing business partners and organizations that mediate between scientists and

companies may prove very helpful. Next, based on an analysis of long-term goals for university development, they should identify the companies that have the most impact on co-creating new knowledge and, consequently, on university development. This may be done through assessment of the benefits of collaboration and potential specific values for the university. At this stage, it is also possible to evaluate the capacity and potential of a given company to co-create value with the university. To this end, the individuals responsible for establishing long-term relationship between the university and business can use relevant tools to better understand the interests of micro, small, medium and large companies, respectively. One of such tools may be a matrix of university–business partners that provides for the potential of a company to co-create with the university a digital technology-based value.

The matrix classifies businesses based on two dimensions: how much is a company interested in the university's knowledge of digital technologies and what has been the company's practical application of digital technologies so far (Figure 5.3). Depending on the distribution of the above-mentioned criteria, there are the following categories of companies:

- companies with a very large potential to co-create with the university a digital technology-based value (segment 1);

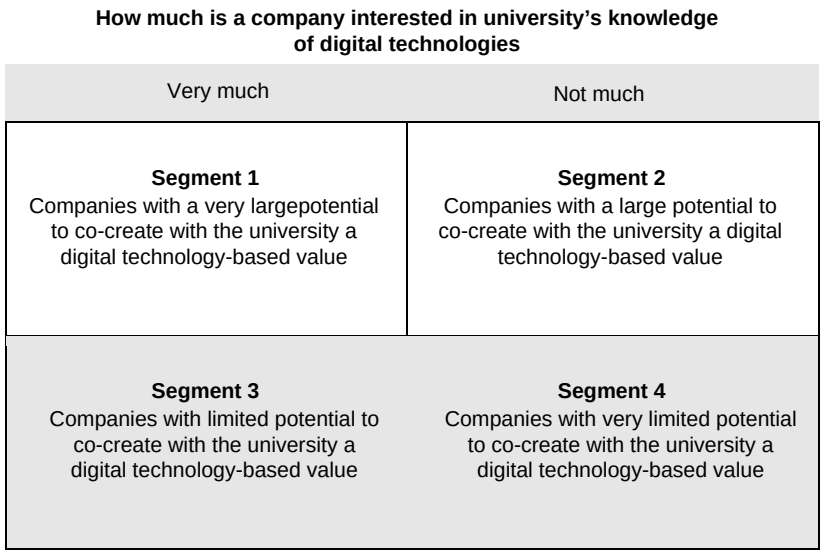

Figure 5.3 A matrix of university–business partners that provides for the potential of a company to co-create with the university a digital technology-based value.

Source: Own elaboration based on research.

- companies with a very large potential to co-create with the university a digital technology-based value (segment 2);
- companies with limited potential to co-create with the university a digital technology-based value (segment 3);
- companies with very limited potential to co-create with the university a digital technology-based value (segment 4).

Segment 1 are the companies that universities should strive to establish long-term relationship in the context of digital transformation in the first place. It is very likely that the companies in this category have the most potential to co-create with the university a digital technology-based value. In these businesses, digital technologies are usually fundamental for their unique competency, which is the source of competitive advantage on the market. For these companies, digital transformation is an opportunity, and they turn to universities for new knowledge that they can develop and adapt to their own business purposes. Importantly, collaboration between a university and this category of businesses, developed and strengthened through interactions, very often significantly contributes to major knowledge growth for both partners, which is one of the main goals for universities.

Segment 2 are companies with a relatively large potential to co-create with the university a digital technology-based value. They are (often foreign) businesses that have been applying and developing digital technologies in their organizations for many years. They value mostly practical solutions that can streamline their processes. They are usually large businesses with highly qualified personnel and very well-equipped laboratories that they can use to develop knowledge of digital technologies for themselves (without collaborating with universities). Thus, segment 2 are a very important group of businesses for a university (because of their extensive resources and research and development potential) to co-create value with and generate new knowledge or identify new areas for knowledge application. However, compared to the previous group, this segment is much less willing to collaborate with universities and much less interested in establishing bonds, meaning that there may be obstacles in the process of establishing long-term relationship with this group of businesses.

