THE STUDY OF COMPETENCES IN THE IT SECTOR

Report on the conducted research

Report prepared upon the commission of the Municipality of Kraków (UMK) by the Centre for the Evaluation and Analysis of Public Policies and the Interdisciplinary Centre for Organizational Research and Development
Jagiellonian University

SUMMARY

The report presents the results of research carried out within the framework of "The Study of Competences of the Kraków Scientific Centre" in the IT sector.

Due to its unique position on the map of Polish new technology centres, the IT sector in Kraków is particularly important in the development strategy of the city. For the purposes of this study, the following companies have been included in the IT sector: **companies providing services directly or indirectly related to the processing of information** (in the area of software development) and **data communications companies dealing with the processing, flow and remote data transmission**. The definition includes companies from the IT and ITO sector, the largest ICT companies and smaller companies with high growth and innovation potential (start-up companies).

As part of the conducted work, based on the analysis of job advertisements and in-depth interviews with opinion leaders and representatives of companies, we have analysed almost 80 competences expected of graduates of Kraków universities of different importance for the development of the industry. These competences have been divided into four areas: **specialist knowledge and skills** (39 competences), **business knowledge and skills** (11 competences), **soft skills** (17 competences), **language skills and other requirements** (11 competences). In the next step, we conducted quantitative research on the demand for competences (together with a reanalysis of the data from last year, we included the results from 44 IT companies employing a total of **over 3,600 employees**), which were then compared in the study with the results of the supply of competences (8 fields of study/20 specializations – which, in 2015, will be completed by a total of about 1,200 students).

With regard to the demand analysis, the report provides information on key competences sought by employers in the IT sector today. These include **English, cooperation, customer orientation, integrity, involvement, focus on technical development, concern for quality, learning, organization of one's own work** and **focus on goals**. In the next five years, in addition to the aforementioned competences, which will remain important, the following will also gain significance: **knowledge of Agile methodology in project management, the ability of giving and receiving feedback, analytical skills, software testing** and **project management**.

Among the most important competences, the most difficult to find in the labour market are those associated with **involvement, customer orientation, cooperation, innovation/creativity, project management, concern about quality** and **organization of one's own work.**

Representatives of the IT sector are very optimistic about the future and predict a sharp increase in employment growth. The report also includes information on the positions to which Kraków employers from the analysed sector most often recruit candidates.

The supply analysis included in the report provides information about the fields of study that satisfy the needs of the IT sector, according to employers, and an evaluation of the obtained learning outcomes important from the point of view of employers (definitions of competences have been "translated" into general learning outcomes). Among the competences important to the employers, the most commonly obtained, according to universities, are: **learning, focus on**

technical development, general technical and engineering knowledge, honesty and **knowledge of new trends**.

One of the most frequent problems indicated by representatives of the IT sector is the insufficient number of qualified professionals available in the labour market. Therefore, cooperation between universities and companies in the IT industry seems crucial – so far, it has been very limited and is often perceived in the categories of exploitation of academic human potential by businesses. The weak relationship between science and business may be the result of different opinions of universities and businesses concerning the type of graduates that universities should educate, particularly in the area of key soft skills. This may create inadequate mental models that hinder long-term, mutually beneficial cooperation of science and companies from the IT sector.

A major constraint and challenge for small and medium-sized companies are the limitations associated with conducting business in Kraków. In the course of the study, Kraków IT companies made numerous suggestions concerning the activities and potential of UMK, including the expectations regarding its involvement in the promotion of the IT industry, investment support and participation in daily activities.

Finally, the report presents detailed conclusions resulting from the analysis, along with suggestions of activities aimed at the development of universities and companies operating in the sector.

Since both universities and companies are rather sceptical about the cooperation between education and business, it is necessary to change the mental models in a way that would allow for long-term cooperation and the establishment of common goals of Kraków IT companies and universities. Soft skills, for which universities feel responsible, may assist technical competences, but also offer a lever to build individual careers of graduates. The solution may be the formation of inter-faculty directions of study, which, on the one hand, would not neglect the development of technical competences, but on the other hand, would offer a solid foundation in fields traditionally considered to be in the area of "Humanities".

Kraków IT companies, following the example of other Polish cities, expect UMK to provide new companies with office space, legal support, assistance in the organization of regular industry meetings, mediation in dealing with business angels and support of business incubators and clusters of new technologies. In addition, the industry expects that politicians and officials involved in entrepreneurship will take an active part in industry events and support financial institutions assisting local companies in the IT industry.

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INTRODUCTION

For the third time, thanks to the project "The Study of Competences of the Kraków Scientific Centre", we are pleased to present you with the results of the study on the relationship between the demand and supply of competences in sectors occupying a key place in the strategic map of development of the city of Kraków. In previous editions, the study concentrated on the following sectors: outsourcing (BPO and ITO), life science, energy, creative and passive and energy-efficient construction. In 2014, research was carried out in the following sectors:

1. Construction, taking into account construction companies and architectural and design offices,
2. **IT, taking into account companies operating in the area of information and communication technology**

A unique solution on a national scale was the expansion of research in the construction sector to include the analysis of positions that require education at the level of **technical and vocational schools**. This area of research was supported, both as to the funding and content, by the **Provincial Labour Office in Kraków**.

The innovative project "The Study of Competences", realized thanks to the commitment of the Municipality of Kraków and the Provincial Labour Office in Kraków, has far exceeded the regional borders with its range of impact. The results of the last two years of work and approach to the analysis of supply and demand of competences have already gained recognition on a national scale. As Jarosław Górniak observes[1] in the introduction to the report on the research Study of Human Capital, which described the Kraków research, the approach used herein "provides [...] the key to the "black box" called "specific sector-oriented professional competences", the lid of which, in the case of the Study of Human Capital, can be only slightly opened". Naturally, as with all analytical work, the applied methodological approach is associated with a variety of constraints that must be taken into account when using the results in practice.

As in the previous year, the reports devoted to each of the sectors present the demand of Kraków companies for specific competences and the supply of competences on the part of Kraków universities. There have been no changes in the objectives set before the research team that focused on questions about the expectations of employers from graduates of Kraków universities (as well as vocational and technical schools) and the level of teaching of competences sought by employers in the process of formal education.

In terms of the applied methodology, compared to the study conducted in 2013, there were no major changes. All the modifications were aimed at reducing the burden of time on the side of the respondents, while maintaining a high quality of data.

The conclusions presented in the reports have been formulated on the basis of questionnaires and several dozen interviews with sector experts, representatives of companies, universities and

[1] J. Górniak (2013). Competences of Poles and the needs of the Polish economy. A report summarizing the fourth edition of the BKL Study of 2013. Warsaw: PARP.

vocational and technical schools. The subject of research also included job advertisements and, to a lesser extent, the documents related to the curricula in selected fields of study of universities and secondary schools in the case of the construction sector.

In 2014, the project commissioned by the Municipality of Kraków was realized in cooperation with the Centre for the Evaluation and Analysis of Public Policies at the Jagiellonian University and the Interdisciplinary Centre for Organizational Research and Development at the Institute of Psychology at the Jagiellonian University. Complementary work on the study in the construction sector, at the level of technical and vocational education, was financed by the Provincial Labour Office in Kraków. The two complementary projects would not have been possible if not for the kindness and professional assistance of representatives of the UMK, WUP, business, representatives of Kraków universities, Kraków vocational and technical schools and business environment institutions. While taking, as the research team, full responsibility for any possible imperfections and shortcomings of the report, we would like to express our gratitude to the ASPIRE Association (re. the study in the IT sector), the Association of Polish Architects (re. the study in the architectural sector) and the Galician Chamber of Construction (re. the study in the construction sector) – without their support and professionalism, our research would not be possible.

We extend our particular thanks to, in alphabetical order:

- Sector experts and those who enabled us to understand the essence of the functioning of all the analysed sectors in a broader context and who made numerous comments, often very critical, which improved the quality of the applied tools and definitions: Marian Bednarek (Zespół Szkół Informatycznych PDP Chemobudowa-Kraków), Adam Biernat (Provincial Labour Office in Kraków), David Carton (ITEKNA), Paul Chen (K'Sup), Łukasz Ciesielski (Making Waves), Jacek Ewy (Ingarden&Ewy), Marek Filipczyk (Practical Training Centre), Matthias Funke (IBM Lab), Marek Gajowniczek (Ericpol), Przemysław Gawor (SARP), Andrew Hallam (ASPIRE), Katarzyna Hodor (Faculty of Architecture, PK), Piotr Hrabia (Galician Chamber of Construction), Zbigniew Jabłoński (Municipal Engineering Works), Artur Jasiński (Faculty of Architecture and Fine Arts, KA), Stanisław Kaczmarczyk (Małopolska Regional Chamber of Civil Engineers), Kazimierz Koterba (Development Office of Kraków), Paweł Kubik (Projektsystem), Rafał Kulczycki (Municipality of Kraków), Maria Leńczuk (Provincial Labour Office in Kraków), Bohdan Lisowski (SARP), Richard Lucas (OpenCoffee etc.), Elżbieta Madej (Hive53), Eoin McCoy (GE Healthcare), Andrzej Mielczarek (Zespół Szkół Informatycznych Nr 1), Andrzej R. Pach (Department of Computer Science, Electronics and Telecommunication, AGH), Michał Pazdanowski (Faculty of Civil Engineering, PK), Wojciech Przybylski (Kraków Technology Park), Stanisław Rybicki (Wydział Inżynierii Środowiska, PK), Małgorzata Ulmaniec (Department of Environmental Engineering, PK), Andrzej Witkowski (Galician Chamber of Construction, Paal Metal), Aleksander Wojnarowicz (Innovation Nest), Katarzyna Wysocka (Municipality of Kraków), Tadeusz Zając (Galician Chamber of Construction, KrakChem).

- Representatives of IT companies[2]: Amistad* AnanaStar*, Aplixcom Solutions, Berrylife*, Brainly, Brainnovative*, CD Projekt RED*, ClickMaster Polska, Compact Solutions Polska, Compendium Centrum Edukacyjne, Ericpol, GE Healthcare, HCL Poland, IBM Polska Kraków Software Lab, ITEKNA Polska, IVISION.PL*, JPEmbedded, Lumesse, Lunar Logic, Making Waves, NETFACE*, notatek.pl, Nano Games*, Ocado Polska, Onet*, Polcode, Razorbear, Semihalf, Smultron*, SoInteractive*, Thulium, u2i.

- Representatives of universities associated with the IT industry: AGH University of Science and Technology (Faculty of Computer Science, Electronics and Telecommunications, Computer Electronics and Telecommunications, Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering*), Jagiellonian University (Faculty of Physics, Astronomy and Applied Computer Science, Faculty of Mathematics and Computer Science).

As in previous years, we have attempted to write particular reports in a way that, on the one hand, would enable their use by employers, universities, public authorities, students and graduates, and on the other hand, would provide a bridge between these groups and serve as a medium of communication. We believe that the presented results of research will remain a permanent element in the discussion on the relationship between the labour market and the education sector in Poland.

[2] The list of companies comprises only those entities that have agreed to include their names in the report. Both in the case of companies and universities, the list includes institutions that have completed the research questionnaire, in part or in whole, or participated in in-depth interviews. * represents companies and universities whose opinions and/or responses from 2013 have been partly reanalysed and used in developing this year's report.

RESEARCH TEAM

Leading experts:

Jarosław Górniak – dr hab., professor, dean of the Faculty of Philosophy of the Jagiellonian University, director of the Centre for Evaluation and Analysis of Public Policies, director of the Department of the Sociology of Economy, Education and Social Research Methods at the Institute of Sociology of the Jagiellonian University. A sociologist and an economist, an expert in social research methods and data analysis, evaluation methodology and analysis of public policies, as well as the sociology of economy and organisations. Scientific patron of the systemic research project "Study of Human Capital", and previously – director of numerous research projects and author of studies on the labour market and public policies. A member of the Consulting Council at the Presidium of the City of Kraków.

Małgorzata Kossowska – dr hab., professor, deputy dean for educational issues at the Faculty of Philosophy of the Jagiellonian University, director of the Social Psychology Unit, President of the Polish Society of Social Psychology in the years 2008-2011 and 2011-2013, President of the Management of the Interdisciplinary Centre for Organizational Research and Development at the Institute of Psychology of the Jagiellonian University (ICBRO). She conducts research related to such issues as: individual differences, political approaches and beliefs, conditions for political beliefs, cognitive rigidity. Holder of numerous prestigious awards and distinctions. Author of numerous books and articles.

Team members:

Piotr Prokopowicz – Doctor of humanities, graduate of sociology and psychology at the Jagiellonian University. Senior lecturer at the Institute of Sociology of the Jagiellonian University, researcher at the Centre for the Evaluation and Analysis of Public Policies at the Jagiellonian University. Co-worker and lecturer at Cologne Business School and Jagiellonian University, Visiting Fellow at Saint Mary's University in Halifax. Specialist in organisation research and data analysis. When working as a consultant for Great Place to Work Institute Europe in Copenhagen, he took part in preparing the list of 100 best employers in Europe and South America. Author and editor of many studies, books and articles about sociology and psychology of management.

Grzegorz Żmuda – Doctor of social studies, psychologist and sociologist, Managing Director of ICBRO, member of the team monitoring the implementation of the development strategy of the Jagiellonian University. He specializes in the psychology of management and organisation, in particular in psychological organisational diagnostics, participatory management and psychology of personnel. He is also working on creating innovative tools for organisational

development. He is working on his PhD thesis concerning the preferences of management styles among young entrepreneurs. He is the author of numerous publications and presentations about organisational psychology.

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Karolina Dukała – psychologist, PhD student in the Department of General Psychology at the Institute of Psychology at the Jagiellonian University. She specializes in the psychology of interrogations and lies. A certified coach of the group training method, she provides training mainly in the field of personal development and the use of soft skills in business, with particular emphasis on negotiation. As the President of the Association of Doctoral Students of the Jagiellonian University, she is engaged in the popularization of science and the creation of a platform of cooperation between business representatives and academics of the Jagiellonian University.

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scholarships. He specializes in statistical analysis using the software environment of R, SPSS, STATISTICA and AMOS.

Marianna Król – psychologist, PhD student at the Social Psychology Unit of the Institute of Psychology at the Jagiellonian University. As a coach and a trainer, she specializes in development programmes for companies and organisations, which include trainings in the soft skills necessary for effective functioning in a complex business environment and individual coaching sessions focused on increasing efficiency and motivation among employees.

BASIC ASSUMPTIONS OF THE STUDY[3]

With regard to the basic assumptions and used methodology, as compared to the studies from 2013, there were no major changes in the presented research. One of the main objectives of the report is to present the opinion of sector experts, representatives of companies and universities on the competences of graduates of Kraków schools without the use of excessive simplification and evaluation. Although this was a significant challenge, we have made every effort to show the flow of intellectual capital from the universities to business, mutual expectations and the adopted perspectives in an objective manner.

As in the previous years, the Study of Competences derives from the analysis of the needs of Kraków companies. In this regard, we tried to maintain the previously adopted standard of not making assumptions in terms of the necessity of adjusting the educational offer to the current shape of the labour market. In our opinion, the needs of the employers should be one of the main factors taken into account in the construction of the curriculum, but certainly not the only one. Similarly, the assumption that cooperation problems arise only from a lack of willingness on the part of employers and their possibility to use the potential of universities is, in our opinion, difficult to defend. This year's survey has once again shown that the development of intellectual capital is based on a complex system, and the only way to carry out a positive change is to establish close cooperation between business, education and public authorities. We hope that the results of the conducted research and the conclusions drawn from them will become one of the elements of such cooperation and will serve the development and implementation of system solutions.

A with last year, the term "competence" is understood as "a set of behaviours belonging to a common category, enabling the effective implementation of organizational goals and tasks on a specific workstation, determined by a variety of psychological factors".

In this sense, competences are sets of behaviours associated with the characteristics expected for a particular position. For simplicity, this year we decided to combine the categories of specialized knowledge and skills. The following list includes the categories of factors identified in the demand analysis:

- Knowledge – information acquired during the learning process (e.g. knowledge of the heat flow in buildings, knowledge of sector law)
- Skills – actions learned in a particular area (e.g. operation of MS Office, communication)
- Abilities – inborn predispositions in a particular area (e.g. analytical skills)
- Others – properties that cannot be attributed to the aforementioned categories (e.g. mobility, honesty, etc.)

In a further part of the report, the word "competences" will collectively determine the behavioural manifestations of expectations expressed in the above categories, which is

[3] Developed on the basis of the Study of Competences of 2012 and 2013. Readers interested in more detailed assumptions may refer to last year's publication. Research methodology and the used tools have been described in more detail in Appendix 2.

consistent both with the Polish tradition of research and the generally accepted international convention.

Competences, which are one of the fundamental concepts in business institutions, have their university counterpart - learning outcomes. As Kraśniewski observes[4], the essence of learning outcomes "boils down to the assumption of (...) what the learner should know, understand and be able to do at the end of a certain period (process) of education." In Poland, learning outcomes are usually divided into three categories: **knowledge, skills and social competences**, though these are not always separable categories. As part of our work, we made a simplified translation of the expected competences into learning outcomes. As in previous studies, we decided to apply a fairly general catalogue of outcomes that could be easily detailed and adapted to the specific characteristics of particular fields of study.

[4] See also: A. Kraśniewski (2011). How to prepare training programmes in accordance with the requirements of the National Qualifications Framework for Higher Education. Warsaw: MNiSW; E. Chmielecka (2010). Curriculum autonomy of the university. Qualifications framework for higher education. Warsaw: MNiSW; Regulation of the Minister of Science and Higher Education dated 02.11.2011 on the National Qualifications Framework for Higher Education

BASIC INFORMATION ON THE ANALYSED SECTOR

DEFINITION OF THE SECTOR

The IT industry can be divided into three main segments: the creation and sale of software, provision of IT services (including ICT) and the production and sale of computer equipment. The present study focuses on the first two segments. For this reason, the IT industry in this study will include companies engaged in services related directly or indirectly to the processing of information (including development of software) and data communications companies engaged in processing, flow and remote data transmission. The definition includes companies from the IT and ITO sector[5], the largest ICT companies and smaller companies with high growth and innovation potential (start-up companies).

THE SPECIFIC NATURE OF THE SECTOR IN KRAKÓW

The IT industry has a growing influence on the global economy. IT solutions are becoming more advanced and more common in all areas of the economy and public institutions. Importantly, the products of IT companies are in fact intangible assets (software and services). This means that they can be made (performed) in a different place than where they are used. The specific nature of the entire industry means that the most important factors for its development in a particular city are legal and economic conditions concerning business activity in a given area and highly qualified human resources that enable the smooth functioning of enterprises. Because of the human potential and political stability (associated with joining the European Union), the IT industry in Poland is growing faster and generating increasing profits[6].

Kraków has in a unique position when it comes to the development of the IT industry. This is mainly the result of two elements: outsourcing companies that deal with IT processes and software development and the development of start-ups that develop and implement new solutions in the field of computer science.