Segment 3 are companies that, because they have no experience using digital technologies in practice, have limited possibilities and potential to co-create value with a university or to generate new knowledge. Nonetheless, they are very interested in universities' knowledge of digital technologies and are eager to collaborate with them. Thus, universities should strive to establish and strengthen bonds with this group of companies, since it is their mission to not only expand and deepen their knowledge but also to disseminate it.

Segment 4 are companies with very limited potential to co-create with the university a digital technology-based value. These are mostly micro or small companies that, in general, do not use digital technologies in their

economic activity, nor are they interested in universities' knowledge of digital technologies. This means they have very little interest in collaborating with universities. Accordingly, this group of companies is the most irrelevant for universities, there being little common ground for them to co-create value based on knowledge of digital technologies and generate knowledge.

When analysing the respective segments of companies, it is also worth assessing the characteristics of the respective interest groups based on the criterion of potential for threat vs cooperation discussed in the literature (Savage, Nix, Whitehead & Blair, 1991). On this basis, it is possible to identify four categories of companies with which a university can establish long-term relationship in the context of digital transformation. These are as follows:

- crucial – companies with high potential for threat vs cooperation (e.g. companies that work with universities on strategic projects founded on knowledge related to digital technologies);
- helpful – companies with a low potential for threat and a high potential for cooperation that help a university deepen and expand knowledge of digital technologies (e.g. companies that evaluate university's teaching programmes, recruit students for on-the-job training and engage in educating students. They are interested in strengthening their bonds with a university and assessing the possibilities that those bonds offer, etc.);
- unhelpful – companies with a high potential for threat and a low potential for cooperation (e.g. specialist companies that provide research, implementation and expert services involving digital technologies; they often compete with universities in the market of university services);
- marginal – companies with a low potential either for threat or for cooperation that is not an interesting target group for universities to establish long-term relations.

It should be noted that the potentials for threat and for cooperation are dynamic, i.e. they may be reduced or triggered by certain changes in university's environment or activity. For example, availability of European Union (EU) funds affects universities' relationship with different groups of companies, e.g. it intensifies relationship with businesses interested in joint bilateral research projects or consortium projects.

Analyses of companies should conclude with a hierarchy of importance for the university's interest groups and potential tools for effectively impacting them. The final goal of this stage of the process of establishing long-term relationship is to select the best partner to work towards the university's values and goals.

5.4 Offering and co-creating value in the process of establishing long-term relationship between universities and businesses

It is very challenging for a university to create knowledge related to digital technologies that will constitute value for a business (because, among other things, this knowledge is very scattered and rapidly becomes outdated). It should also be noted that the university's offer has many different forms, is developed through a multidimensional process and integrates knowledge related to many different technological solutions. The variables in this process are stochastic and their impact may be impossible to fully and precisely define. The effectiveness of respective groups of solutions in the area of modern technologies (e.g. the "Monitoring and automation of processes", "Data integration and big data analytics" or "Protection and cybersecurity" solutions proposed in this book) varies, depending, among other things, on the depth of the relationship between a university and a company or on changing terms of cooperation (according to the results of the author's quantitative and qualitative research). The driving force of long-term relationship between universities and businesses based on knowledge of digital technologies is the desire to co-create value. This desire leads to a synergistic effect that should stimulate growth of knowledge, in particular knowledge of digital technologies. In other words, universities that establish and strengthen bonds with businesses strive to create bigger value than they could generate on their own.

Thus, the main goal of long-term relationship between universities and businesses in this model is to increase, update and aggregate knowledge that will become the main component of their respective offers addressed to different target groups. That offer is a source of value not only for the businesses that are a university's long-term partners but also for the other stakeholder groups (Cf. De Wit & Meyer, 2007): secondary school graduates, students, post-graduate students, doctoral students, employees, local community and other organizations interested in digital technologies. The stronger the bonds between a university and businesses, the wider and thicker the network of university's connection with other stakeholder groups and, consequently, the higher the advantages of networking (Niedzielski, 2005).