In the case of companies in the ITO sector, their development in Kraków has been very dynamic. This is closely linked with the general trend of the development of outsourcing, which can be understood as the transfer of processes and services to a place where they can be performed cheaper than in the current location, while maintaining the same quality. Today, Kraków is one of the most important centres when it comes to the development of outsourcing in the world. According to the ranking "2014 Tholos 100 Outsourcing Destinations", in 2014, Kraków came in first position in Europe (9th place in the world) in terms of the potential for this type of service. It should be noted that the beginnings of the development of the outsourcing industry in Kraków are associated with the handling of information processes (the maintenance of databases, ERP change management)[7]. Currently, more advanced IT processes are being transferred, including software and application development. In recent years, Kraków has built a strong position in the

[5] Outsourcing companies dealing with IT processes, IT services and software development
[6] See: the report "The IT sector in Poland", 2013 edition, prepared by the Polish Agency for Foreign Investment
[7] See: Study of Competences in BPO and ITO in Kraków, http://krakow.pl/biznes/17621,artykul,bilans_kompetencji.html

outsourcing of IT processes[8]. The main reason for this was access to specialists with specific competences. In the case of companies operating in the ITO sector, these are directional skills related to information technology and telecommunications processes and a very good knowledge of foreign languages. Kraków, as an academic city, provides access to a large number of professionals who are ready to work for less than the applicable rates in Western Europe[9], which are about 35% higher than the average wage in the national economy[10]. Earnings, thus, become a factor that is likely to maintain a steady supply of new graduates of fields of study related to IT processes.

Start-up companies, operating in the broadly understood IT sector, have a growing importance for the development of the industry in Kraków. They can be characterized as companies working on innovative products or services, the operation of which is risky. Kraków is becoming a leader in this field on the Polish market. From 2013, there have been a number of start-up companies that began to succeed, not only on the Polish market, but also internationally. Industry experts give examples of such initiatives as Estimote (wireless sensors transmitting information to smart devices - mobiles, tablets, etc.), BASE (solutions that enable and facilitate enterprises to manage sales, contact database, business strategy and customer relations), Sher.ly (a tool for sharing files) or Brainly (a social learning platform that enables doing homework together). Kraków's position in this field has been confirmed by numerous meetings, conferences and seminars, including the Bitspiration conference[11], which brings together experts in the field of new technologies from around the world, to a large extent stemming from Silicon Valley, or Digital Dragons[12], a festival dedicated to computer games.

The development of the start-up scene in Kraków is a process that has evolved thanks to the interaction of many different factors. The most important of these, according to experts, is human capital, namely young, enterprising, well-educated people with innovative ideas who live in Kraków and are connected with the city. However, in order for the development of the start-up scene to gain momentum, it was necessary to provide adequate structural support. The preparation of physical space, in which such initiatives can start their operation, seems crucial in this respect. Providing office space, legal support and access to initial capital are key elements to build adequate support for start-ups. In Kraków, this has been largely achieved. The business environment of start-up companies has become very friendly thanks to, among other things, the support from European funds in the form of direct subsidies and indirect measures (e.g. through the development of technology development centres operating at universities). An important role in facilitating the operation of this type of company is played by the Małopolski Information Technology Park[13], which offers office space and access to modern laboratories for companies. Importantly, many initiatives are also supported by private investment funds, often associated

[8] See: Computerworld Top200 Report, 2012 edition
[9] Micek, G., Działek, J., & Górecki, J. (2010). Service centres in Kraków and their relationships with the local environment
[10] Data for 2011, see: the report "The IT sector in Poland", 2013 edition, prepared by the Polish Agency for Foreign Investment
[11] http://festival.bitspiration.com/
[12] http://digitaldragons.pl/pl/
[13] It operates within the Kraków Technology Park, http://mpti.krakow.pl/

with the Silicon Valley. For this reason, investors and journalists[14] have named the city of Kraków as a city of start-ups (the so-called "Dragon Valley"[15]).

In summary, the characteristics of Kraków in the field of the IT industry include two elements – the outsourcing of IT processes and the development of start-ups. The development of these two sectors was mostly affected by human capital in the form of well-educated professionals with high language skills and the cultural capital of the city. According to experts, Kraków is a good city to live in. The atmosphere attracts young and well-educated people, who give it strength.

COOPERATION BETWEEN BUSINESS AND SCIENCE

Cooperation between companies and science should be considered with regard to two aspects. Firstly, the IT industry needs well-qualified employees to function efficiently. Secondly, the cooperation between universities and enterprises may be related to conducting common research projects.

With reference to the first aspect, cooperation is quite good. Respondents in the interviews repeatedly referred to the very large human potential, which is an asset of Kraków, but had reservations concerning the practicality of certain programmes and specializations. Many companies work with partner departments in conducting classes and preparing educational programmes, which in turn prepares candidates for jobs in the companies. However, representatives of universities indicated possible problems related to the drainage of students and academic staff by local, large IT companies.

Common research projects are practiced less frequently. On the one hand, large IT companies (including those from the ITO sector) have their own research centres, which operate according to the rhythm of the enterprise. On the other hand, start-up companies are frequently created on the basis of ideas emerging during the studies. They are very specific and rarely implemented in cooperation with the university. Nevertheless, they constitute a form of direct transfer of solutions developed by science to business.

There are certain problems with cooperation, perceived by both parties. Universities are often afraid of the financial capacity of companies with which they are to collaborate. The reason for this concern is the danger of outflow of part of the research workers to companies, which may threaten the quality of scientific work conducted at universities and the level of teaching. Another problem is the form of cooperation between universities and business, which, according to experts participating in the interviews, is informal and based on personal contacts. It is therefore essential to create solutions designed to promote such forms of cooperation between business and science, which are aimed at a permanent solution. A good example of such a

[14] See: http://weekend.gazeta.pl/weekend/1,138262,16440625,Krakow_polska_Dolina_Krzemowa__Wysyp_startupow_pod.html

[15] With reference to Silicon Valley, the centre of new technologies industry, especially the IT industry in the US.

solution is the activity of the Kraków Technology Park[16], as well as the operation of financial projects under the regional innovation system of the Małopolska Province[17].

DEVELOPMENT PERSPECTIVES OF THE SECTOR IN KRAKÓW

Kraków has every possibility to become a long-term leader in the IT industry, not only in Poland, but throughout Europe. The currently observed dynamic development of ITO service centres and start-ups is a good sign for the future. According to experts, the accumulation of IT companies is beginning to resemble a chain reaction. The companies operating in Kraków attract talented and skilled employees. And the large human capital attracts more business. An accumulation of imaginative and well-educated people creates an environment generating new and innovative ideas. This is just a step away from creating start-up companies, where the ideas are converted into specific products or services. According to experts, Kraków has every possibility to become a significant player in the IT start-up scene in Europe in the future; however, this requires the significant commercial success of a product developed in the context of the scene in Kraków.

Kraków's development potential with regard to information technology has been recognized in the report "Technological Perspective for Kraków-Małopolska 2020"[18], prepared under the direction of the Kraków Technology Park. Among the 10 technologies of the future in which Małopolska may become a leader, two are directly related to generally understood information and communication technology (these are: intelligent systems[19] and universal access to information[20]). It should be noted that IT plays an important role in other technologies by providing appropriate IT tools.

The Małopolska Province plans to introduce actions aimed at the development of an information society. This is one of the priorities of the "Regional Innovation Strategy of the Małopolska Province for the years 2013-2020", which provides for activities in three main areas: development of infrastructure for the development of an information society, widening the range of available e-services and creating new ones and increasing their availability for Małopolska residents, as well as increasing the digital content on the Internet. These actions will have a positive impact on the development of the industry. On the one hand, programmes addressed to the population will increase the role of IT solutions in more aspects of everyday

[16] http://www.sse.krakow.pl/
[17] See: "The regional innovation strategy for the Małopolska Region for 2013-2020"
[18] Bendyk, E., Kisieliński, S. (ed.) (2010). "Perspektywa technologiczna Kraków – Małopolska 2020. Wyzwania rozwojowe"
[19] "systems with built-in logic to process information that enables autonomous adaptation of their activities to the changing conditions of work" cited after Bendyk, E., Kisieliński, S. (ed.) (2010). "Perspektywa technologiczna Kraków – Małopolska 2020. Wyzwania rozwojowe"
[20] "technology that allows access to information communication terminal equipment, cooperating transparently with computer networks that use the media, data transmission protocols and data sources." Cited after Bendyk, E., Kisieliński, S. (ed.) (2010). "Perspektywa technologiczna Kraków – Małopolska 2020. Wyzwania rozwojowe"

life. On the other hand, investment in ICT infrastructure will result in the increased profits of enterprises, which will affect their development.

The activities planned in the long-term strategies for the development of the city and the province will have a positive impact on the industry in Kraków. An important role in the development strategy of the city of Kraków is the concept of a "SmartCity". The concept itself may be understood as a city that is friendly to its residents, offering comfortable living conditions, while being neutral to the environment. As part of this concept, the use of a diverse range of IT processes is particularly important in order to facilitate the management of the city and provide services for its residents (i.e. e-services). In this context, the opportunities offered by the development of start-up companies should not be underestimated. Their innovative character and focus on solutions improving the quality of life fit with the idea of the "SmartCity". This kind of context for start-ups can also be considered in relation to the concept of the "Living lab"[21], which may be understood as focusing on the perspective of the user in research activities. The science lab becomes a place whose aim is to resolve the problems of the communities in which it operates. The activities of start-ups seem to be very close to this idea, and the engagement of innovative IT companies in such initiatives can bring benefits not only for the city, but also for entrepreneurs and local communities.

In order for the optimistic scenario of the development of the industry in Kraków to be fulfilled, it is important to provide appropriate conditions for growth. The support provided to investors by the Municipality is particularly important. UMK representatives should play a more active role in the mediation between investors and people wanting to establish a start-up company. The impact of the Municipality is even more important in the case of investments concerning outsourcing companies – all Municipality activities associated with this sector should be aimed at facilitating the investment process in the city. This requires fairly simple actions, such as ordering the information on the website so that it is clear what kind of issues can be reported to specific offices. Examples of good practices in the support of start-up companies may be provided by the experiences of other cities. An overview of support practices provided to start-ups in the largest Polish cities[22] indicates that most of them based their activities on the same elements, including the preparation of office space, legal support, assistance in the organization of regular industry meetings, mediation in dealing with business angels and start-up capital, the activities of business incubators and clusters of new technologies. An example of such activity is Centrum Przedsiębiorczości Smolna in Warsaw or free co-working space organized in Poznań.

Human capital seems to be the most important factor affecting the development of the industry. First of all, universities and schools should be supported in maintaining a high level of education. It is important that good professional education is supported by general education and that students were also trained in group work. On the other hand, the city itself should be a good place to live in. During the interviews, the experts stressed the fact that Kraków is now trendy and has a unique atmosphere, which facilitates the placement of new business initiatives in the

[21]See: Technology Innovation Management Review, November 2012 (http://timreview.ca/issue/2012/september)
[22]See: http://mamstartup.pl – articles from the series "What does your city do for start-ups?"

city. It should be noted that in order to continue this positive trend, the city should become increasingly friendly to its inhabitants and, more importantly, not lose its special atmosphere.

PESTER AND SWOT ANALYSES

PESTER, i.e. analysis of the external environment (Environment: Political-Legal, Economic, Socio-cultural, Technological, Environmental, Regulatory)

a) Political and legal environment

The IT sector is highly globalized. As long as Poland and Kraków are seen as politically stable, the decisive factor for locating ITO companies in the city will be access to appropriate staff. All the events destabilizing the political environment of Poland or the functioning of the European Union are a threat to the development of the industry.

b) Economic environment

The economic crisis, which affects the value of the Euro or PLN, can be very dangerous for the competitiveness of Kraków in the context of the functioning of the ITO industry. A similar effect may be the result of increased payment requirements, which may lead to an outflow of personnel to countries in which real wages are higher. In the case of start-up companies, the risk of "brain drainage" is also an important threat.

c) Socio-cultural environment

The greatest danger should be associated with the decrease in the number of students, especially students of technical faculties. Another important issue would be an increase of nationalist and anti-immigrant views, which would decrease the popularity of Kraków as a good place to live in for everyone, including foreigners.

d) Technological environment

Information technology is a rapidly growing sector in terms of technology. For this reason, the large potential for development in Kraków is a good sign for the future – the chances of preparing a product that may achieve spectacular success are very high.

e) Natural environment

Increased use of information technology in the management of the city and its services should result in better environment protection (the concept of a "Smart City"). On the other hand, the existing air pollution in Kraków reduces the quality of life of its residents and affects the image of the city.

f) Regulatory environment

Significant changes in the regulations of labour law may have a huge impact on the functioning of ITO companies. Allowing companies wider use of data collected by public institutions may result in providing services for people.

SWOT analysis, i.e. summary of the strengths and weaknesses of the sector and the opportunities and threats that arise from the environment of the sector.

Strengths of the IT sector in the region:

- Significant human potential, both in terms of knowledge and skills, as well as creativity
- A large number of companies engaged in many different areas of IT (diversity)
- Strong brand of Kraków

Weaknesses of the IT sector in the region:

- Lack of an international IT product developed in Kraków and clearly associated with the city
- Low percentage of "high order" processes (e.g. R & D) located in Kraków

Opportunities of the IT sector in the region:

- Development of an information society supported by public projects from EU funds
- Development of the city based on the concept of a "Smart City"
- Demographic projections indicate an increase in the number of inhabitants of the city

Threats to the IT sector in the region:

- Local and international competition of other centres of the IT industry
- Outflow of personnel to other centres of the IT industry

DEMAND ANALYSIS: THE DEMAND OF THE SECTOR FOR COMPETENCES

The report on the analysis of the demand of the IT sector for competences begins with the presentation of the list of positions most frequently recruited for by IT companies in Kraków (Table 1). By far, the widest and most sought-after category of graduates includes programmers, sought both for positions starting a career in a company (the so-called *entry-level*), as well as for independent specialist positions. The English description of many of the positions indicated by the representatives of business is worth noting, as it points to the international nature of the industry.

Positions for graduates most often mentioned by companies from the IT sector
3D Artist
Account Manager, Business Development Manager, Sales Specialist, Sales Representative
Administrator, Junior IT Systems Administrator, System Administrator
Business Intelligence, IT Analyst
Enviro Artist
Graphic Designer, Web Designer,
IT Security Engineer
IT Network Engineer
IT Leadership Programme
IT Specialist
Platform Operations Engineer
Developer (.NET, mobile applications, back-end, Big Data, C (Embedded), C++, Flash / Action Script, front-end, FX, gameplay, iOS, J2EE, PHP, Ruby on Rails, embedded systems), Junior Developer, Intern, Software Developer, Software Engineer, Web Developer
Project Manager
Quality Engineer
Editor
Sound Engineer
Logistics Specialist
Team Leader
Technical Support Engineer
Software Tester, Tester/QC Specialist, Software Development Engineer in Test, Software Tester
UX/UI Designer

Table 1. List of positions to which graduates of the IT sector are recruited (names of positions left in the original version).

Although employment growth in the IT industry is widely recognized, the plans for hiring graduates for 2015 and 2020 in Kraków IT companies seem to be particularly ambitious.

Comparing the number of planned recruitments to the current state of employment, it is clear that job offers for graduates of IT faculties and related faculties will increase. Based on the conducted interviews with industry experts, it should be noted that this situation is both a blessing and a curse for Kraków – increased competition for graduates leads to an increase in wages in the IT industry, at the same time creating a very difficult situation in the environment for companies, especially new players who would like to make use of the pool of highly skilled workers offered by Kraków. The dynamics of the employment of graduates is as follows:

Employment of graduates in 2015	Employment of graduates in 2020
23.5%*	**41.2%***
Growth in employment of graduates	

Table 3. Dynamics of employment of graduates in the IT industry.
* Graduates who will be employed in 2015 and 2020 as a percentage of the current employment status (taking into account all legal forms)

The most common form of employment among the companies participating in the survey is contracts of employment (82% compared to 18% of civil law contracts) – this suggests a stable situation in the industry, oriented on long-term cooperation with the employed staff.

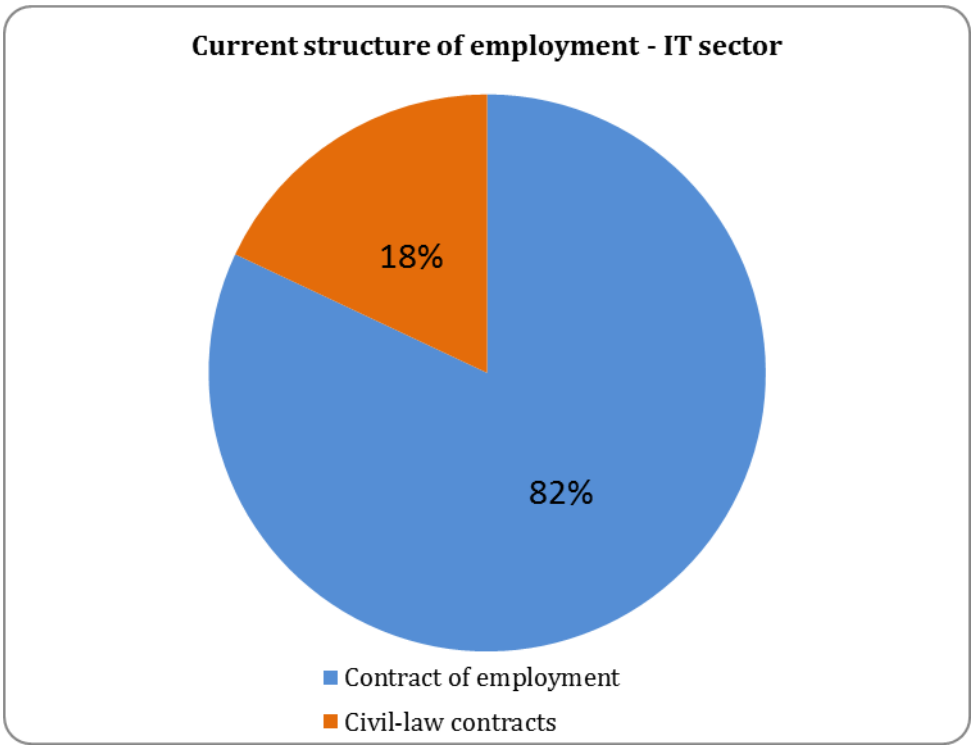

Figure 1. The structure of employment in the IT industry with regard to the type of contract.

COMPETENCES OF TODAY AND TOMORROW

As mentioned in the introduction, the analysed competences have been identified on the basis of interviews with opinion leaders, companies and the analysis of job advertisements. To make

them clear, they were divided into 4 groups: specialized knowledge and skills (professional), business knowledge and skills, soft skills, foreign languages and other requirements. **The list of competences, although extensive, does not have to be exhaustive** – there are many companies on the market that need other, often very specific and unique skills. Therefore, competences related to the creative industry and interactive agencies, which were developed in a separate report in 2013, were not analysed in detail in the current year.

As part of our preparatory work, we tried to bring the sought for competences to a similar level of generality. However, it was not always possible, or even desirable; therefore, **individual competences will vary in details,** which to a certain extent reflects the specific nature of the sector.

Companies participating in the study answered questions relating to, among other things, the importance of the competences now and in the future. Due to the segmented nature of the sector, there are significant differences in the importance of individual competences depending on the profile of activity and specialization of the entity. **Therefore, we have taken the perspective of the entire sector, with the reference point being the job market for graduates as a whole.** This should be taken into account when interpreting the results. For example, the significance of particular technical skills was assessed relatively low – which does not mean that there are no companies on the market for which this competence is of vital importance – however, from the point of view of the overall number of graduates employed in the future, its weight is relatively smaller.

It should be noted that, as in previous reports, the **presented data describes the opinions of people who are responsible for personnel policy or management in companies operating in the industry, and hence they are not prescriptive.** In other words, we present the beliefs of the management of the companies, refraining from the evaluation of whether these beliefs are true or not and whether the strategy based on them is good.

The table below presents a set of 20 core competences (requirements) in the years 2015 and 2020 for the IT industry.

The most important competences today, recognized by representatives of the industry, from the point of view of the labour market, include: **English, cooperation, customer orientation, honesty and involvement**[23]. The results do not indicate a significant shift in the future. Five core competences in the future are**: cooperation, concern for quality, learning, English language** and **involvement.** Among the competences that appear on the list of "the future", there are: **project management, technical documentation, coping with stress, initiative/entrepreneurship** (see Table 4a).

[23]Precise definitions of these and other competences have been included in the dictionary of competences in Annex 1.

20 core competences (requirements) today	Important in 2015
English	4.82
Cooperation	4.81
Customer orientation	4.79
Honesty	4.76
Involvement	4.74
Focus on technical development	4.70
Concern for quality	4.68
Learning	4.68
Organizing one's own work	4.67
Focus on goals	4.65
Feedback	4.57
Innovation/creativity	4.52
Analytical skills	4.50
Knowledge of AGILE methodology in project management	4.46
Software testing	4.38
German	4.38
Oral communication	4.36
Version Control Systems	4.33
General technical and engineering knowledge	4.32
New trends	4.31

20 core competences (requirements) of tomorrow	Important in 2020
Cooperation	4.79
Concern about quality	4.76
Learning	4.76
English	4.75
Involvement	4.71
Knowledge of AGILE methodology in project management	4.65
Feedback	4.64
Analytical skills	4.61
Customer orientation	4.59
Focus on technical development	4.56
Focus on goals	4.53
Software testing	4.48
Honesty	4.47
Organizing one's own work	4.44
Project management	4.40
New trends	4.38
Innovation/creativity	4.32
Technical documentation	4.32
Coping with stress	4.31
Initiative/entrepreneurship	4.30

Table 4a. Competences today (recognized as important in 2015) and competences of tomorrow (recognized as important in 2020). Orange indicates competences that in 5 years will lose their place among the top 20. Green shows competences that in 5 years will join the list of the top 20.

It is worth noting that among the 20 most important competences for the IT industry, more than half belong to the group of "Soft skills". This confirms the universal importance of such qualities and skills as cooperation, honesty and involvement to success in the workplace. At the same time, the statement clearly shows that the development of soft skills may be an advantage for graduates wanting to enrich their expertise in the field of technical competence. Table 4b presents 10 core competences in the year 2015 and 2020 in the area of specialized knowledge and skills.

10 core specialist competences	Important in 2015
Software testing	4.38
Version control system	4.33
General technical and engineering knowledge	4.32
Technical documentation	4.15
Software design	4.11
Human-computer interaction	4.07
Designing user interfaces	4.03
Algorithms and data Structures	4.00
Windows	3.93
Programming in JavaScript	3.92

10 core specialist competences	Important in 2020
Software testing	4.48
Technical documentation	4.32
General technical and engineering knowledge	4.26
Version control system	4.25
Human being-computer interaction	4.15
Algorithms and data Structures	4.14
Software design	4.11
Developing applications for mobile device	4.11
Designing user interfaces	4.00
Safety	3.94

Table 4b. Competences today (recognized as important in 2015) and competences of tomorrow (recognized as important in 2020). Orange indicates competences that in 5 years will lose their place among the top 10. Green shows competences that in 5 years will join the list of the top 10.

COMPETENCE GROUPS

The graphs in this section present the detailed results concerning the competences in individual groups (specialized knowledge and skills, business knowledge and skills, soft skills, languages and other requirements), comparing the present situation with the 5-year perspective.

In the case of specialized knowledge and skills (Fig. 2), the importance of individual competences in the coming years, according to the employers, will be relatively stable. The most important competences include: **software design, technical documentation, general technical and engineering knowledge, version control systems, software testing**. It is worth noting the growing importance of expertise in such areas as: **OS X, developing applications for mobile devices, programming in Python and programming of cloud-based solutions**.

In terms of business knowledge and skills (Fig. 3), the following competences were considered as most important and will remain so in the following years: **knowledge of Agile methodology in project management, new trends, project management, business etiquette, presentations**.

In the area of soft skills (Fig. 4), the following competences were considered as most important: **cooperation, customer orientation, involvement, concern for quality, learning**. In the next five years, according to Kraków's IT companies, the importance of the following competences will increase: **analytical skills, coping with stress, intercultural sensitivity**, whereas the following areas will lose importance: **organizing one's own work, innovation/creativity and impact on others.**

The last analysed category are foreign languages and other requirements/expectations. In the IT industry (Fig. 5), the most important is and will be: **English, German, honesty, focus on**

technical development. The importance of **mobility** and **technical English and German** will increase. Spontaneously surveyed companies also mentioned the following languages as important: **French and Italian**.

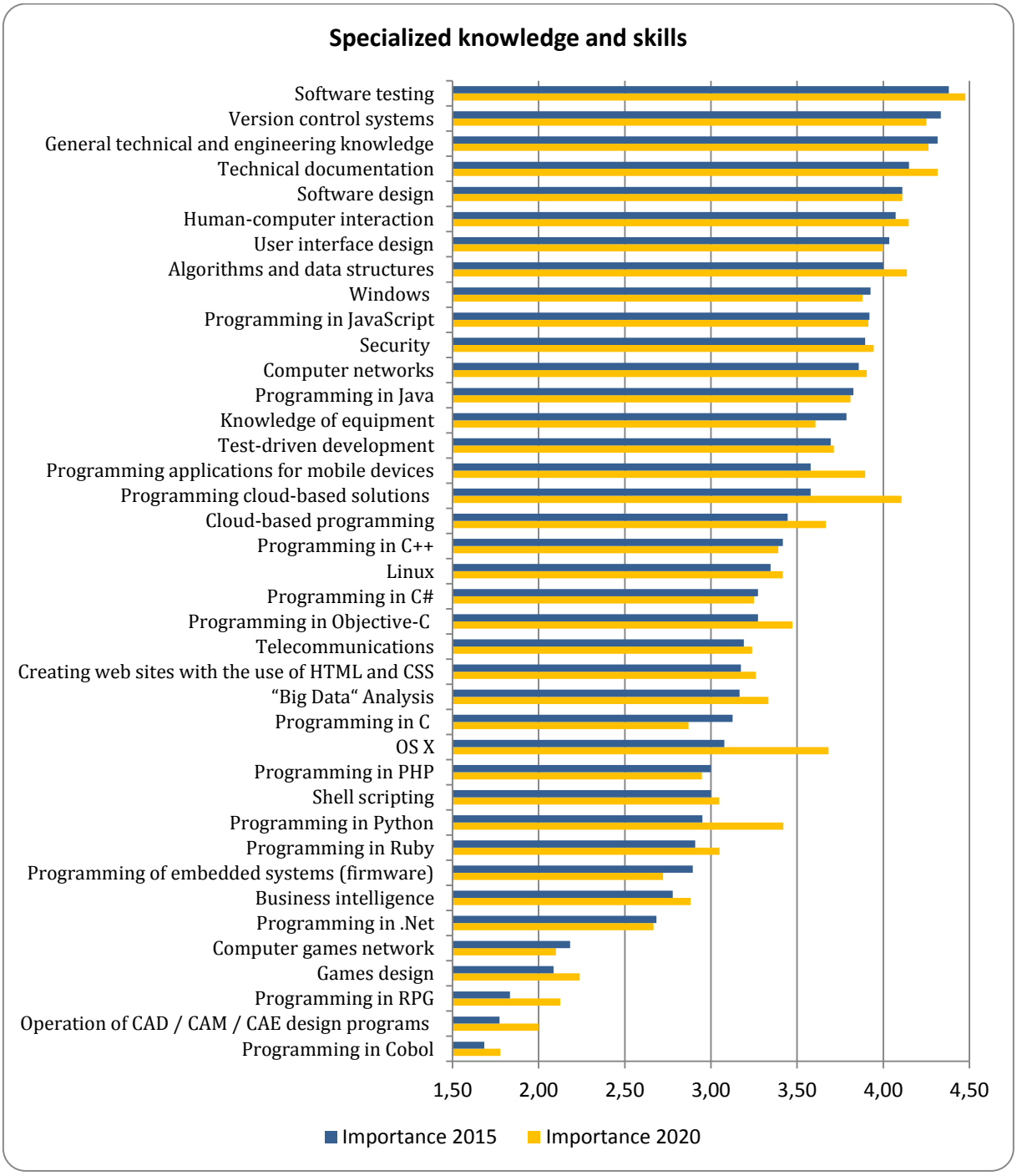

Figure 2. Predicted importance of competences in the area of "Specialized knowledge and skills" in the eyes of employers in the years 2015 and 2020.

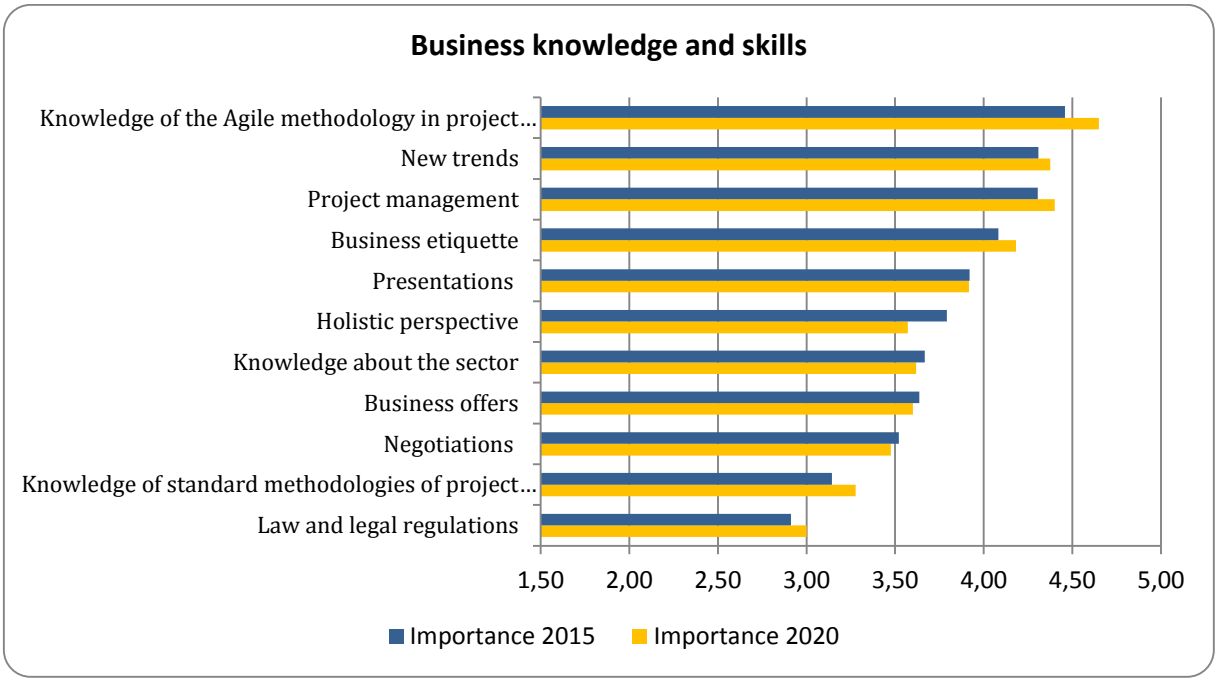

Figure 3. Predicted importance of competences in the area of "Business knowledge and skills" in the eyes of employers in the years 2015 and 2020.

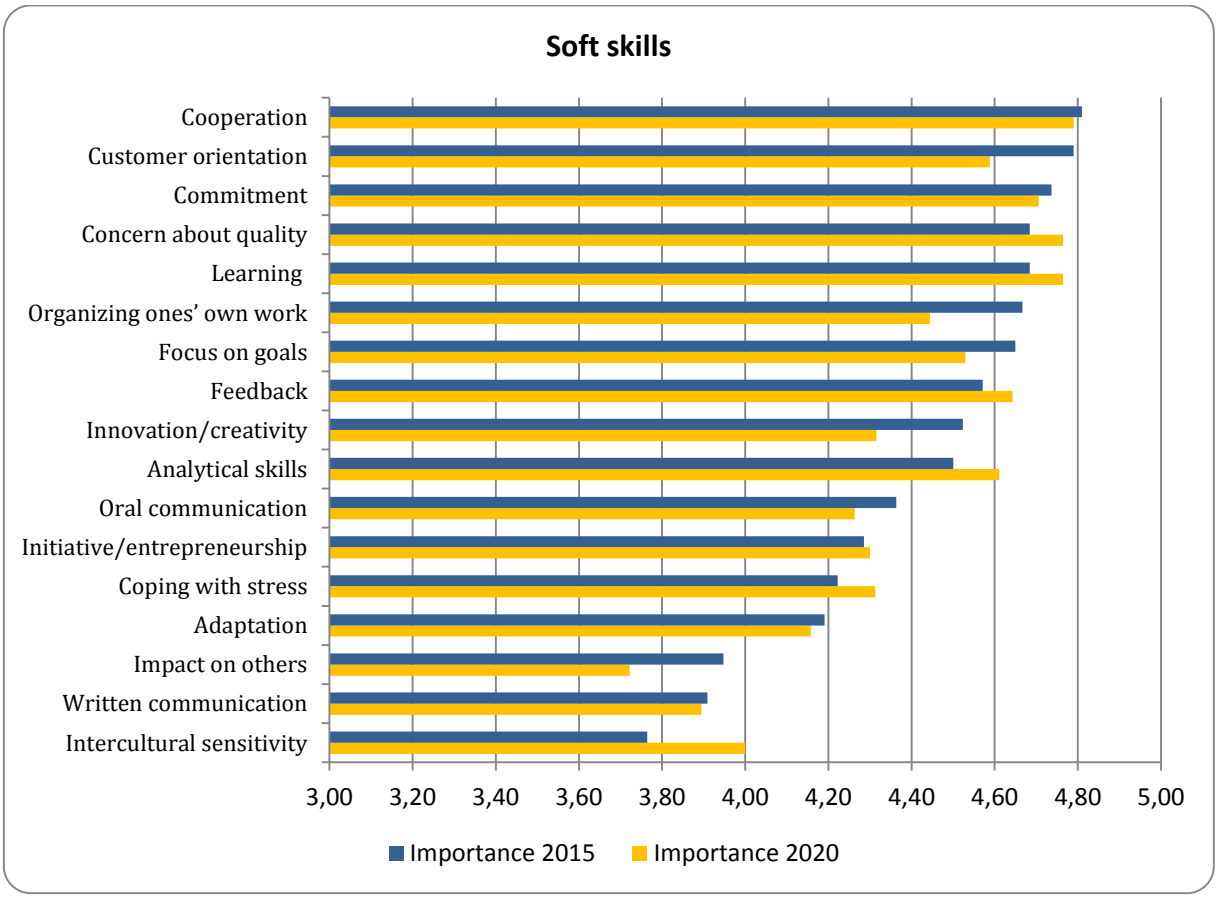

Figure 4. Predicted importance of competences in the area of "Soft skills" in the eyes of employers in the years 2015 and 2020.

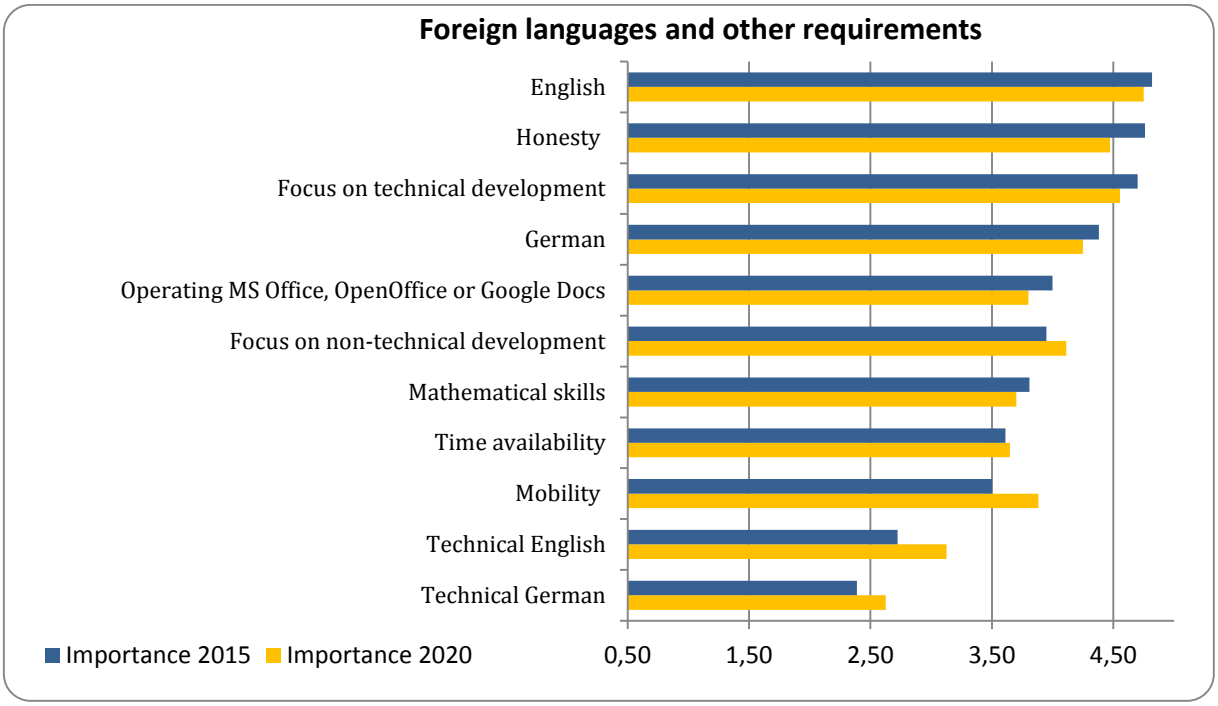

Figure 6. Predicted importance of competences in the area of "Languages and other requirements" in the eyes of employers in the years 2015 and 2020.

We also asked employers to provide a list of competences that are crucial in the context of promotion in the IT industry. They are listed in the table below:

List of competences/requirements that are essential in the context of promotion	
Experience (internship or practice)	Programming
Flexibility	Independence
Work ethics	Self-development
Initiative	Reliability
Other foreign languages (fluent)	Conscientiousness
Innovation	Extensive knowledge of the Internet and social media
Quality	Learning speed
Communication	Honesty
Creativity	Ability of abstract thinking
Loyalty	Ability to work in a multicultural environment
Resistance to criticism	Leadership skills
Responsibility	Technical skills
Courage to present one's own ideas	Management skills and team building
Work organization	Cooperation
Focus on goals	Commitment
Customer orientation	Passion to learn and develop one's competences
Planning	Project management
Creativity and openness (open mind)	Analytical skills
Practical technical skills	Knowledge of English

Table 5. List of key competences for graduates to obtain promotion (competences marked in green were most frequently mentioned by respondents).

The indicated competences compose an interesting catalogue of skills, knowledge and abilities required of an employee who wishes to develop in an IT company. What is interesting, programming, though identified as significant for promotion, is only one of the essential competences – the others are connected with good command of English, soft skills and business skills. This confirms the hypothesis according to which the most important competences, from the point of view of promotion within a given company, are unique competences, which are difficult to find in the internal and external labour market, and not necessarily those because of which a given person started working for the company (usually technical skills).

KEY SECTOR COMPETENCES

One of the most important indicators affecting the perception of the education market from the point of view of employers is the comparison of the importance of specific competences with the difficulty in obtaining them. As shown by the data presented in Table 8, the twenty most important competences include both those which are readily available on the labour market (green), as well as those which are difficult to obtain (red). Following this line of thought, key competences – from the point of view of supply and demand – include competences that industry representatives consider important yet are difficult to obtain, as they are particularly scarce. Key, though difficult to obtain, competences include: **cooperation, customer orientation, involvement, innovation/creativity** and **oral communication.** The following core competences are much easier to obtain: **English, honesty, focus on technical development** and **version control systems**.