The inter-organizational bonds between universities and businesses have a strong market context and can well be strengthened by means of relationship marketing. Market oriented and universities of the third decade of the 21st century offer knowledge-based services to business clients. Yet, in many cases, universities are clients of businesses that offer access to knowledge, technologies and infrastructure. In both cases, creating value for the client involves co-creation of knowledge and mutual learning. Skilfully managed inter-organizational relationship between a university and business can ensure high efficiency, usefulness and sustainability for

both partners. The decisive factors here include, among other things, knowledge exchange, involvement and reciprocity. Reducing obstacles and using stimuli of inter-organizational bonds between a university and business is a major challenge in the process of developing mutual relations, requiring identification of the needs and expectations of both partners. For a university, which is usually less prepared to cooperation in marketing terms and allocates its knowledge resources differently than a company, market recognition is particularly important in order to identify partners that offer the most advantages.

Collaboration between a university and a business in the model designed by the author is obviously bilateral. In that model, a university has an impact on a company's knowledge related to digital technologies (e.g. it helps deepen and broaden that knowledge), whereas a company, being a conscious and active recipient of that knowledge and identifying, among other things, the possibilities of its practical use, becomes an actual co-creator of the value it receives. As a co-creator, the company contributes to the relationship and to the growth of university's knowledge. Thus, it can be assumed that if a university wants to generate as a high added value related to new knowledge as possible, it should strive to develop long-term relationship with different businesses at the same time, both with regional, supra-regional and international companies (which, of course, does not mean that knowledge growth is proportional to the number of university's business partners).

The value stemming from regularly deepened and broadened knowledge of digital technologies should be inscribed in the university's long-term strategy in the form of the mission and lower rank goals of the organization. It should be noted that if a university's mission is strongly embedded in the desires of company managers (who associate the development of their organizations with knowledge of digital technologies), the university has a more stable position in its environment and is better prepared to control the changing circumstances and conditions of operations as well as to develop its competencies.

Knowledge of digital technologies, which is the most important component of a university's offer for its existing and potential business partners, can be transferred in the following areas of cooperation (Ławicka, 2020):

- educational services dedicated to businesses (e.g. dedicated specialties in selected fields of study, certain post-graduate courses, implementation doctorates);
- advisory/expert services offered by academics to businesses (e.g. in order to improve company's products or develop a new product, implement organizational, technical and technological innovation in a company, and train the employees);
- research services (e.g. partnership in research and implementation projects or commissioning research to a university);

- mobility of human capital (e.g. assisting students, offering on-the-job training/internship for students in companies, students writing diploma theses as requested by specific companies, engaging practitioners in teaching university courses and developing study programmes and teaching programmes, engaging businesses in developing university's strategic documents, academics doing internship in companies);
- disseminating knowledge (e.g. joint scientific publications combining theoretical and practical knowledge of digital technologies, company representatives attending conferences and events organized by universities, academics attending congresses and other business events organized by companies);
- commercialization of the results of research and development (e.g. licensing solutions or patenting inventions);
- other services (e.g. academic entrepreneurship, spin-offs, student entrepreneurship developed with the engagement of practitioners from companies).

University managers in charge of establishing and strengthening long-term relationship with businesses in the model presented in this book should place the value that will be co-created by a company in an offer covering one of several of the above-mentioned areas of cooperation.

The key stage in the process of developing long-term relationship between a university and business in the context of digital transformation is designing an offer, the main element of which is knowledge of digital technologies, which is of value both for businesses that either begin to establish their bonds with a university or are strengthening their already existing bonds. In the context of values created and offered by universities that wish to meet the expectations and needs of different businesses, Ratajczak and Sojkin identify different categories of values that are crucial for the competitive advantage of companies (2004):

- universal and individual value;
- graduate's market value;
- research and development value;
- value of a scientific and technological base;
- developed value – market image (university's image).