20 core competences (requirements) today	Importance	Difficulty in obtaining
English	4.82	3.00
Cooperation	4.81	3.60
Customer orientation	4.79	3.73
Honesty	4.76	2.93
Commitment	4.74	3.80
Focus on technical development	4.70	2.94
Concern about quality	4.68	3.47
Learning	4.68	3.31
Organizing one's own work	4.67	3.44
Focus on goals	4.65	3.07
Feedback	4.57	3.42
Innovation/creativity	4.52	3.75
Analytical skills	4.50	3.28
Knowledge of AGILE methodology in project management	4.46	3.45
Software testing	4.38	3.32
German	4.38	3.15
Oral communication	4.36	3.60
Version control system	4.33	2.70

General technical and engineering knowledge	4.32	3.06
New trends	4.31	3.30

Table 8. Twenty core competences and the difficulty in obtaining them. Green shows competences readily available in the labour market, red shows the ones that are the most difficult to obtain.

Below, we present graphs reflecting the importance of and the difficulty in obtaining individual competences in the four aforementioned groups (specialist knowledge and skills, business knowledge and skills, soft skills, languages and other requirements).

In the area of specialist knowledge and skills, there is quite a significant variation in terms of the difficulty in acquiring competences in the labour market (Fig. 7). Among the most important competences, the following are relatively easy to obtain: **version control system, algorithms and data structures, computer networks, Windows**. It is much more difficult to obtain competences related to: **security, technical documentation, software testing, software design, human-computer interaction.**

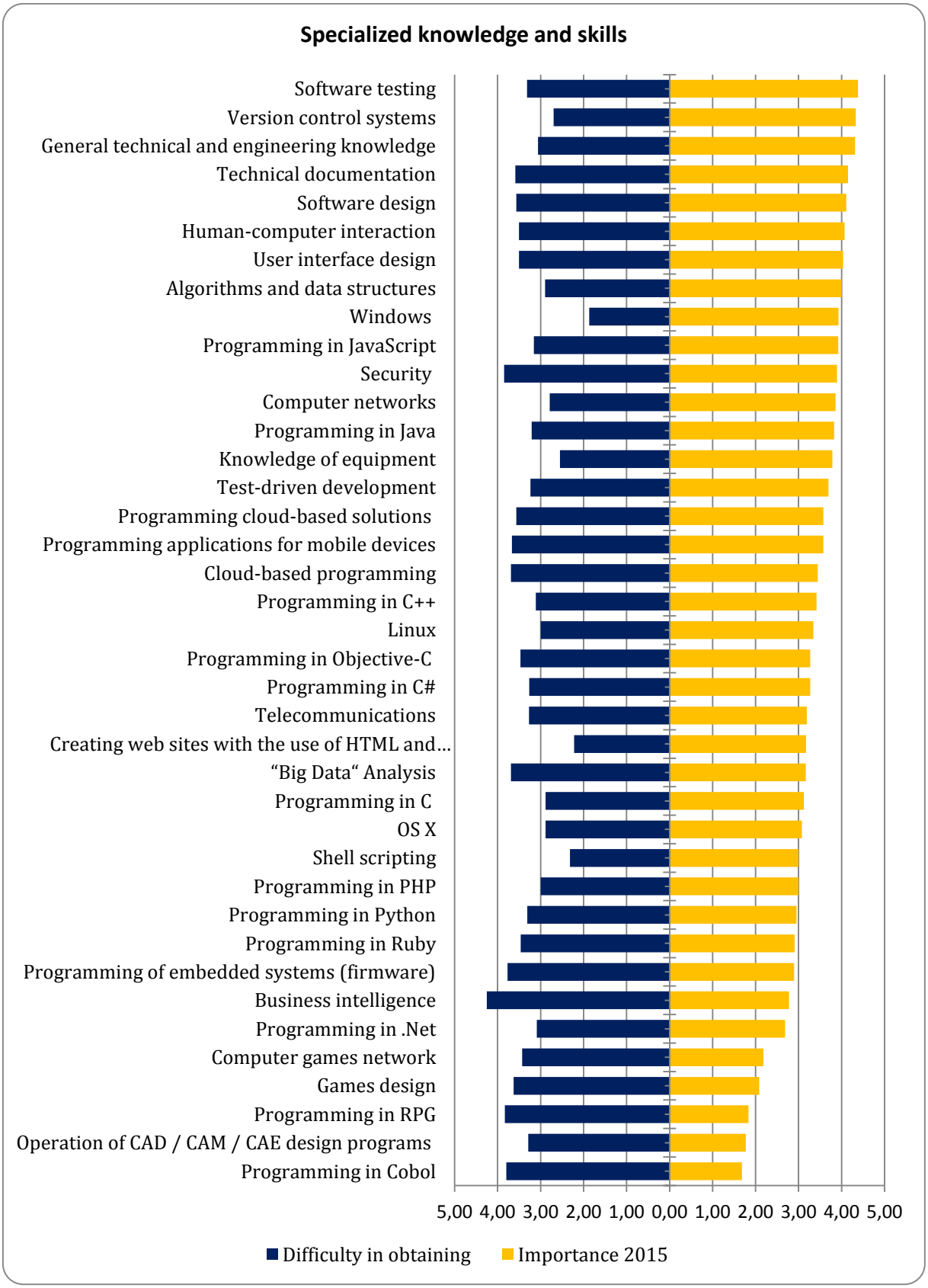

Figure 7. The importance of and the difficulty in obtaining competences in the area of "Specialized knowledge and skills" in the eyes of employers.

In the area of business knowledge and skills (Fig. 8), the low diversity in terms of the difficulty in obtaining the competences in the labour market is worth noting. Important, but easily available competences are **new trends** and **presentations**. Difficult to obtain and very important from the point of view of employers are: **project management, business etiquette** and **business offers.**

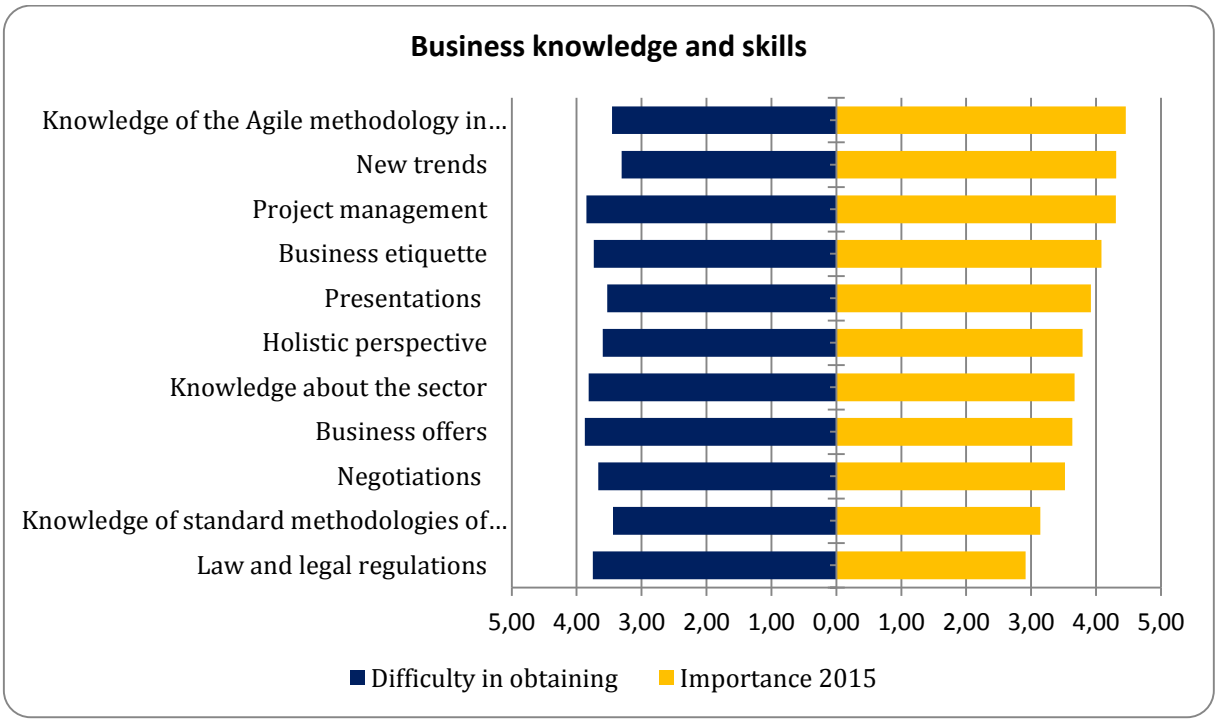

Figure 8. The importance of and the difficulty in obtaining competences in the area of "Business knowledge and skills" in the eyes of employers.

In the area of soft skills in the IT industry, we have observed that competences which are very highly rated in terms of importance are also difficult to obtain. Employers included the following competences in this category: **cooperation, customer orientation** and **commitment**. Representatives of IT companies indicated the following competences as difficult to obtain, but quite important: **innovation/creativity** and **oral communication.** The following were indicated as important and relatively easy to obtain in the labour market: **focus on goals, learning** and **analytical skills**. Once again, the analysis of the candidate profile sought by employers in the IT industry (difficult to find) indicates the practical significance of soft skills and attitudes, which supplement technical competence providing a potential advantage for graduates in the labour market.

As far as other requirements are concerned (Fig. 10), employers estimate their availability in the IT industry as quite high – important competences, such **as English, honesty** and **focus on technical development**, are considered to be relatively easy to obtain in the labour market.

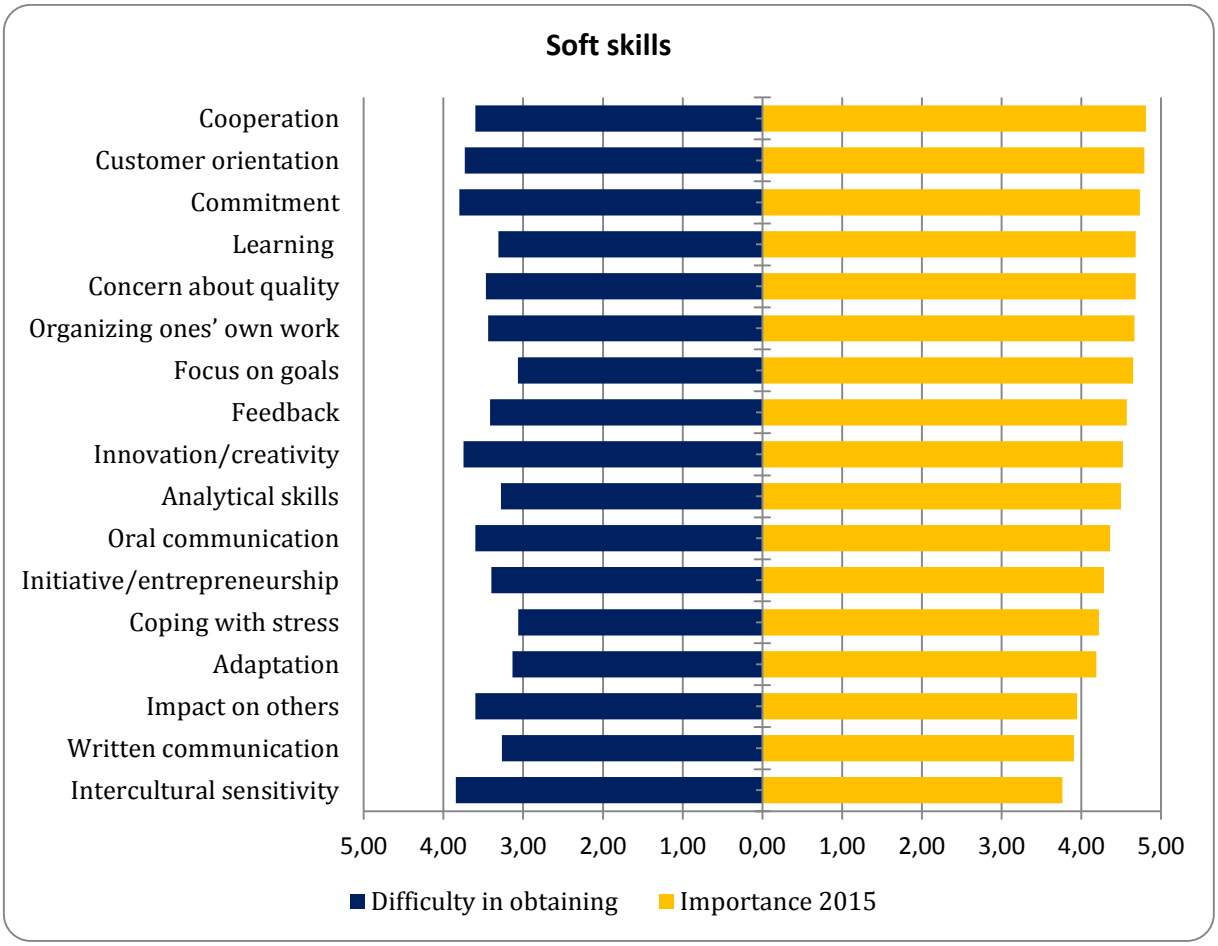

Figure 9. The importance of and the difficulty in obtaining competences in the area of "Soft skills" in the eyes of employers.

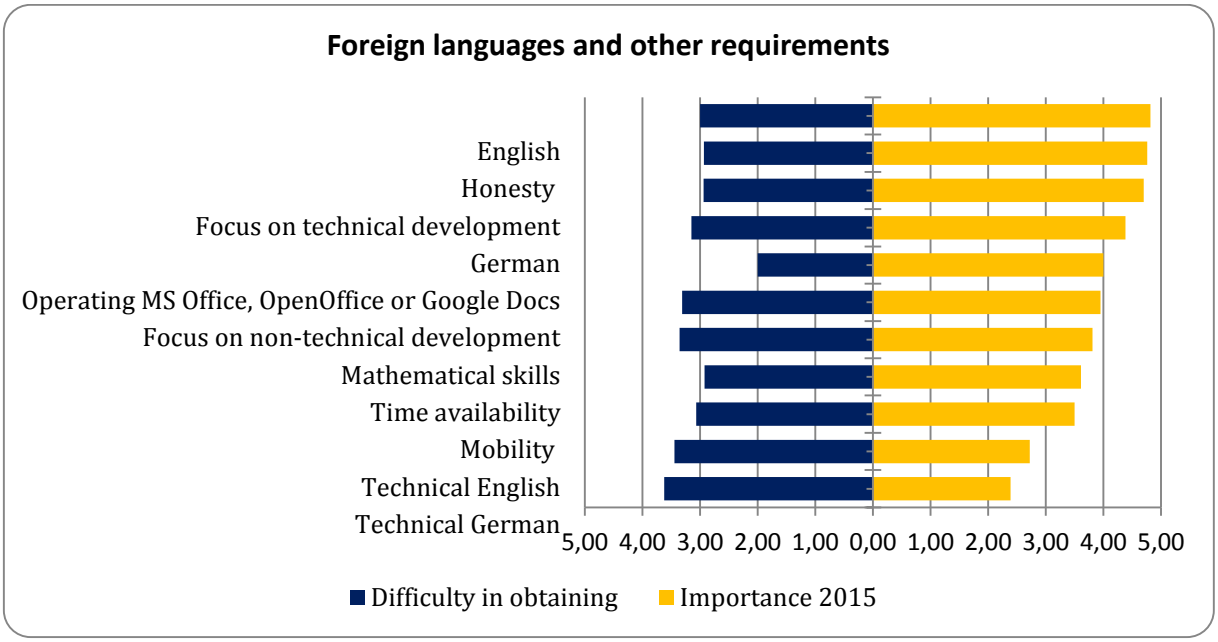

Figure 10. The importance of and the difficulty in obtaining competences in the area of "Languages and other requirements" in the eyes of employers.

The surveyed companies reported some additional competences and requirements with regard to graduates. Some of them coincided with the competences included in the original lists, but sometimes they are defined slightly differently, and for this reason, it is worth paying attention to them. Some of these additional competences refer to the creative segment, which was discussed in a separate report in 2013 and has not been analysed in detail this year.

Additional competences/requirements identified by employers in the IT sector
EPLAN
Emotional intelligence
LABVIEWS
System thinking and systems design
Team work (in the broad sense)
Processes for producing software (in a wide range)
Independence
SAP and other ERP
SCALA
Communication skills
Practical skills in web development
Leadership skills
Knowledge of computer architecture
Knowledge of frameworks
Knowledge of French
Knowledge of Italian
Understanding the financial structure

Table 10. List of additional competences important in the IT sector.

SUPPLY ANALYLIS: LEARNING OUTCOMES IMPORTANT FOR THE SECTOR

The analysis of learning outcomes obtained in the fields of study related to the IT industry is fairly complicated. By definition, learning outcomes relate to the "average student", which, in practice, means that graduates leaving university include both those who are better and worse prepared than the average score suggests. Both representatives of companies in the IT industry as well as representatives of universities confirm that there is a huge demand for competences related to IT and communication systems generated by the market in Kraków and Małopolska. Experts also agree on the assessment of education – they pay attention to the fact that while theoretical and technical knowledge of the graduates of Kraków universities is at a high level, they lack more general skills and abilities that would allow them to translate this knowledge into daily practices in the organization. This does not mean that it is difficult to find a good IT graduate in Kraków – according to experts, it is relatively difficult to find an IT graduate in Kraków whose practical knowledge would allow him/her to quickly become a good employee.

The following table lists the fields of study that representatives of IT companies considered as the most adjusted to their expectations. Interestingly, a high number of companies indicated fields of study offered at universities other than in Kraków (including the University of Technology in Gliwice and the Polish-Japanese Institute of Information Technology). Among Kraków universities, the following were most often mentioned: AGH University of Science and Technology and Cracow University of Technology.

Fields of study/specializations /profiles[24] most often mentioned by companies operating in the sector as adjusted to their expectations
Automation, Automation and robotics
Mechanical engineering
Drimagine 3D Animation & VFX Academy
Electronics, Electronic data processing
Philology
Finance and accounting, Bookkeeping/Accounting
Physics
Information technology, Applied Information Technology, Software and Databases Engineering
Social communication
Mathematics, Mathematics and Natural Sciences
Functional art
ICT, Telecommunication
Production of video games
Management

Table 11. List of fields of study, specializations and study profiles indicated by employers as providing education adjusted to the needs of the IT industry.

The acquisition of individual learning outcomes in each of the four competence groups will be presented in several diagrams below. These will not be average responses, as in the case of the

[24]The original names provided by entrepreneurs have been maintained; different categories are not always mutually exclusive. The results have been supplemented by desk research analysis.

demand for competences, but a percentage of the surveyed fields of study where the given learning outcome is achieved at least at an average level. This is related to the fact that, apart from certain post-graduate courses and a small number of specialized courses, the curriculum rarely includes most of the competences important for the sector. On the other hand, the curricula often include learning outcomes that are not particularly important for a given sector (hence, the unfair assessment frequently made by business representatives that graduates possess a lot of useless knowledge – this knowledge may be applied in other sectors). The use of an average or weighted average would artificially lower the results and fail to provide a complete picture of the supply of competences.

As part of the curriculum of the analysed fields, the learning outcomes most often achieved within the area of specialist knowledge and skills are: **programming in Java, Linux, Windows, designing user interfaces, programming in C language, programming in C ++, version control systems.** More than half of the analysed competences are taught at least at an average level in at least half of the fields/specializations related to the analysed industries. Competences that are the least frequently taught in the analysed fields of study include: **programming of cloud-based solutions, "Big data" analysis, business intelligence. programming in RPG** and **programming in Cobol** (Fig. 11).

In terms of business knowledge and skills (Fig. 12), the curricula of all the analysed fields of study include issues related to **new trends**, as the vast majority provides training of the following competences: **presentations, laws and regulations, knowledge of the industry, project management**. At the other extreme, there are: **negotiations, knowledge of standard project management methodologies, business etiquette, business offers.** According to the representatives of universities, other competences from the area of business knowledge and skills are taught at an average level in more than half of the fields of study.

In the area of soft skills (Fig. 13), the vast majority of universities declares that their curricula include contents related to the following competences: **innovation/creativity, concern for quality, learning, analytical skills.** Less than half of the universities involved in the study declare that their curricula include learning outcomes related to: **focus on goals, customer orientation, intercultural sensitivity, feedback.**

With regard to other requirements (Fig. 14) – students in all the analysed fields of study learn: **focus on technical development**, and in the vast majority of courses, the remaining competences: **operating MS Office, OpenOffice or Google Docs, mathematical skills, focus on non-technical development, honesty.** While the development of ethical behaviour is a particularly disputed issue in the field of university learning outcomes, it is worth noting that highly valued candidates build their advantage in the job market on these competences.

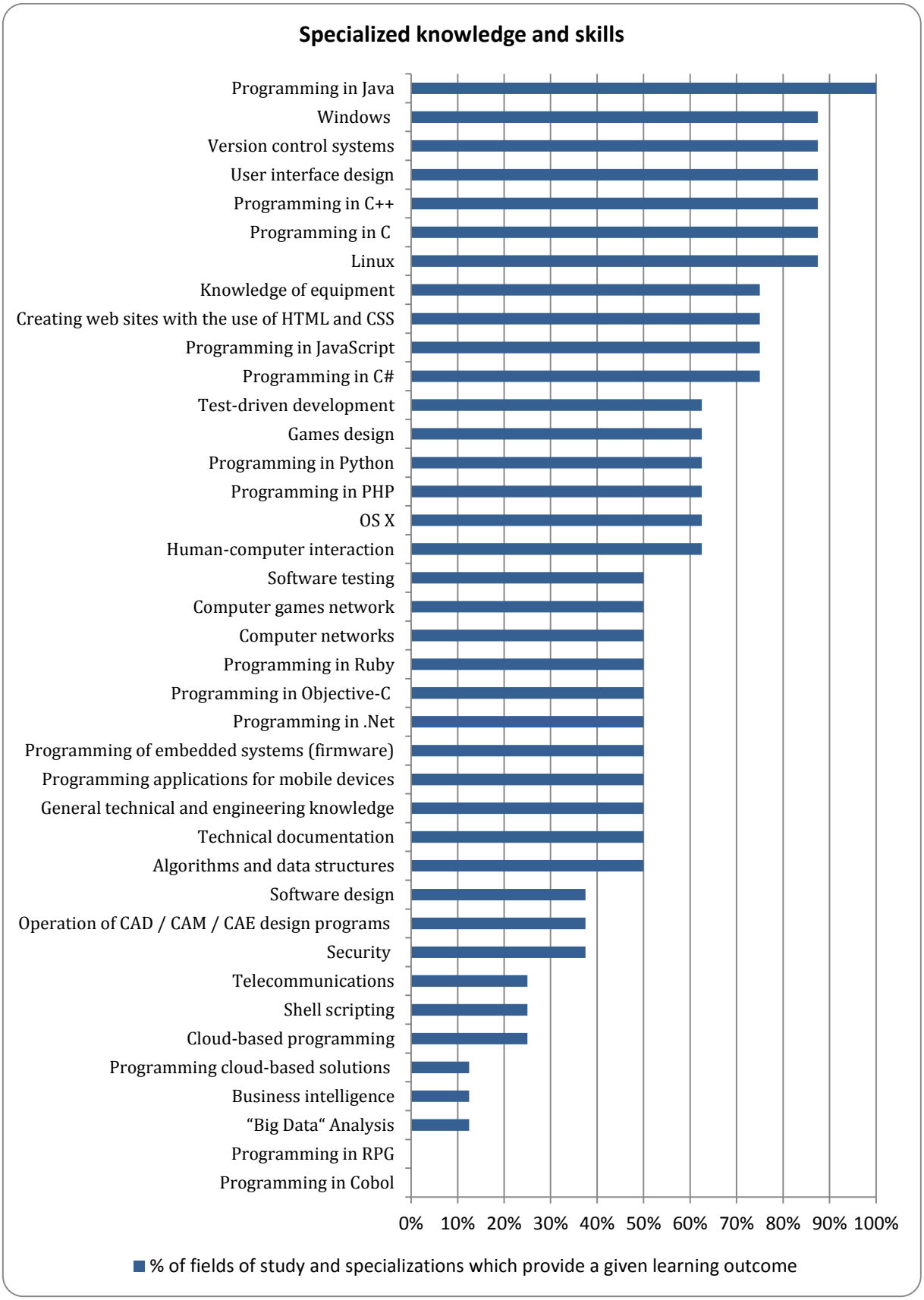

Figure 11. Percentage of fields of study and specializations which provide learning outcomes in the area of "Specialized knowledge and skills" at least at an average level (university perspective).

Figure 12. Percentage of fields of study and specializations which provide learning outcomes in the area of "Business knowledge and skills" at least at an average level (university perspective).

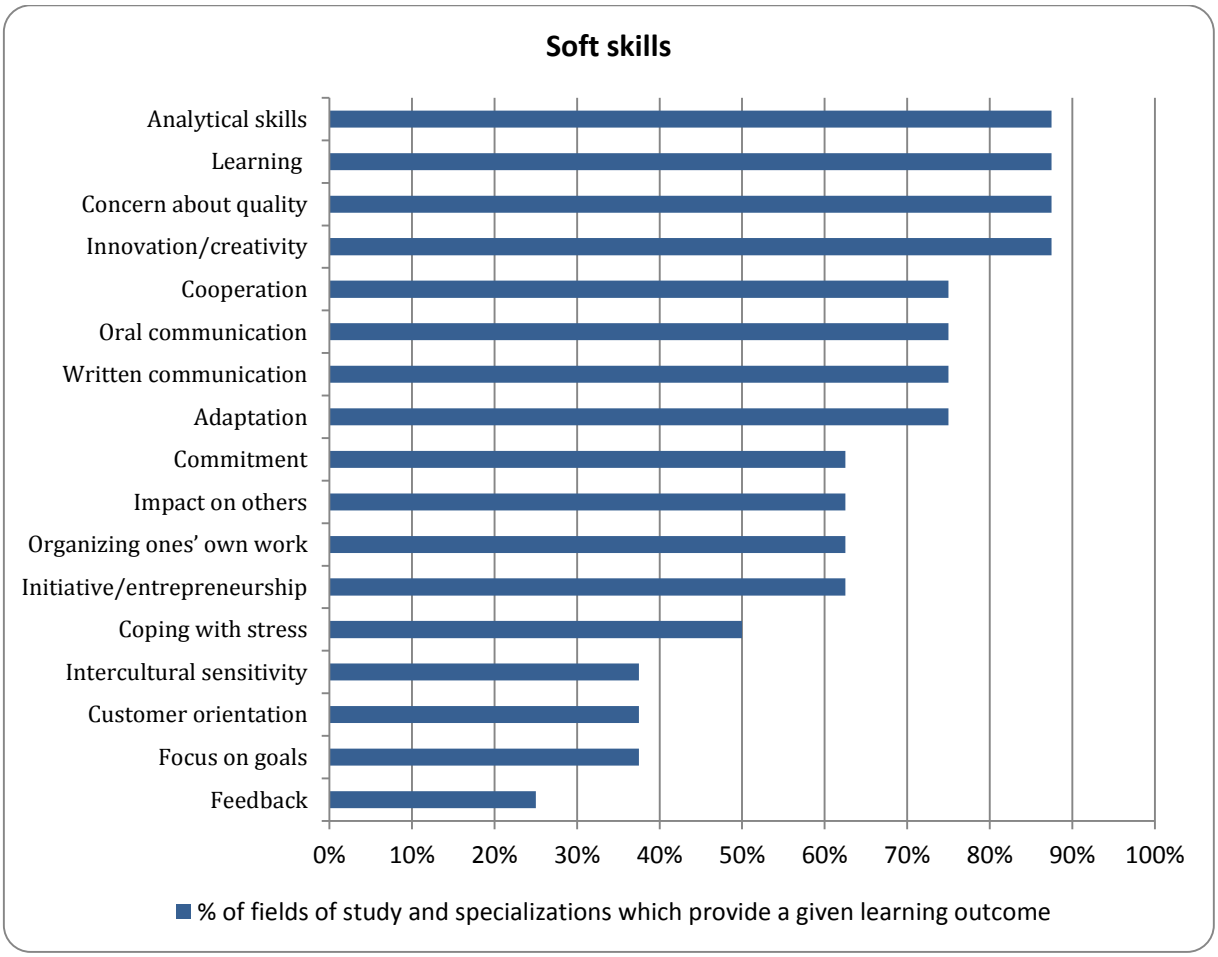

Figure 13. Percentage of fields of study and specializations which provide learning outcomes in the area of "Soft skills" at least at an average level (university perspective).

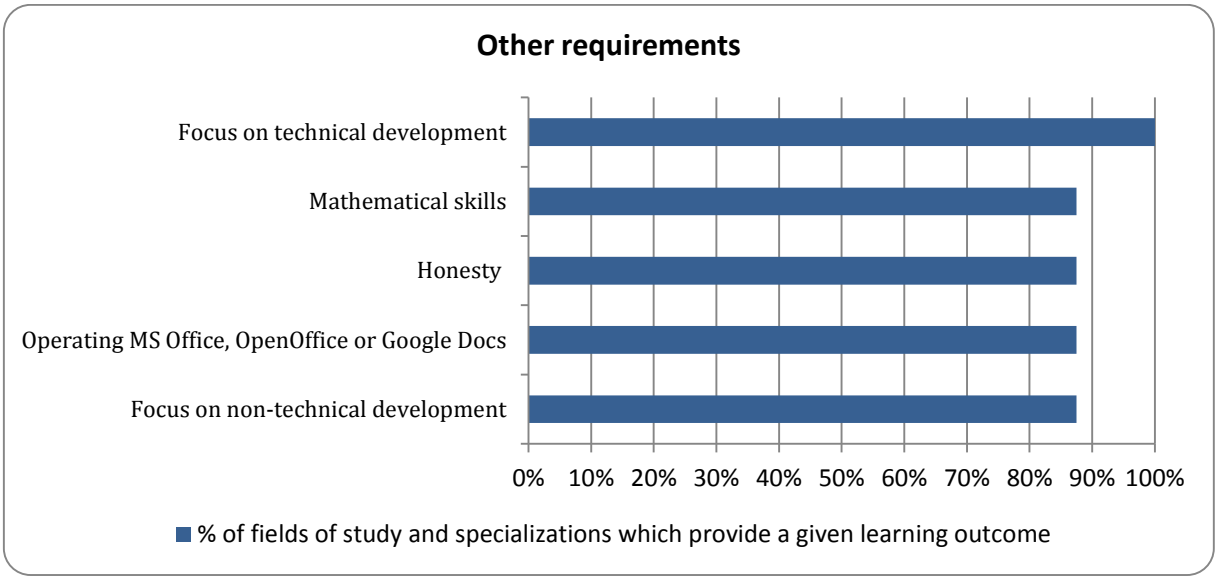

Figure 14. Percentage of fields of study and specializations which provide learning outcomes in the area of "Other requirements" at least at an average level (university perspective).

In summary, the analysis of the supply of competences shows that the fields of study and specializations involved in this study are able to achieve, at least at an average level, about half of the learning outcomes related to specialized knowledge and skills and most of the competences in the area of business knowledge and skills and soft skills. This situation is quite natural and should not be surprising, as individual companies often recruit graduates from different fields of study for diverse working positions.

STUDY OF COMPETENCES: TRANSFER OF COMPETENCES FROM UNIVERSITIES TO BUSINESS

Our demand analysis pointed to key competences, from the point of view of the sector, and the difficulties experienced by employers when recruiting graduates with specific knowledge and skills. The supply analysis, on the other hand, showed what kind of learning outcomes are achieved in the fields of study related to the sector and the complexity of training in this field. The following section presents a summary of these two perspectives, focusing on the comparison of the difficulty in obtaining the competences with the average level at which they are obtained at universities. Similarly to the study conducted in 2013, we would like to raise one important objection associated with the observed non-compliances of assessments related to the difficulty in obtaining competences and training provided at universities.

In the case of a perfect compliance of opinions of business and universities, we would deal with a situation in which competences which, according to employers, are difficult to obtain, are not taught, according to universities. In the case of the presented results, such compliance in the IT sector is quite high in the area of specialized knowledge and skills

(correlation r = -0.45[25]) and business knowledge and skills (correlation r = -0.52). Other areas present a different relationship – a low connection between the declared difficulty/ease of acquiring competences with the obtained learning outcomes. We would like to stress that these differences in opinions between universities and business do not mean that the "fault" lies exclusively on the part of universities, which inadequately assess their educational offer. Although to some extent, this may be one of the reasons for the difference in evaluations; other interpretations are equally plausible (they were described in last year's reports; a summary is presented below).

One of them is associated with the observed polarization of the development of HR processes in companies – problems with finding suitable candidates may therefore result from the use of inappropriate tools of recruitment and selection, remuneration policy or work introduction programmes (on boarding). The second reason may be the way in which learning outcomes are defined. They relate to the qualifications gained by an average student – this means that both better and worse graduates appear in the labour market. Another reason may be the fact that graduates of fields of study identified as adjusted to the profile of the sector are also employed in other sectors of the economy, in other cities and even outside the country. Although there is no official data as to the size of this phenomenon, it is likely that engineers with better language skills more frequently find employment abroad as compared to those who did not decide to go. Furthermore, individual competences may be understood differently by representatives of universities and business – what is satisfactory for the former may be below the acceptable minimum for the latter. Finally, not all the sought-after competences can or should be taught at universities. The presented results of the Study of Competences should therefore be treated as a tool that may be used by both universities and companies to establish effective co-operation and initiate a discussion on the curriculum.

Figure 15 shows the relationship between the difficulty in acquiring specific competences and the obtained learning outcomes in the area of twenty core competences in the IT sector (if, among the 20 core competences, there were competences not analysed on the supply side – e.g. availability and mobility, they were replaced with the next most important competences from the list). The graph includes a range of presented values, which allows for a clear presentation of the division into the most difficult and relatively easier to acquire competences and the division of outcomes obtained in a greater and lesser extent (otherwise, most of the competences should be considered as difficult to obtain and taught simultaneously).

The results show the convergence of company and university ratings in the area of such competences as: **focus on technical development, general technical and engineering knowledge, honesty** and **version control systems** (taught and readily available) and, among others, **project management, customer orientation, oral communication, knowledge of**

[25] The correlation (or Pearson's r) is a measure of the linear relationship of two variables, included in the range from -1 (perfect negative relationship – every increase in the first variable is accompanied by a proportional reduction in the size of the other variable), through 0 (total lack of relationship – every increase in the first variable is accompanied by a random change in the size of the other variable) to 1 (perfect positive relationship – every increase in the first variable is accompanied by a proportional increase in the size of the other variable).

AGILE methodology in project management, commitment, innovation/creativity (less accessible and taught to a lesser extent). Moderate differences relate to **concern about quality** (relatively difficult to obtain, but taught) and **focus on goals** (relatively easy to obtain and taught to a limited extent).

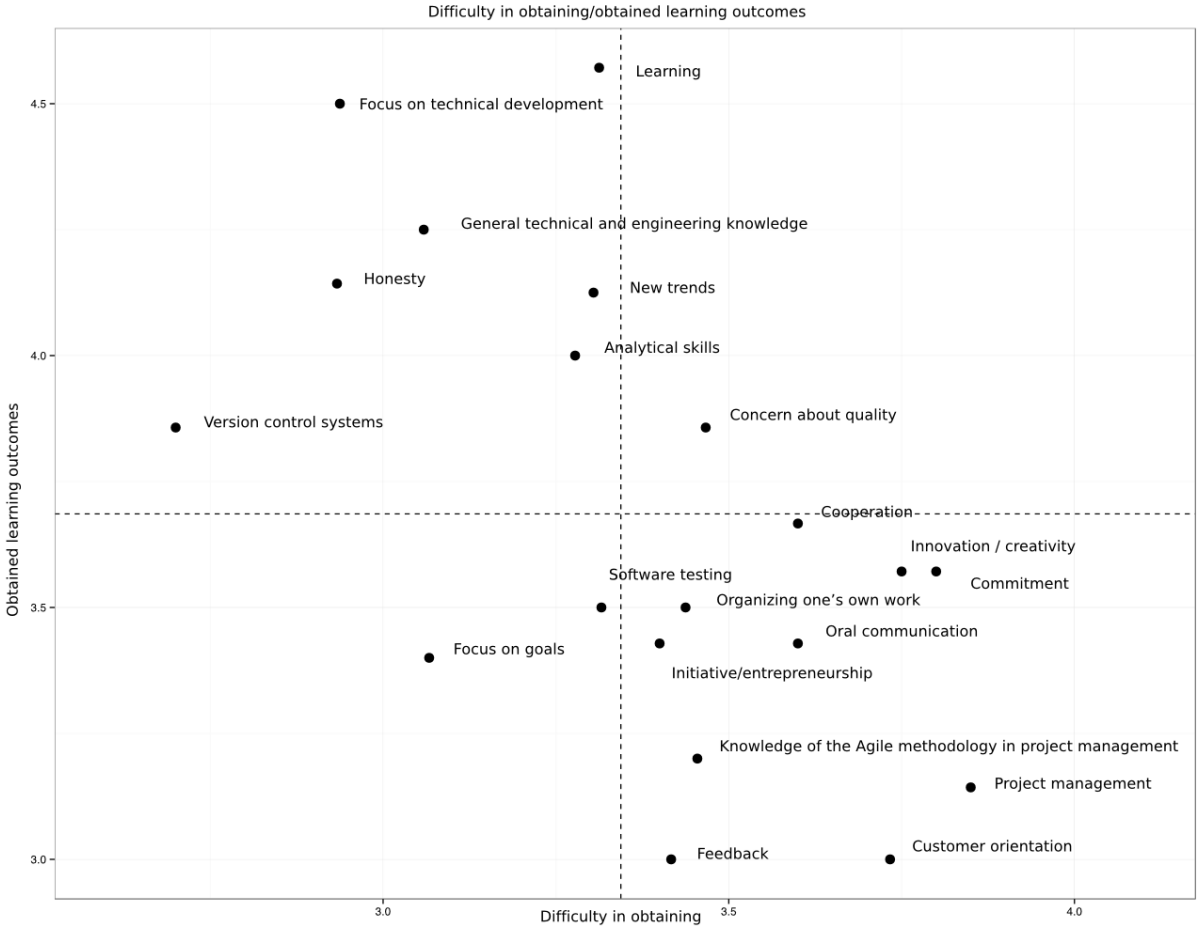

Figure 15. Matrix illustrating the relationship between the difficulty in acquiring specific competences (the employers' perspective) and the obtained learning outcomes (university perspective) for the 20 core competences. For better understanding of the graph, a trimmed scale has been used (from 2.5 to 4.0 for the difficulty and from 3.0 to 4.5 for the obtained outcomes).

In the area of specialized knowledge and skills, there is direct relationship between the assessment of the degree of implementation of learning outcomes at universities and the difficulty in obtaining them according to the employers – competences such as **business intelligence, RPG programming, Cobol programming, cloud-based programming, "Big data" analysis, programming of cloud-based solutions** are difficult to obtain and are taught at a moderate level. The situation is different in the area of competences such as **algorithms and data structures, C language programming, knowledge of the equipment, web pages design using HTML and CSS, Windows**, which are fairly easy to obtain and taught at universities (see Fig. 16).