In the context of digital transformation, the above-mentioned indicators of a university's competitive position should also be lined with knowledge of digital technologies, which is the starting point in the process of designing an offer for a company. Thus, the author, following a factor analysis (see subchapter 4.3), identified three main components related to digital technologies ("Monitoring and automation of processes", "Data integration and big data analytics" and "Protection and cybersecurity"), which may be the main components of a university's offer dedicated to partners that the

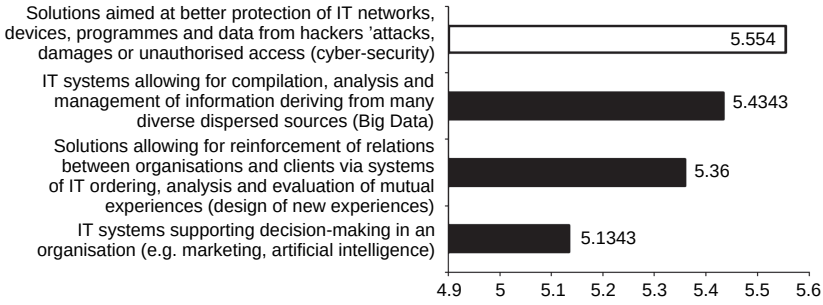

Figure 5.4 Digital technologies in the area of "Data integration and big data analytics" (black columns) and "Protection and cybersecurity" (white column) as instruments for creating bonds between a university and a business (grade on a scale of 1–7, N = 350).

Source: Own research.

university wishes to establish or strengthen bonds with. These factors integrate the knowledge of different solutions in the area of modern technologies. Figure 5.4 presents an evaluation of the solutions that are the components of the "Data integration and big data analytics" and "Protection and cybersecurity" factors and can be applied at the stage of establishing partnership between a university and a business.

Comparing the research results (presented in Figure 5.4) to the observations made by Ratajczak and Sojkin, it should be noted that, at the stage of establishing bonds between a university and a business, individual value offered to the partner may be analysed by reference to the type of services the university may provide to the business. These are mostly educational and research services, focusing, among other things, on solutions that help better protect networks, devices, programmes and data from cyberattack, damage or unauthorized access (cybersecurity), or on information systems for the collection, analysis and management of data from many different and scattered sources (big data). According to Helgesen, in order to establish long-term relationship with institutional stakeholders, a university should not limit its activities (at the stage of establishing bonds) to educational services only. University's activities should be much broader, providing for the need to create and develop company resources, such as people, technology, know-how, time and a proper system to manage those resources during partnership and making up a satisfactory offer (2008). Ławicka believes that at the stage of establishing long-term relations, collaboration may also include internship projects offered by companies to university students (2020). Undoubtedly, university students and graduates have an important role to play in establishing long-term partnerships between the university and businesses. Graduates who are well prepared to meet the demands of the labour market (with high market value) are in a way

ambassadors of a university. They are often guarantors of good communication between the university (that taught them) and the company (where they put their knowledge into practice) – which can prevent the bonds between partners from slackening or breaking.

The author's research suggests that when a university strengthens its bonds with a company in the context of digital transformation, it is particularly important for it to offer services based on knowledge that is relevant to "Data integration and big data analytics" and on digital technologies relevant to "Monitoring and automation of processes". An evaluation of the respective solutions that are the components of the "Monitoring and automation of processes" factor and can be applied at the stage of strengthening partnership between a university and business is presented in Figure 5.5.

Comparing the research results (Figure 5.5) to the indicators of a university's competitive position identified by Ratajczak and Sojnik, it seems that a university should prepare an offer that can become the source of research and development knowledge for a company. Such offer should be based, among other things, on knowledge of the "Monitoring and automation of processes", as companies look for ways to automate simple household chores or to make devices intelligent through an Internet connection. Research and development value co-created by a university and business is, in the author's opinion, crucial in the process of generating new

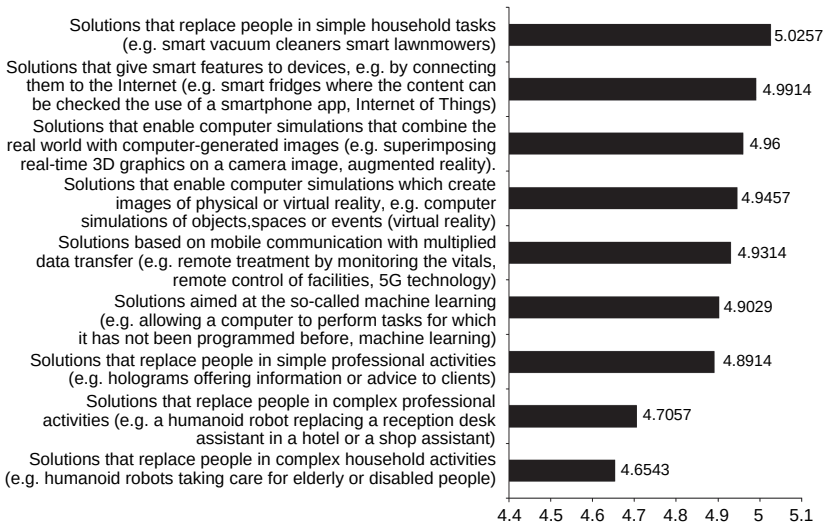

Figure 5.5 Digital technologies in the area of "Monitoring and automation of processes" as instruments for strengthening bonds between a university and business (grade on a scale of 1–7, N = 350).

Source: Own research.

knowledge. At the same time, factors that influence assessment of the value of respective research and development projects implemented in science–business partnership are directly linked to the value of the scientific and educational resources of the university as well as the technical and laboratory resources of the company. Using the resources of both partners can create a synergistic effect that, as has already been mentioned, is crucial in the process of generating new knowledge both for the university and for the company. Another value that is potentially desirable for businesses that strengthen their bonds with a university is the university's positive image, especially if it is based on the university's reputation for expert knowledge of digital technologies. A good image certainly attracts potential partners to a university, making it much easier for the university to establish and strengthen bonds with companies.

Long-term relationship between a university and business in the context of digital transformation is developed both through co-creation of value and the partners learning from each other, which should be taken into account when a university prepares its offer for companies. If bonds with institutional stakeholders are effectively strengthened, both the university and the company aggregate knowledge. Good cooperation enables effective knowledge transfer and commercialization of research results, stimulating innovation both in science and business. It is particularly important for long-term relationship that the university's business partner is convinced it receives useful knowledge that can translate into real benefits. This means that very specific needs are satisfied, leading to loyalty and trust. D. Ballantyne notes the importance of dialogue in maintaining and strengthening bonds (Furtak, 2003). Unfortunately, in the opinions of company managers who participated in the research, such dialogue does not always take place.

The respondents claimed that not all universities are interested in long-term partnership with businesses and that in most cases, the initiative comes from companies. Universities tend to be passive and do not try to initiate such partnerships. According to the managers who responded the research, this is probably due to lack of organizational units or individuals delegated to undertake such tasks and the non-transparent and non-conductive to business partnership organizational structure of universities. The model designed by the author takes into consideration the possibility that bonds might slacken or break (marked with the symbol "–" in Figure 5.2) both when they are being established and strengthened. A bond slackens or, in extreme cases, breaks, if the university's offer founded on knowledge of digital technologies does not meet the expectations of a company.

Unfortunately, the research has shown that university and business partnership is often broken early into the process of its development. Meanwhile, it should be noted that bonds may slacken or break apart even after they have been established. A university is put to test when it offers a new value, e.g. invites a company to be a partner in a new research and

implementation project. If the company decides to engage with the university one more time, the bond is strengthened, but if it rejects the offer, the bond is loosened. Consequently, if a company repeatedly rejects values offered by a university, the bond may finally break. Cooperation may break due to a number of reasons, some of them beyond a university's control. However, according to the research, failure to establish or strengthen bonds is in most cases caused by misunderstanding a company's needs. In the context of digital transformation, businesses expect universities to offer the latest and practically applicable knowledge of modern technologies and not all universities can come up to this expectation.

Notes

1 For example, W. Sztoff and J. Zieleniewski claim that a model cannot be identified with a theory.
2 Before designing a hypothetico-deductive model, one should first explore the theoretical foundations by reviewing and critically analysing the relevant literature and on this basis determine the conceptual framework of the research through precise definitions of the concepts used to describe the research problem. In management and quality studies, the conceptual framework takes the form of a theoretical construct of phenomena that cannot be directly observed. More on this issue: Bamberger & Ang (2016); Czakon (2022); Kumar (2011).
3 Czakon, W. ed. (2015). Podstawy metodologii badań w naukach o zarządzaniu [Fundamentals of Research Methodology in Management Science]. Warszawa: Wolters Kluwer.
4 Sułkowski, Ł., Lenart-Gansiniec R. (2021). Epistemologia, metodologia i metody badań w naukach o zarządzaniu i jakości [Epistemology, methodologyMethodology and research methodsResearch Methods in managementManagement and quality sciencesQuality Sciences. Łódź: Wydawnictwo Społecznej Akademii Nauk, pp. 170–171.