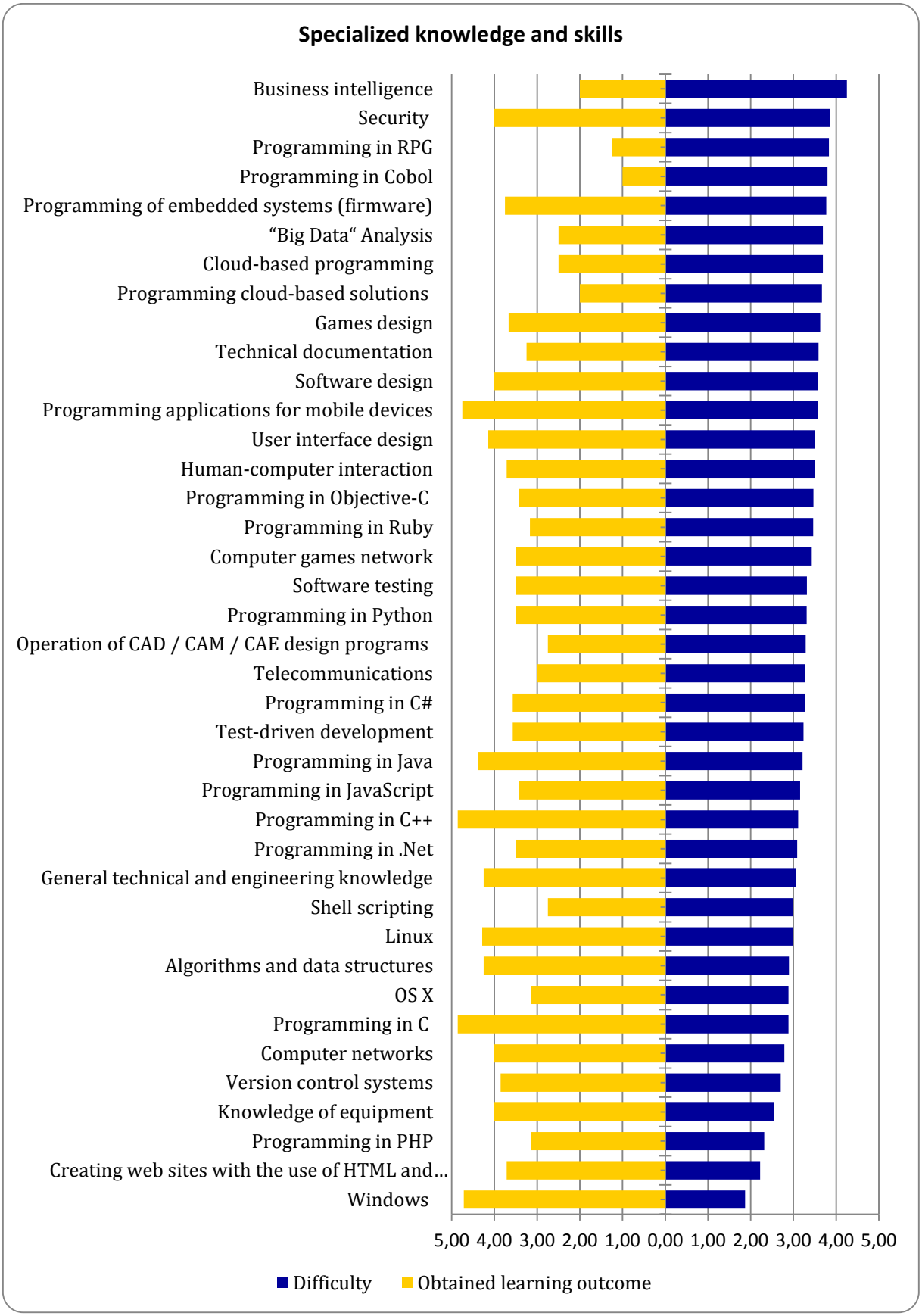

Figure 16. Comparison of the difficulty in acquiring competences (the employers' point of view) and the obtained learning outcomes (university point of view) in the area “Specialist knowledge and skills”.

The competences that are difficult to acquire and are taught at a moderate level at universities include: **business offers, business etiquette, negotiations.** "Conflict" competences, difficult to obtain, but which are taught at universities, include: **presentations and knowledge of the industry** (see Fig. 25).

In the case of business knowledge and skills (Fig. 17), the competences that are difficult to obtain, according to business, and implemented from the point of view of universities include competences associated with **knowledge of the industry, presentations** and **knowledge of new trends.**

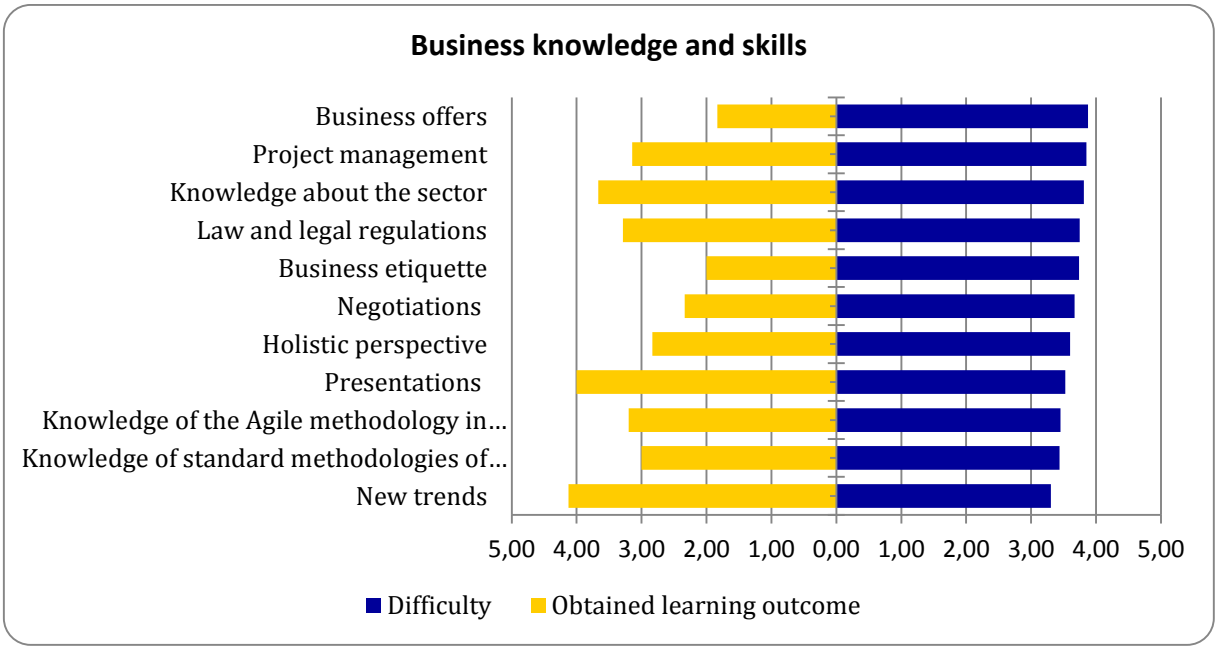

Figure 17. Comparison of the difficulty in acquiring competences (the employers' point of view) and the obtained learning outcomes (university point of view) in the area "Business knowledge and skills".

In terms of soft skills (Fig. 18), **intercultural sensitivity** is considered a competence that is difficult to obtain and taught in a limited degree at universities, while **learning** is considered to be a competence that is taught at universities and is relatively easy to obtain in the labour market.

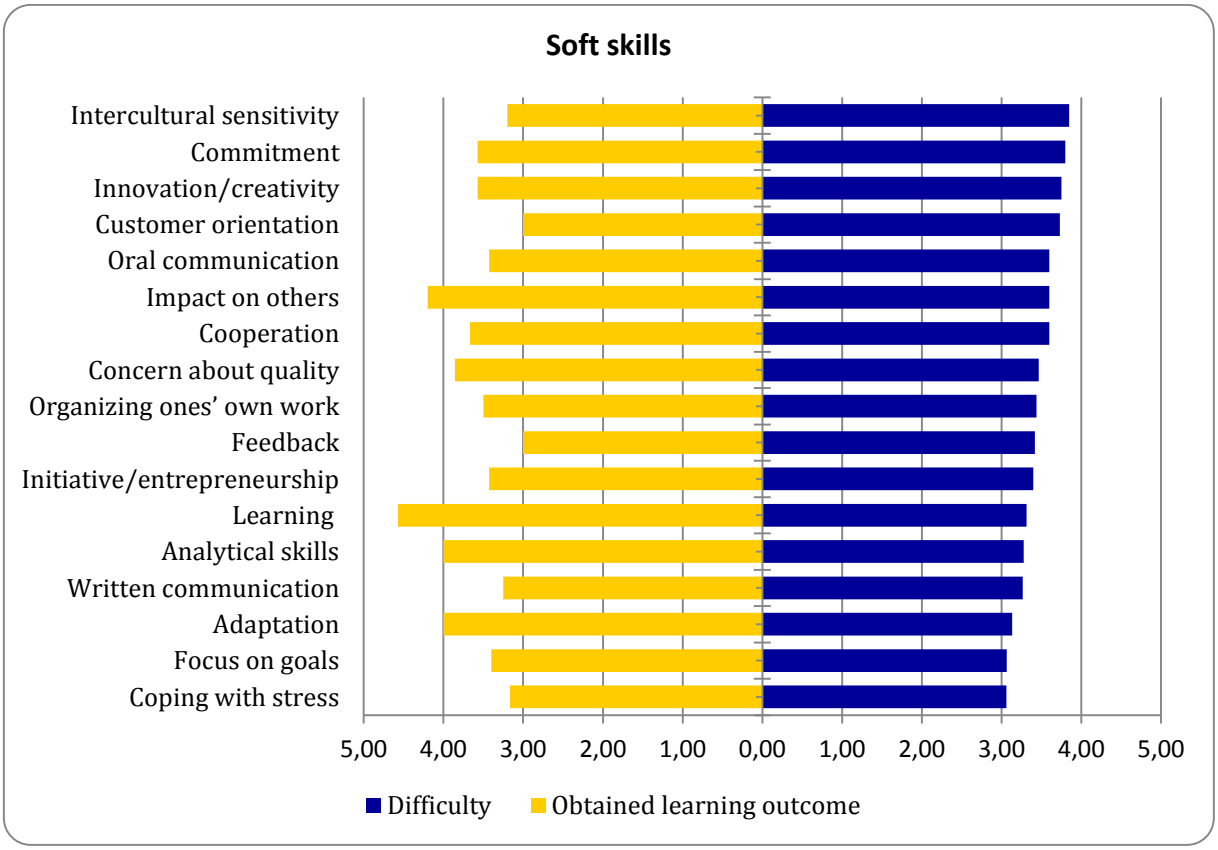

Figure 18. Comparison of the difficulty in acquiring competences (the employers' perspective) and the obtained learning outcomes (university perspective) in the area "Soft skills".

In the case of other requirements in the IT industry, all the competences are recognized as, on the one hand, taught at universities and, on the other hand, relatively easy to obtain in the labour market (see Fig. 19).

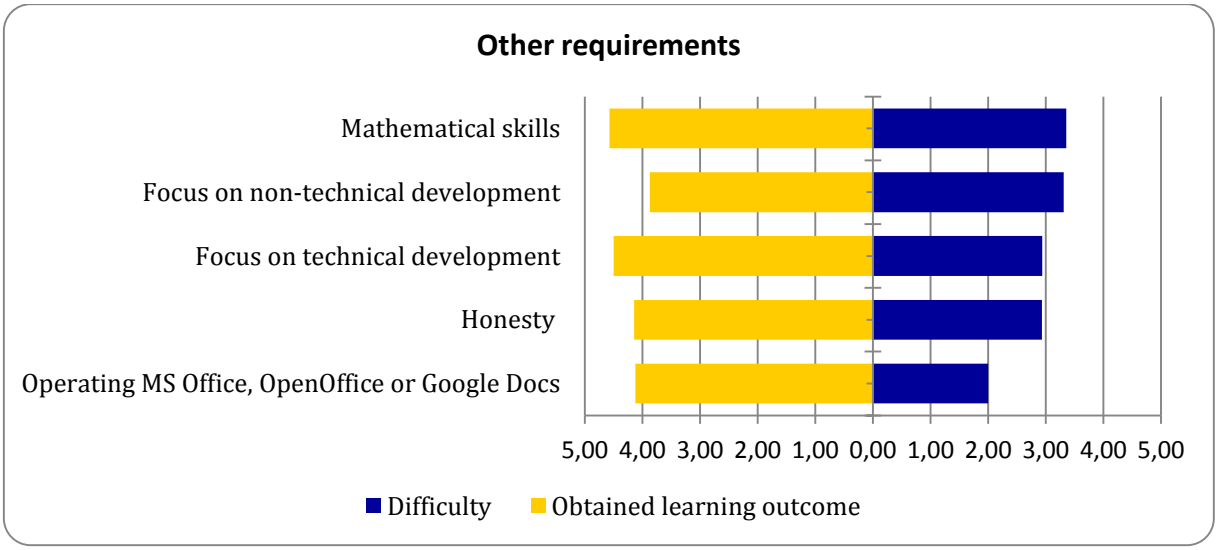

Figure 19. Comparison of the difficulty in acquiring competences (the employers' perspective) and the obtained learning outcomes (university perspective) in the area "Languages and other requirements".

TASKS OF THE UNIVERSITIES

As in 2013, one of the additional aspects analysed in the context of the Study of Competences, were the opinions of the representatives of business and universities whether the teaching of particular competences should be the task of universities.

In the light of full agreement of employers and universities as to which competences should be taught at universities, we would expect a situation where the responses of both communities are highly correlated. With regard to the presented results in the IT sector, a high correlation is observed in the area of specialist knowledge and skills (correlation r = 0.79), while for other groups of competences, this correlation is fairly moderate (r = 0.44 for soft skills and r = 0.33 for business knowledge and skills).

Figure 20 presents the opinions of the representatives of companies and universities whether the teaching of each of the twenty core competences is the task of universities.

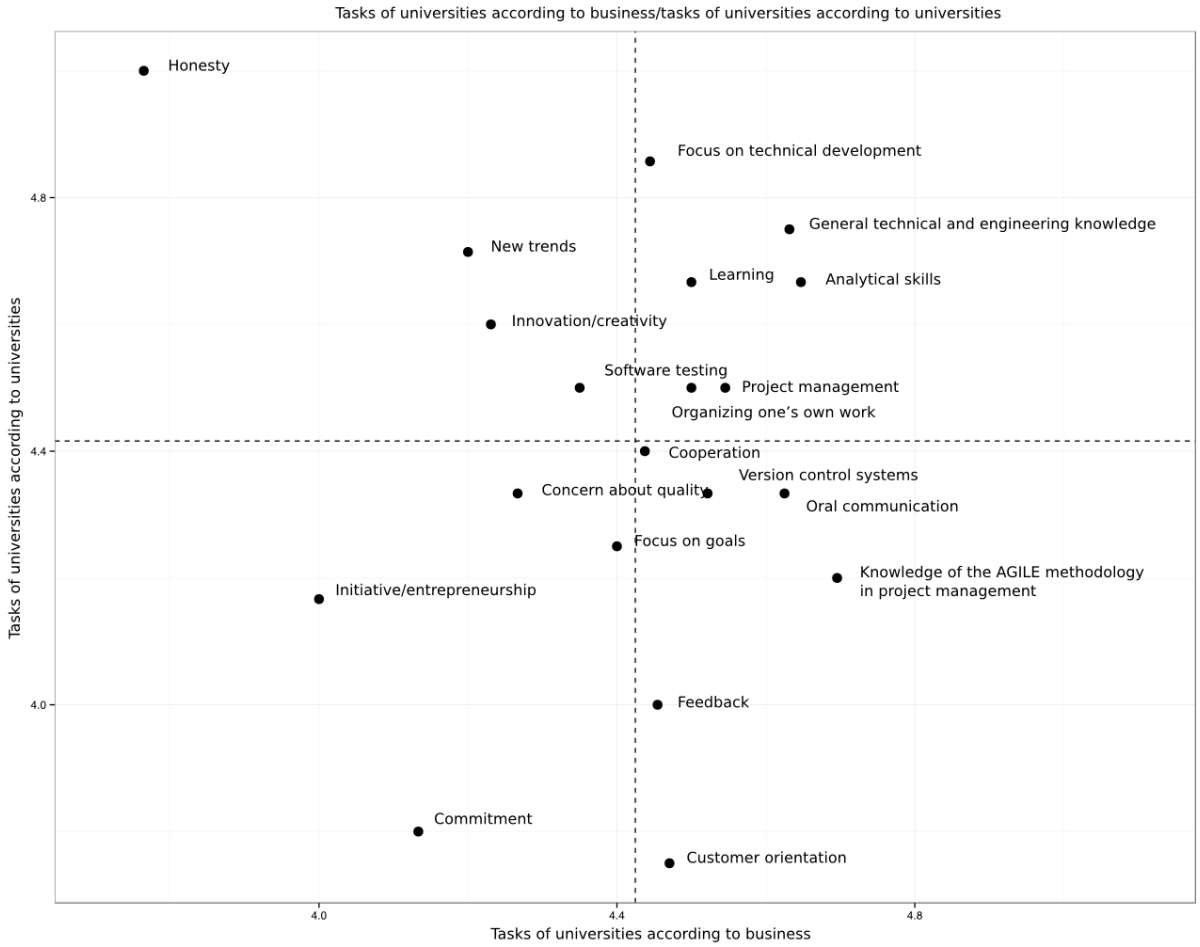

Figure 20. Matrix illustrating the relationship between the teaching of specific competences perceived as a task of universities by representatives of business and universities for twenty core competences in the sector. For better understanding of the chart, a trimmed scale has been used (from 3.5 to 5.0 for the opinions of employers and universities).

When it comes to the understanding of the tasks of universities in the context of specialized knowledge and skills (Fig. 21), companies and universities seem to agree – competences which the employers are convinced should be the result of the activities of universities are also competences the teaching of which universities should take responsibility. However, there are certain competences which are perceived differently by universities and companies. For example, **RPG programming, business intelligence, programming in Cobol, programming of cloud-based solutions, cloud-based programming** are seen as the tasks of universities from the point of view of business, but not by the universities themselves. The situation is different in the case of such competences as: **programming in C, programming applications for mobile devices, shell scripting, programming in Python, programming in C ++, Linux** – universities indicated these competences more frequently than companies, with regard to responsibility for obtaining the aforementioned learning outcomes.

The results in the area of business skills and knowledge are interesting (Fig. 22). There was full agreement in the case of **project management and knowledge of the industry**. Companies assign more responsibility to universities in such areas as: **preparation of business offers, business etiquette, knowledge of Agile methodology in project management**. Universities, on the other hand, take on more responsibility in the area of teaching **standard project management methodologies, new trends, laws and regulations**.