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Conclusions

Although the impact of knowledge as a determinant of organizational development has never been questioned, the increasing turbulency of the environment and the growing demands of market players and their changing needs due, among other things, to rapid technological progress, put that knowledge in a completely new dimension in the third decade of the 21st century. Thus, universities, which unquestionably have the potential to develop knowledge, are particularly prone to satisfy the cognitive needs of other organizations (including companies) in terms of digital technologies by offering a value that is the core of many different services. Meanwhile, universities, the same as businesses, are interested in applying those technologies in different areas of activity, causing an even greater need to explore them. The COVID-19 pandemic turned out to be a catalyst of accelerated implementation of digital technologies at most universities. First of all, it triggered fast organizational and management changes, e.g. increased online communication, more work from home, development of e-learning and using electronic communication platforms to teach university courses. Also, the wave of accelerated digital transformation affected the way research is conducted and the subject matter of research helped universities increase their international activity and open up to "digitized clients", for which companies tend to compete. Finally, digital transformation makes knowledge a key element in the process of establishing a long-term relationship between universities and businesses.

The development of digital technologies significantly increased the potential of universities. However, the author believes that this potential does not grow at the same pace in all universities, some of them being "digitally determined", while others – "digitally scattered". This is proven by the results of research conducted for the purposes of this publication, which suggest that Polish universities have different dynamics of transforming to the business model of a knowledge-based university. Thus, not all universities are good at building long-term relationships with businesses based on value stemming from knowledge of digital technologies. Obviously, the author is fully aware that it is not an easy task, given the complexity of the process of establishing long-term relationships in the

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university services market, as it requires strengthening different inter-organizational relationships based on rapidly developing knowledge as a product, resource and source of competitive advantage.

The ability to establish long-term relationships in the context of digital transformation is a very valuable managerial skill and it constitutes an important element of science and business dialogue. As it has been discussed in this publication, this process is a "creative" combination of the concepts of relationship marketing, value marketing, theory of stakeholders, learning organizations and knowledge-based organizations, leading to knowledge growth for the partners of a relationship who learn from each other based on the values they provide and co-create. This process needs to be corrected and modified on an ongoing basis and it depends both on the university's current position and image in its environment and on changes taking place in companies. In other words, in order to effectively establish and strengthen bonds with universities based on value stemming from digital technologies, universities should constantly accommodate their structure and offer to the challenges of the changing balance of power in the very dynamic market of university services.

The main goal of the work, i.e. designing a model of the development of a relationship between a university and business in the context of digital transformation required answering the question of what factors shape the development of a long-term relationship between a university and business (P2) and identifying the attributes and competencies of a university that are conductive to inter-organizational cooperation with companies. The author thinks that they are, in the first place, a university's market orientation, ability to co-create value through provision of services and ability to absorb knowledge as well as authentic willingness and ability to learn from a partner. The most typical goal of learning from one another is development, often through innovation. The author believes that in the third decade of the 21st century the open innovation model will become popular, creating additional demand for outsourced knowledge.

The research conducted for the purpose of this publication suggests, however, that a vast majority of universities in Poland are not well prepared to transfer knowledge outside to companies that implement innovation in the open model (especially knowledge of digital technologies). Equally importantly, the author thinks that transfer of outside knowledge to universities in order for universities to implement innovation is much too rare. The research also suggests that in science and business relations, transfer of knowledge tends to be one-way, which does not help the new approach (presented in this publication), i.e. co-creation of value that leads to knowledge growth for both partners. In order to co-create value and aggregate knowledge, it is necessary to use many internal and external sources of knowledge. This, in turn, forces university authorities and company managers to find the right balance between the depth and width of their search for knowledge, often entailing a strategy of market

specialization. Knowledge of digital technologies, which concerns aspects of crucial importance for the contemporary socioeconomic system, is one of such key areas of specialization – as has been proven in this publication.

The first research question (P1) was how the transformation of a university into an entrepreneurial organization based on knowledge is conductive to its inter-organizational cooperation with companies. In the context of digital transformation, a university needs to establish long-term partnerships with businesses in order to continue its operations. As it has been presented in this publication, universities may be unable to transform and to meet growing technological needs, of which both universities and their business partners are aware. In the author's opinion, entrepreneurial universities based on knowledge and economy, market, innovation and management orientation are much better prepared to offer knowledge both as an attractive product and the accompanying value, which also makes them more successful in establishing long-term relationships with companies. An entrepreneurial university based on knowledge often has the organizational capacity to anchor its activities in the market and competitive environment. It can also quickly identify and develop knowledge-based competitive advantage (e.g. related to educational, scientific and research activity in the field of digital technologies), which, in turn, attracts potential business partners.

As this publication has shown, a distinguishing feature of an entrepreneurial and knowledge-based university is that it undertakes different forms of inter-organizational cooperation with companies in line with at least one of the three academic missions, i.e. education, scientific and research activity and creating relationships within its community. Each of these missions may involve different application of knowledge of digital technologies, e.g. academic education, scientific research or application projects. At the same time, each of these three missions, in order to be complete, needs to be founded on practical knowledge and the lessons a university learns from its community, e.g. from companies. In other words, cooperation between a university and a company involves transferring knowledge outside and receiving knowledge from outside, which may be done on market terms or within the framework of the corporate responsibility of science. As the publication has shown, inter-organizational cooperation between a university and business requires symmetry in the partners' management structures and methods and overcoming any differences in their respective organizational structures, which affect the progress and outcomes of joint projects. The other conditions that the author believes need to be taken into consideration in order to successfully establish long-term relationships between universities and companies are organizational proximity, institutional proximity and social proximity. Meanwhile, in terms of digital technology development, which, the author thinks, should underline such cooperation, spatial (geographical) proximity is much less relevant.

In order to achieve the main goal of this publication, it was also necessary to identify the key digital technologies in the process of establishing and strengthening bonds between a university and a business (in other words, to answer the question: which digital technologies are essential in the process of establishing and strengthening bonds between a university and business? –P3). Direct research conducted both at universities and in companies made it possible to identify 18 types of knowledge of digital technologies that, in the opinion of the university and company managers who responded the research, can be of importance in the process of establishing a long-term relationship between a university and business. This was followed by factor analysis, which reduced the number of elements of knowledge of digital technologies to the following three factors: monitoring and automation of processes, data integration and big data analytics and data protection and cybersecurity. The author thinks that these factors encourage a company to establish and strengthen partnership with a university. These assumptions were confirmed by the parameters of two hypothetico-deductive models ("Establishing bonds" and "Strengthening bonds"), which suggest that the three factors related to knowledge of digital technologies (1: Monitoring and automation of processes, 2: Data integration and big data analytics, 3: Protection and cybersecurity) have a one-way positive effect on both establishing and strengthening bonds (for positive result of verification of hypotheses H1, H2 and H3 – see subchapter 4.3.).

This means that the more a university does to deepen and broaden its knowledge of digital technologies, the more a company is willing to establish and strengthen its bonds with that university. Thus, it can be assumed that the different university offers founded on knowledge of digital technologies may be the source of significant value for businesses and as such may be used in the process of creating a long-term relationship with business. Also, based on qualitative research (IDI and FGI), it may be assumed that university's knowledge of digital technologies offered in a cycle of recurrent episodes may be the key factor in the process of co-creation of value by a university and a company. This leads to learning and knowledge aggregation by partners – stimulating mutual trust and strengthening the bond between a university and a company.

Direct research conducted in universities and companies made it possible to define the mechanism and main components of a normative (optimization) model that reflects the process of developing a long-term relationship between a university and business. Chapter 5 contains a diagram of an optimization model of the things universities need to do in order to successfully develop a long-term relationship with businesses (answer to the research question P4). The model that will enable university managers to focus on activities that are the most important for developing a long-term relationship with businesses. It may be noted that the mechanism of the model starts to work once a company is convinced to use the services a university offers (establishing bonds – the initial phase of the development

of relationship). This is followed by the main stage of the relationship, i.e. strengthening bonds.