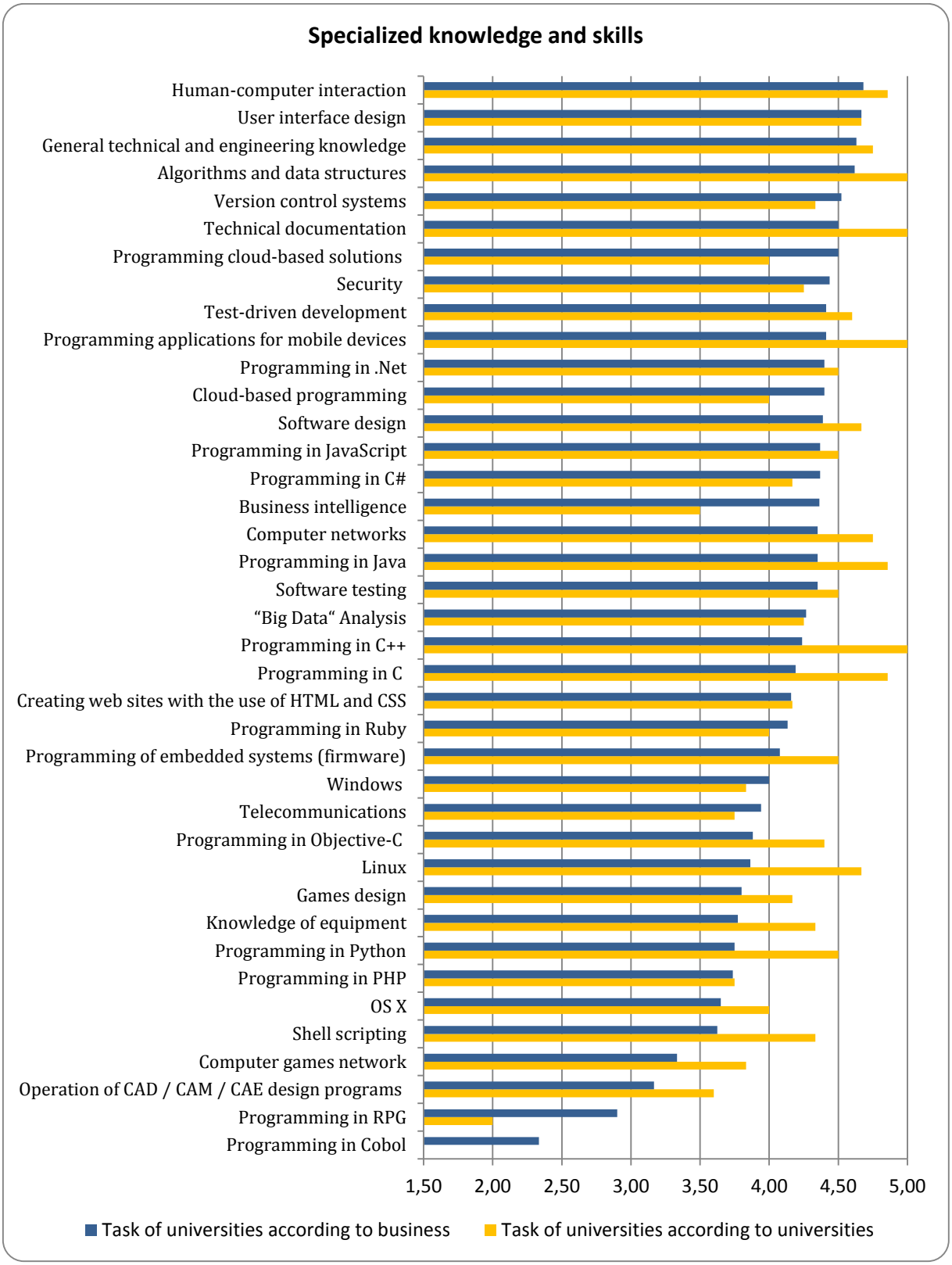

Figure 21. Comparison of the perceived role of universities in teaching competences in the area of "Specialized knowledge and skills".

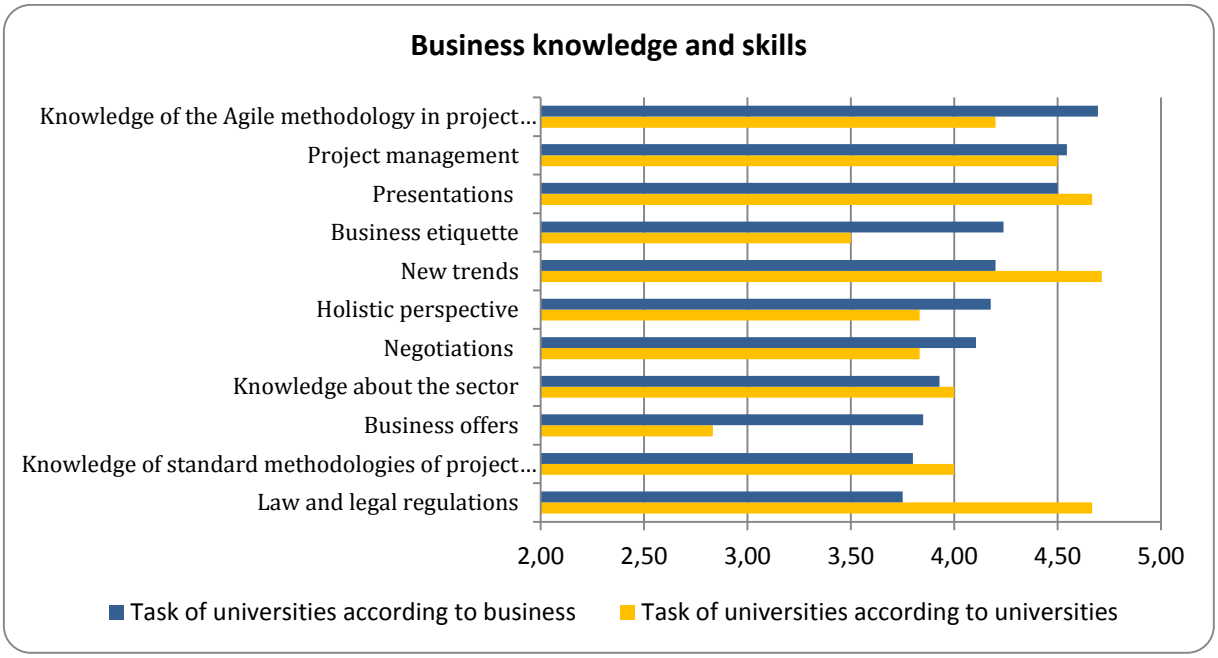

Figure 22. Comparison of the perceived role of universities in teaching competences in the area of "Business knowledge and skills".

In the case of soft skills and other requirements, we observe similar trends as in the case of the sectors analysed last year, where universities take on more responsibility than it would result from the opinion of business representatives (Fig. 23 and 24). This is particularly evident in the case of competences such as **honesty, focus on non-technical development, adaptation, impact on others and innovation/creativity.**

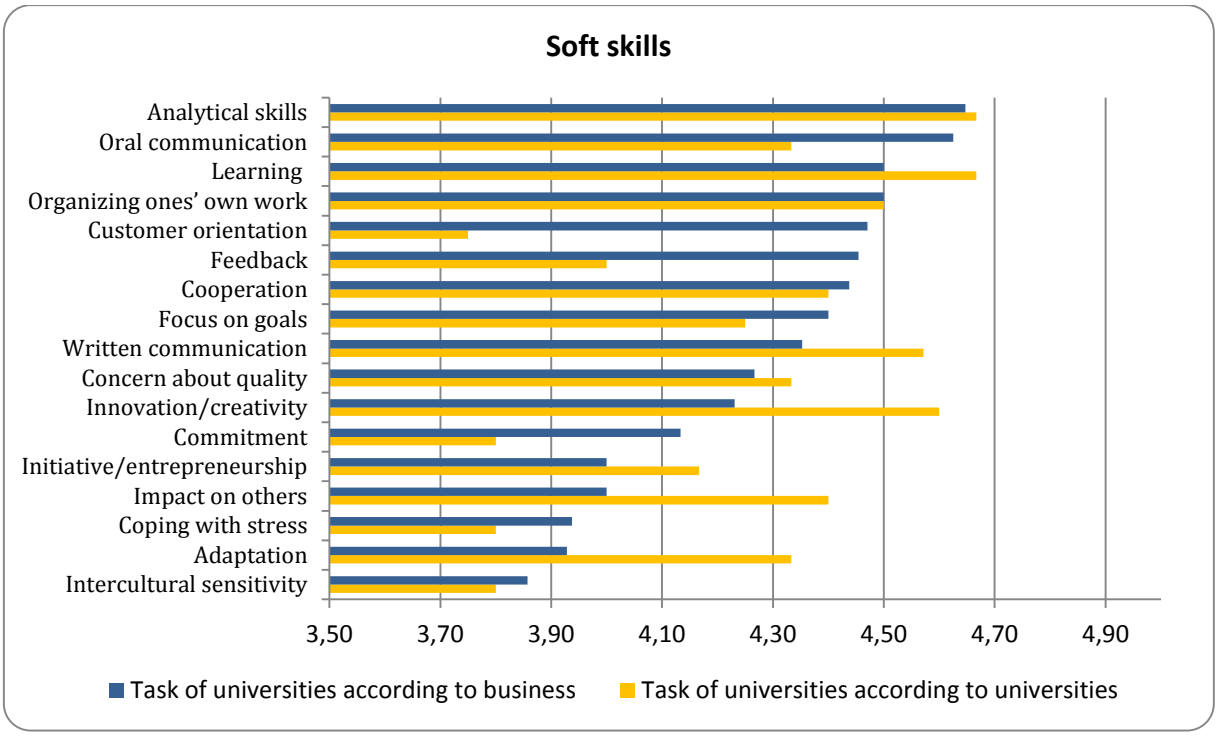

Figure 23. Comparison of the perceived role of universities in teaching competences in the area of "Soft skills".

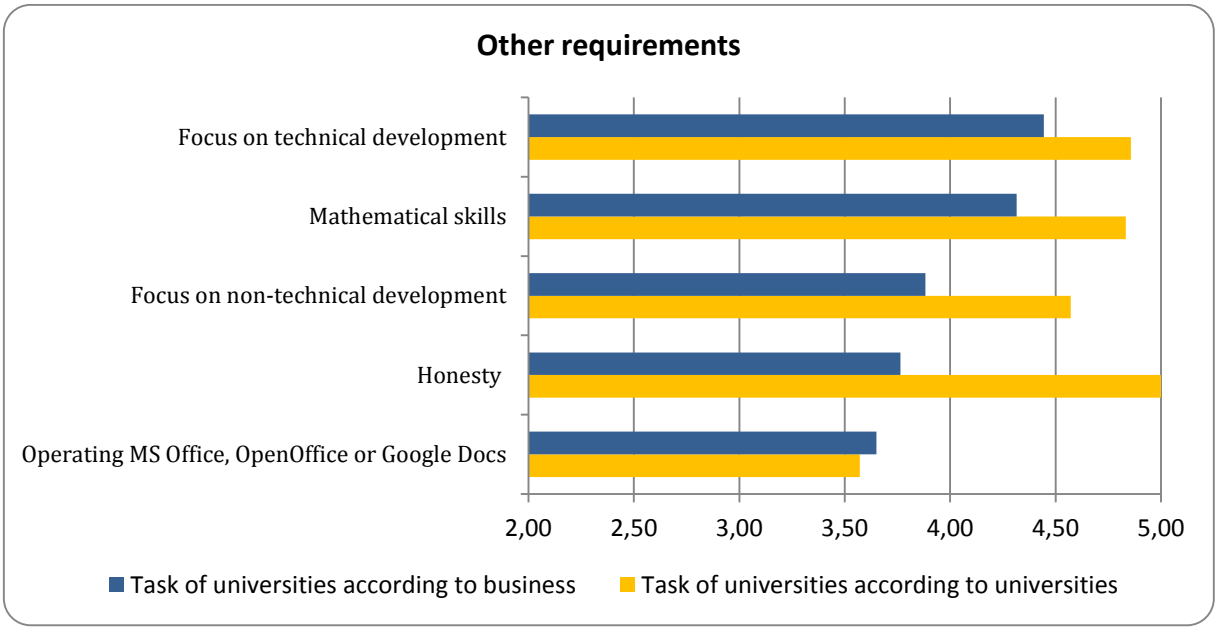

Figure 24. Comparison of the perceived role of universities in teaching competences in the area of "Languages and other requirements".

FINAL CONCLUSIONS AND RECOMMENDATIONS

The IT industry is of great importance for the development of the city and as such should be considered as one of the basic elements of its development strategy. The potential of the "Dragon Valley", stressed by representatives of both universities and companies, seems to put the IT industry in a privileged position as compared to other sectors which are the subject of analysis of the Study of Competences. This is reflected not only in the opinions of experts, but also the expectations of business representatives concerning employment growth in the IT sector.

However, the rapid development of information technology also has a negative side. **One of the main challenges, indicated especially by large companies operating in the IT industry, is the insufficient number of qualified professionals in the labour market.** It turns out that while the number of students graduating from technical faculties and information technology in Kraków is relatively high, the diversity of competences that students and graduates possess leads to a situation in which there is more or less a direct struggle for good candidates, which in turn leads to a rapid growth of wages in the sector. Experts do not consider this phenomenon as a clear threat to the growth of the IT industry in Kraków, though they recognize the danger related to breaking the image of Kraków as a place offering qualified staff and competitive labour costs.

The summary of other most important findings concerning the IT industry is presented in Table 13:

Main findings of the Study of Competences in the IT industry	
Core competences sought by employers today	English, cooperation, customer orientation, honesty, commitment, focus on technical development, concern for quality, learning, organizing one's own work, focus on goals
The largest relative increase in the importance of competences in 5 years	OS X, programming applications for mobile devices, programming in Python, technical English, mobility, programming of cloud-based solutions, programming in RPG, technical German, intercultural sensitivity, operation of CAD / CAM / CAE design programs, cloud-based programming
Competences most difficult to obtain in the labour market, yet important	Commitment, customer orientation, cooperation, innovation/creativity, project management, concern for quality, organizing one's own work
Competences most readily obtained in the labour market, and also important	Version control systems, honesty, focus on technical development, English, general technical and engineering knowledge
The most commonly obtained learning outcomes important from the point of view of employers	Learning, focus on technical development, general technical and engineering knowledge, honesty, new trends
The main tasks of universities in terms of core competences according to business	English, knowledge of AGILE methodology in project management, German, analytical skills, general technical and engineering knowledge, oral communication, project management, version control systems
The main tasks of universities in terms of core competences according to universities	Honesty, focus on technical development, general technical and engineering knowledge, new trends, analytical skills, learning, innovation/creativity

Table 13. Synthetic summary results of the Study of Competences for the industry in Kraków.

Cooperation between universities and companies in the IT industry is very limited and, unfortunately, still considered more in terms of capacity and less formal relations than a systemic action. Both business representatives, as well as representatives of universities, claim

that cooperation is hampered by the short-term nature of the business activities of the industry and the lack of a clear offer from universities. The scepticism of both the scientific and business environment when it comes to the possibility of developing cooperation is quite striking. Both universities and companies consider universities as areas that are gradually colonized by business rather than areas of possible synergy – it is necessary to change the mental models in a way that allows for long-term cooperation and the establishment of common goals of Kraków IT companies and universities.

The differences in the visions of universities and businesses concerning the type of graduates universities are to educate, especially when it comes to key soft skills, are quite disturbing. Competences which, according to universities, should be taught at universities differ significantly from those indicated by companies; universities focus on the education of enlightened graduates, whereas, according to companies, universities should prepare qualified graduates who are ready to work. This is a threat, but also an opportunity for universities. **Soft skills, for which universities feel responsible, can not only assist technical competence, but also provide leverage to build the individual careers of graduates**. A good idea in this context would be the creation of inter-faculty fields of study which, on the one hand, would not neglect the development of technical competences and, on the other hand, would offer a solid foundation in fields traditionally considered to be in the area of "Humanities" (critical thinking, creativity, communication in writing and speaking).

A major constraint and challenge for small and medium-sized IT companies are administrative issues related to doing business in Kraków. As mentioned earlier, not everything depends on the representatives of the Municipality; however, there are several areas in which city authorities could help IT companies. Representatives of IT companies draw attention to the aspect of city promotion and creating an atmosphere of support for new start-up companies.

During the interviews, Kraków IT companies made many suggestions concerning the curriculum; however, a large part of their comments also related to the activities and potential of UMK. The support expected by Kraków IT companies relates to the provision of high-quality communication with the IT environment (also in English) and maximization of Kraków's start-up environment by conducting intensive promotional campaigns in Poland and Eastern Europe. Industry representatives also suggested that in this respect, we should look at the example of other cities (Warsaw, Poznań, Wrocław) which offer office space, legal support, assistance in the organization of regular industry meetings, mediation in dealing with business angels and support the activities of business incubators and clusters of new technologies. In addition, the industry expects that politicians and officials involved in entrepreneurship will participate in industry events and support - mostly symbolically - financial institutions assisting local start-ups. This would help to develop the industry and, thus, directly and indirectly affect the social and economic situation of the city.

ANNEX 1. LIST OF COMPETENCES AND LEARNING OUTCOMES

Specialist knowledge and skills			
No	Name	Description of competence	Learning outcome
1	Linux	Ability to work in the Linux operating system	Student is able to work in the Linux operating system.
2	OS X	Ability to work in the OS X operating system	Student is able to work in the OS X operating system.
3	Windows	Ability to work in the Windows operating system	Student is able to work in the Windows operating system.
4	Human-computer interaction	Ability to design human-computer interaction	Student is able to design human-computer interaction.
5	Design of user interfaces	Ability to design user interfaces	Student is able to design user interfaces.
6	Knowledge of equipment	Ability of practical use of the equipment used in a given work position in the IT industry	Student is able to use the equipment used in a given work position in the IT industry.
7	Computer networks	Ability to operate (design, implement, maintain and administer) computer networks and systems	Student is able to operate (design, implement, maintain and administer) computer networks and systems.
8	Algorithms and data structures	Ability to operate (design, implement, analyse and program) algorithms and data structures	Student is able to operate (design, implement, analyse and program) algorithms and data structures.
9	Telecommunications	Ability to use the knowledge of transmission, broadcasting, reception, control and operation of telecommunications systems	Student is able to use the knowledge of transmission, broadcasting, reception, control and operation of telecommunications systems in practice.
10	Software testing	Ability to carry out tests and validation (planning, evaluation and implementation) of software	Student is able to carry out tests and validation (planning, evaluation and implementation) of software.
11	Programming in C	Ability to program in C	Student is able to use the programming language C in practice to solve problems specific for the industry in accordance with the profile of study.
12	Programming in C#	Ability to program in C#	Student is able to use the programming language C# in practice to solve problems specific for the industry in accordance with the profile of study
13	Programming in C++	Ability to program in C++	Student is able to use the programming language C++ in practice to solve problems specific for the industry in accordance with the profile of study.
14	Programming in Java	Ability to program in Java	Student is able to use the programming language Java in practice to solve problems specific for the industry in accordance with the profile of study.
15	Programming in JavaScript	Ability to program in JavaScript	Student is able to use the programming language JavaScript in practice to solve problems specific for the industry in accordance with the profile of study.
16	Programming in Objective-C	Ability to program in Objective-C	Student is able to use the programming language Objective-C in practice to solve problems specific for

			the industry in accordance with the profile of study.
17	Programming in PHP	Ability to program in PHP	Student is able to use the programming language PHP in practice to solve problems specific for the industry in accordance with the profile of study.
18	Programming in Python	Ability to program in Python	Student is able to use the programming language Python in practice to solve problems specific for the industry in accordance with the profile of study.
19	Programming in Ruby	Ability to program in Ruby	The student is able to use the programming language Ruby in practice to solve problems specific for the industry in accordance with the profile of study.
20	Programming in RPG	Ability to program in RPG	Student is able to use the programming language RPG in practice to solve problems specific for the industry in accordance with the profile of study.
21	Programming in Cobol	Ability to program in Cobol	Student is able to use the programming language Cobol in practice to solve problems specific for the industry in accordance with the profile of study.
22	Programming in .Net	Ability to program with the programming platform .Net	Student is able to use the programming platform .Net in practice to solve problems specific for the industry in accordance with the profile of study.
23	Programming applications for mobile devices	Ability to use programming languages for creating applications for mobile devices	Student is able to use programming language in practice to design applications for mobile devices.
24	Programming embedded systems (firmware)	Ability to use programming languages (e.g. C. C++. MATLAB) to program embedded systems (firmware)	Student is able to use programming language in practice to program embedded systems (firmware).
25	Designing games	Ability to design games in accordance with the GDD (Game Development Design)	Student is able to design games in accordance with the GDD (Game Development Design).
26	Version control systems	Ability to use popular version control systems (SVN. GIT)	Student is able to use popular version control systems (SVN. GIT).
27	Game production environments	Ability to program in game production environments (e.g. Unity SDK. Marmalade SDK. Unreal DK)	Student is able to program in game production environments (e.g. Unity SDK. Marmalade SDK. Unreal DK).
28	Test-driven development	Ability to apply the principles of test-driven programming	Student is able to apply the principles of test-driven programming.
29	Programming of cloud-based solutions	Understanding the nature of cloud-based solutions and the ability to design and create them	Student has knowledge of cloud-based solutions and the ability to design and create them.
30	Cloud-based programming	Ability to work in cloud-based software development environments	Student can work in cloud-based software development environments.
31	"Big data" analysis	Ability to apply statistical and computational tools to analyse big, varied and updated in real time databases	Student is able to apply statistical and computational tools to analyse big, varied and updated in real time databases.
32	Business intelligence	Ability to analyse data aimed at increasing the efficiency of the business organization using popular business	Student is able to analyse data aimed at increasing the efficiency of the business organization using popular business

		intelligence tools (e.g. COGNOS. Business Objects)	intelligence tools (e.g. COGNOS. Business Objects).
33	Security	Ability to develop software using the best security practices	Student is able to apply in practice the principles of software using the best security practices.
34	Shell scripting	Ability to create scripts in the shells of systems based on Unix	Student is able to create scripts in the shells of systems based on Unix.
35	Software design	Ability to design software architecture aimed at solving a specific business problem	Student is able to use in practice the principles of designing software architecture aimed at solving a specific business problem.
36	Creating web pages using HTML and CSS	Ability to create web pages using HTML and CSS	Student is able to create web pages using HTML and CSS.
37	Operation of CAD / CAM / CAE design programs	Ability to operate CAD / CAM / CAE design programs (e.g. CATIA. AutoCAD. Unigraphics)	Student is able to use in practice CAD / CAM / CAE design programs (e.g. CATIA. AutoCAD. Unigraphics).
38	General engineering and technical knowledge	Structured knowledge of the processes and phenomena of science connected with work in the IT industry.	Student has structured knowledge of the processes and phenomena of science connected with work in the IT industry.
39	Technical documentation	Awareness of the importance and ability to create technical documentation in the process of creating IT solutions	Student is able to create technical documentation in the process of creating IT solutions and has knowledge of its importance for the software development process.