At this stage, partners need to be able to transform a single transaction into a complex relationship developed in cycles of recurrent episodes. The driving force of this mechanism is the desire to co-create value, which leads to a synergistic effect that should stimulate growth of knowledge, in particular knowledge of digital technologies. Meanwhile, it is important, in the process of developing relationships, to monitor every relationship between a university and a company with view to its duration, frequency of contacts, type and content of exchange, links and dependencies between the partners, level of mutual trust and engagement in the relationship. Otherwise, the bond between the partners may slacken or even break. The author believes that the value of a relationship for a university and a company is determined by its profitability, strength and depth, and, among other things, by the usefulness of knowledge exchange, level of satisfaction with the bonds and the life cycle of the relationship. It should also be noted that both partners incur certain costs in the process of exchange, so the value of a relationship should also be examined in time in order to determine whether it is worth maintaining and investing in.

It would not be possible to achieve the main goal of this publication without designing a relevant research procedure. Accordingly, the author reviewed the research methodologies, methods and techniques that could be used in order to solve the main research problem. The author determined that in order to achieve in-depth and comprehensive results regarding the development of long-term relationships between Polish universities and businesses, the research should be founded on methodological pluralism. Thus, the author used an integrated research approach, combining direct interpretive research and positivist research. This required qualitative as well as quantitative research and various research tools (designing individual in-depth interview (IDI), focused group interview (FGI), computer-assisted telephone interview (CATI) questionnaires) arranged in a new, previously not used sequence of methods to understand the force of impact of knowledge of the respective digital technologies on the willingness of companies to establish or strengthen bonds with universities. Also, statistical analysis methods were identified (e.g. factor method or structural equation modelling method) as well as their possible application to help university managers make important decisions on the university offer (founded on knowledge of digital technologies) when establishing and strengthening bonds with businesses (which offered, among other things, an answer to research question P5).

The limitations of this work are mainly due to the direct research method used. Interview methods, CATI technique, the individual IDI as well as the FGI, despite their advantages, have some drawbacks that affect the quality of research results. First of all, it should be noted that individual IDIs with university managers responsible for creating university relations with

businesses or focused group interviews with representatives of companies that either cooperate or not cooperate with universities are qualitative in nature and are based mainly on subjective evaluation and opinions of the respondents, which makes it impossible to draw general conclusions for all universities or companies. Second, quantitative research using the CATI method of randomly selected companies (350) were quasi-representative (the group of companies in the research meets only some requirements of the representative method), thus it is important to be careful (duly reserved) when making general conclusions about cooperation between universities and companies in the university services market in Poland.

It should also be noted that digital technologies are a very heterogeneous and internally diversified category. Often the only element that unites them is innovation and method of implementation. Thus, the author is fully aware that the constructs analyzed in quantitative research – statements concerning digital technologies that can be applied in the process of developing long-term relationships between universities and businesses – do not offer a full picture of the set of solutions in the area of digital technologies. This does not mean, however, that the solutions identified in this publication are useless when developing a model of establishing a relationship between universities and businesses in the context of digital transformation. Every model tends to be simplistic in order to present the most important dependencies in the majority of examined organizations.

As it has been shown in this publication, inter-organizational cooperation between universities and companies based on mutual interest in digital technologies is influenced by their internal transformations triggered by the development of those technologies. Both universities and companies frequently change their business models due to organizational transformations triggered by digital technologies – leading to more questions about the nature and depth of those changes as well as their impact (its direction and power) on establishing and strengthening bonds with other stakeholder groups, both of a university and of a company. Thus, the author believes there is also a need for in-depth research to evaluate the power of impact of the value co-created by partners (founded on knowledge of digital technologies) on the aggregation of knowledge both by a university and a company. Comparing the results with the solutions presented in this publication should lead to better understanding of the problem of developing long-term relationships between universities and businesses in the market of university services and in the context of digital transformation.

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Note: *Italicized* and **bold** page numbers refer to figures and tables. Page numbers followed by "n" refer to notes.