Business knowledge and skills			
No	Name	Description of competences	Learning outcomes
1	Business etiquette	Knowledge of and ability to apply the principles of business savoir-vivre. Ability to behave in accordance with the standards, choosing the right dress and language adequate to the situation, also in the context of relationships with customers and international cooperation	Student has knowledge of the principles of business savoir-vivre. He/she is able to behave in accordance with the standards (e.g. chose the right dress and language adequate to the situation, etc.).
2	Negotiations	Ability to conduct business negotiations and the knowledge of the rules that govern them	Student is able to conduct business negotiations according to the rules that govern them.
3	Presentations	Ability to create and submit attractive multimedia presentations	Student is able to create and submit attractive multimedia presentations.
4	New trends	Knowledge about new trends in the industry, developments and technological innovations specific to the industry	Student has knowledge of technological innovations, developments and trends of development of the industry related to the profile of study.
5	Business offers	Ability to prepare and analyse commercial and business offers, including the diagnosis of customer needs and expectations, and the development of solutions, etc.	Student is able to prepare and analyse commercial offers, taking into account customer needs and expectations, different solutions, etc.
6	Holistic perspective	Knowledge and understanding of the social and professional roles occurring in the implementation of the project (e.g. investor, customer, internal and external customer, user, designer, contractor, technician, etc.). Adapting one's activities and coordinating the implementation of	Student has knowledge of different social and professional roles occurring in the implementation of the project related to the industry (e.g. investor, customer, internal and external customer, user, designer, contractor, technician, etc.). Student can adjust and coordinate his/her

		one's tasks with regard to the differences arising from the specific nature of these roles.	activities with regard to the differences arising from the specific nature of these roles.
7	Law and legal regulations	Knowledge about and understanding of the law, regulations, ordinances, laws and norms and standards specific for the operation of the industry	Student has knowledge of the law and legal regulations specific for the industry related to the profile of study. He/she has knowledge of and understands particular regulations, ordinances, norms and standards.
8	Knowledge about the industry	Knowledge of the entities operating in the industry and their environment, understanding the specific nature and context of the functioning of the industry, knowledge of key opinion leaders	Student has knowledge of the specific nature of the industry related to the profile of study. Student has the knowledge of and understands the role of particular entities operating in the market and their business and organizational surroundings.
9	Project management	Ability to effectively manage the work of the project team	Student is able to effectively manage the work of the project team.
10	Knowledge of AGILE methodology in project management	Ability to work effectively in groups using soft project management methodologies (eXtremme Programming, SCRUM, etc.)	Student is able to work effectively in groups managed in accordance with soft project management methodologies (e.g. AGILE. SCRUM).
11	Knowledge of standard project management methodologies	Ability to work effectively in groups using standard ("hard") project management methodologies (e.g. PMBok. PRINCE2)	Student is able to work effectively in project groups managed in accordance with standard management methodologies (e.g. PMBok. PRINCE2).

Soft skills			
No	Name	Description of competences	Learning outcomes
1	Adaptation	Ease and speed of acting in changing conditions	Student is able to adapt his/her habits and behaviour to changing conditions.
2	Initiative/entrepreneurship	Initiating new activities, active search for new solutions and accepting the related responsibilities	Student is able to initiate new activities (initiative) in a specific organizational and social context, taking responsibility for their implementation.
3	Innovation/creativity	Generating ideas, creating and implementing new solutions facilitating work	Student is able to generate new ideas (innovation) in a specific organizational environment, develop and implement them in an innovative way by solving problems.
4	Written communication	Preparation and presentation of written communications, producing clear written reports	Student is able to prepare and present communications, professional documents and reports in written form, using adequate language and form understandable to the customer/ordering party.
5	Oral communication	Presenting and communicating information in verbal form, fluency in speech	Student is able to communicate with others by properly preparing and submitting the information in verbal form, using

			language and form that is understandable to the recipients.
6	Organizing one's own work	Planning one's own work and organizing activities aimed at implementing the plan, prioritizing tasks	Student is able to adequately organize his/her own activities and time, prioritize and optimize the way to perform them. Student is able to set clear and challenging targets when working on a specific task.
7	Focus on goals	Realization of short-term and long-term goals allocated to the given position	Student is able to understand and accept the short-term and long-term goals in the organization in which he/she operates and take action for their timely implementation.
8	Customer orientation	Understanding and meeting the needs and expectations of customers, taking into account the customer's perspective when offering solutions	Student is able to identify the needs and expectations of the recipients of his/her actions (customers or beneficiaries) in the organization in which he/she operates and then use this knowledge to undertake actions aimed at satisfying these needs.
9	Coping with stress	Ease and effectiveness of acting in difficult situations	Student is able to work under pressure, using effective strategies for coping with stress.
10	Feedback	The ability of giving and receiving constructive feedback on the quality of the work done	Student is able to give and receive constructive feedback on the quality of the work done.
11	Concern about quality	Acting in compliance with the rules, regulations and procedures of the organization, accuracy and thoroughness in implementing the tasks	Student identifies the criteria of quality performance of his/her own work (understood as meeting the expectations of the customer or beneficiary of the actions). Student is able to identify how his/her actions affect the results of the organization and take action in accordance with the rules applicable in a specific organizational context, is accurate and meticulous in their execution. Student cares about the quality and thoroughness of the performed tasks.
12	Learning	Ease and speed in assimilating new knowledge	Student is able to efficiently and quickly assimilate new knowledge.
13	Impact on others	Impact on others, the ability to convince with factual arguments and other means of control, self-confidence in communicating one's point of view	Student is able to conduct a substantive discussion, use arguments to convince others and to defend his/her own opinion in a particular organizational environment without antagonizing relationships.
14	Intercultural sensitivity	Practical application of	Student is able to adjust his/her

		knowledge about cultural differences, adapting one's activities to different cultural patterns	behaviour to different cultural patterns in the organization. He/she can identify the cultural background of different behaviours of people in the organization. Respects the diversity of worldviews and the culture of co-workers and customers.
15	Cooperation	Effective teamwork, focus on group objectives	Student is open to cooperation and can cooperate with others in the group, assuming roles that serve the objectives of the team.
16	Commitment	Enthusiasm and passion for work, the "can do" attitude, caring for the company's image	Student is able to engage in activities and show enthusiasm and passion in implementing the tasks. Student understands the importance of caring for the company's image in a specific organizational context.
17	Analytical skills	Ease, speed and reliability of obtaining and processing information	Regardless of the conditions, the student can quickly and reliably find, analyse and process information necessary to complete the task.

Foreign languages and other requirements			
No	Name	Description of competences	Learning outcomes
1	English	Ability to speak a foreign language in a way that enables efficient and effective communication, both oral and written	Student is able to communicate verbally and in writing in the said language. He/she is able to understand the main aspects of concrete and abstract problems presented in the text, including an expert discussion on professional issues. He/she is able to communicate freely and spontaneously so that a conversation with a native speaker is free from tension in the case of both interlocutors. He/she is able to express themselves clearly and in detail on many topics, express an opinion on a given topic, providing both positive and negative aspects of the various (proposed) choices.
2	German		
3	Technical English	The ability to use a specialist foreign language in a way that enables the handling, understanding and creation of technical documentation, efficient and effective communication with other representatives of the industry, both oral and written	Student is able to use specialist foreign language in a way that allows for the understanding and creation of technical documentation, efficient and effective communication with other representatives of the industry, both oral and written.
4	Technical German		

5	Operating MS Office, OpenOffice or Google Docs	Effective use of the possibilities of basic office software packages	Student is able to operate and use basic office software in his/her work (MS Office, OpenOffice. Google Docs).
6	Mathematical skills	Ability to carry out advanced mathematical operations	Student is able to perform various mathematical operations to solve problems and generate knowledge.
7	Focus on technical development	The desire to develop one's own knowledge and skills in the technical field (e.g. programming languages, technologies, frameworks)	Student accepts the need for continuous development of his/her knowledge and skills in the technical field (e.g. programming languages, technologies, frameworks).
8	Focus on non-technical development	The desire to develop one's own knowledge and skills in the non-technical area (e.g. management, soft skills and business skills)	Student accepts the need to continually develop his/her own knowledge and skills in the non-technical area (e.g. management, soft skills and business skills).
9	Honesty	Adherence to accepted moral standards	Student accepts the need for the existence of standards of ethical behaviour and integrity and applies them in his/her actions.
10	Time availability	Flexibility in working hours, working overtime with the possibility of later use of accrued overtime hours	Not applicable
11	Mobility	Accepting proposals of business trips related to the performance of professional duties or learning (conferences, training) outside the workplace	Not applicable
12	Driving licence	Category B driving licence	Not applicable

APPENDIX 2. METHODOLOGY AND DESCRIPTION OF TOOLS USED

The methodology was based almost entirely on the schemes developed in the previous year. The initial stage included a number of consultations with sector experts and an analysis of job advertisements. Preliminary lists of competences developed in this way were then consulted with representatives of companies in the course of in-depth interviews with experts. Upon completing the qualitative research, we conducted in-depth quantitative surveys among companies and universities. In the case of the latter, further in-depth interviews were carried out.

In terms of sampling, wherever possible, we used the PKD classification supplemented with the opinions of experts and analysis of trade fairs. In this context, we would like to once again express our gratitude to the representatives of ASPIRE, SARP and GIB, whose assistance proved to be extremely important. In each of the analysed sectors, all major companies with their registered seats in Kraków were invited to participate in the study, as well as a selected intentional sample of smaller entities. Although a direct consequence of this approach is the inability to evaluate the overall level of employment in the sector (lack of a random sample), and certain restrictions in the conclusions, this approach, as shown by last year's survey, allows for better estimation of market trends and the expected growth in demand for competences.

In order to reduce the time burden of the respondents, we decided to combine the category of specialized knowledge and skills. The fact that the study has been carried out for the third year in a row carries an additional risk. For some companies and a relatively large group of faculties and specializations, this was not the first contact with the tool and the research process. According to the respondents, the current edition of the Study was too time-consuming, despite the fact that the average time for filling in a survey in the case of companies was approx. 30 minutes, and for universities and secondary schools, approx. 20 minutes (less than in the first edition of the Study). This may be the result of the specific nature of the analysed sectors or the perceived usefulness of the research. As a result, the research encountered significant difficulties in persuading the respondents to dedicate their time, especially in situations where e.g. there were only minor changes in the curriculum or there were no changes at all. In such a situation, part of the results obtained in the previous year were re-examined (re. the information technology sector).

As in the previous years, a significant difference was observed in the level of development of the strategic HR function in companies (SHRM Strategic Human Resource Management), which was particularly evident in the IT sector, which consists both of international corporations operating in the ITO sector (usually based on strategic HRM standards derived from the head office), as well as local small and medium-size enterprises from the start-up scene (usually functioning on the basis of an intuitive understanding of the personal function). A direct consequence of this diversity is the fact that some companies do not have specific competence profiles or employment plans for the future.

Below is a step-by-step presentation of all the major stages of the conducted research work:

1. **Initial stage**

a. In-depth interviews with experts, people associated with the sector and consultations with the Municipality of Kraków and the Provincial Labour Office in Kraków, aimed at clarifying the definition of the sector, recognizing the context of its operation and identifying key entities (on the side of business and universities).
b. Desk research analysis of the sector and analysis of job advertisements, whose main objective was to identify the key challenges facing the sector and to create an initial list of competences sought by employers.

2. Analysis of the demand for competences

a. In-depth interviews with representatives of selected companies allowing for insight into the experience of the sector related to recruitment, selection and employee development, evaluation and supplementing the list of sought competences (demand sheet).
b. The creation and testing of the Demand Sheet tool.
c. The creation of a research sample of companies (in the case of the IT sector, on the basis of PKD, desk research analysis of expert opinions and companies; the list of companies invited to participate in the study included a total of 171 entities. After verification, which included the removal of entities that no longer exist, do not conduct business activity related to the analysed sector or have declared that they do not employ, and in the next five years will not employ, graduates of universities, the basis for the research sample included 151 entities.
d. A survey questionnaire in IT companies, enabling the collection of quantitative data on the current and projected needs of the market in terms of core competences of graduates of Kraków universities, the evaluation of the difficulty in obtaining them and opinions on the role of the universities in terms of providing relevant training. In addition, information concerning the following issues was also collected: plans of employment (in 2015 and 2020), competences necessary for the graduates to get promoted within the company and the best, according to companies, fields of study and specializations tailored to the profile of the company (in the case of the IT sector, the analysis used data from 44 companies, including 12 as a result of reanalysis, employing, in various forms, approx. 3,600 employees).

3. Analysis of supply for competences

a. The creation and testing of the Supply Sheet tool.
b. The creation of a research sample of fields of study and specializations at universities (in the case of the IT sector, on the basis of information obtained from the analysis of desk research, opinions of experts and companies, the initial list of courses, including postgraduate courses, invited to participate in the study, totalled 17).
c. Structured interviews connected with completing the supply sheet, aimed at not only obtaining quantitative data on the effects of on-going learning outcomes and projections of the number of graduates in the future, but also getting to know the overall context of a given field of study, challenges in cooperation with businesses and the expectations regarding the company and UMK.
d. An online survey among representatives of universities responsible for the shape of the curriculum. The main objective was to collect quantitative data on on-going

learning outcomes and projections of the number of graduates in the future. In addition, information on additional learning outcomes achieved within a given field of study was obtained, which may be important for the sector. Due to the related and mutually overlapping nature of work positions in both analysed sectors, the responses of universities were analysed together. We used data from 8 fields of study, 20 specializations, which, in 2015, will be completed by approx. 1,200 people.

DEMAND SHEET

A tool designed to test the demand for competences used in two forms: on-line (using Limesurvey software) and MS Excel (in cases where the surveyed companies preferred direct contact with the interviewer).

The tool consisted of 3 parts:

1. **Company data sheet and plans**

- name of company;

- number of persons employed by the company or its Kraków branch on the basis of a contract of employment;

- number of persons employed by the company or its Kraków branch on the basis of a civil law contract or self-employment;

- name of the position to which companies most often recruit (up to 5 positions);

- a plan for the employment of graduates (persons who completed higher education in the last 12 months) on the basis of a contract of employment, civil law contract or self-employment (in 2015 and 2020).

2. **The assessment of competences from the 4 thematic groups (in the following order: specialist knowledge and skills, business knowledge and skills, soft skills, foreign languages and other requirements – the list is available in Annex 1) on the basis of four criteria:**

- important now (How important is it from the point of view of the needs of your company for students and graduates to have a given competence, where 1 means "completely unimportant", and 5 means "definitely important")

- important in 5 years (How important will it be from the point of view of your company for students and graduates to have a given competence in five years, where 1 means "completely unimportant", and 5 means "definitely important");

- difficulty in obtaining (How difficult is it to recruit a person with the expected level of competences, where 1 means "very easy", and 5 means "very difficult");

- the task of the university (Do you think that the teaching of a given competence should be the task of universities? Please answer using a scale from 1 to 5, where 1 means "the teaching of a given competence should not be the task of universities", and 5 means " the teaching of a given competence should belongs to the tasks of universities");

- identification and assessment, based on the same criteria, of up to four additional competences in each category not included in the previously presented lists.

3. **Additional information:**

- indication of 5 courses of study best adjusted to the needs of the company (up to 5 courses; if it is relevant, also the name of the university);

- indication of a maximum of 5 competences that are critical in the context of promotion of the graduate employed in the company;

- additional comments.

SUPPLY SHEET

A tool designed to test the supply of competences, similarly to demand, used in two forms: on-line (using Limesurvey software) and MS Excel (in cases where the surveyed companies preferred direct contact with the interviewer).

The tool consisted of 3 parts:

1. **Company data sheet:**

- name of university, faculty/department, institute and the field of study;

- indication of the learning modes available in the field of study (full-time, part-time, etc.);

- indication of the levels of study offered in the given field (first degree, second degree, postgraduate studies, etc.)

- indication of the different specialization paths/profiles/specializations pursuing similar learning outcomes in terms of the analysed sector;

- planned number of graduates from each of those paths (in 2015 and 2020).

2. **The assessment of competences from the 4 thematic groups (in the following order: specialist knowledge and skills, business knowledge and skills, soft skills, foreign languages and other requirements – the list is available in Annex 1) on the basis of two criteria:**

- obtained learning outcome (To what extent does the field of study covered by the survey provide particular learning outcomes?, where 1 means "It is not obtained", and 5 means "Obtained in a very high degree");

- the task of the university (Do you think that the teaching of a specific learning outcome should be the task of universities?, where 1 means "definitely not", and 5 means "definitely yes").

3. **Additional information:**

- indication of additional learning outcomes achieved in a given field of study which are not included in the list, but are, or may potentially be, important from the point of view of the sector;

- providing information about obligatory classes in modern languages and the ability to learn other languages free of charge;

- additional information.