



Generations on the Polish labor market in the context of competences needed in the economy based on knowledge and 4.0

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Abstract

Motivation: The Polish labor market employs employees from four generations, but not all of them have the competences required by the knowledge-based economy and the 4.0 economy. According to the author, adjusting employees' competences to the requirements of the modern labor market is determined, among others, by specificity of generations. Their features, attitudes, values and job expectations affect competences, which generates quantitative and qualitative changes in the labor market. Therefore, it was decided to check which generations of employees have the competences most appropriate to the needs of these economies.

Aim: The aim of the paper is to assess the adjustment of competences of four generations of Polish employees to the competences required of employees of the knowledge-based economy and the 4.0 based on a literature review.

Results: Research results confirm that generations Y and C have competences best suited to the modern labor market. Moreover, they indicate areas of skills shortages that require support in order to adjust the requirements of the labor market. The added value is provided by a self-developed list of differences between the labor markets of the knowledge-based industrial economy and 4.0 (there was no such was not such a broad list comparison in the literature for the three types of economies) and synthetic assessment of the key competences of four of generations of employees in the context of KBE and economy 4.0 based on a literature review.



Keywords: knowledge-based economy; economy 4.0; labor market; generations; competences
JEL: J21; J24

1. Introduction

Both the third and fourth industrial revolution, which initiated the knowledge-based economy (KBE) and the economy 4.0 respectively, caused the need to reconsider national economies and adjust all their areas, including the labor market. There have undergone huge changes in all aspects of the labor market. The labor market of the knowledge-based and 4.0 economy is characterized by high level of risk and volatility and the imperative of quick and flexible adjustment of the level of employee competences to modern requirements.

The character of new types of economies modified the set of universal competences required from workers in the 21st century. Report *Future of skills: employment in 2030*, created by a group of scientists from the University of Phoenix (Bakhshi et al., 2017, p. 17) and the report *The changing nature of work* of the World Bank (2019) prove that economy 4.0 will need people with the so-called XXI skills, i.e. with a wide spectrum of social competences and higher-order cognitive abilities. Unfortunately in Poland, not all employees managed to acquire the competences appropriate to the KBE. Concededly, the third industrial revolution started over 20 years ago, however its effects in the form of transformations in the Polish economy, employment structure and education are postponed in time as a result of the economic transformation taking place at the same time. Thus, the fourth industrial revolution, bringing another modification of the set of competences required from employees, further aggravated the problem of incompatibility of their competences. The issue of insufficient competences of generations of employees has been the subject of many studies in the field of human resource management in enterprises, in the context of diversity or age management, but not of labor resources in the economy/labor market economics. Therefore, it was decided to check which of the four Polish generations of employees have the competences most appropriate to the needs of these economies.

According to the author, adaptation of employee competences to the requirements of the modern labor market is determined, inter alia, by specificity of generations. Their characteristics, attitudes, values, behaviors, expectations towards employers/work influence the competencies. These, in turn, determine quantitative and qualitative changes in the labor market. The aim of the paper is to assess the adjustment of competences of four generations of Polish employees to the competences required of employees of the knowledge-based economy and the 4.0

The paper presents:

1. Synthetic changes in the labor market in three types of economies: industrial, knowledge-based and 4.0.
2. A synthetic description of the generations in terms of career and development.

3. An assessment of generations' competencies in terms of matching them to those necessary in the knowledge-based economy and 4.0. For this purpose, the method of mapping (non-systematic literature review) and ranking combined with a plus-grade scale were used.

The attained results point out which types of competences in which generations of employees should be strengthened/developed.

2. Literature review

2.1. Changes in the labor market in the knowledge-based economy and economy 4.0: theoretical framework

The changes taking place in the contemporary labor market are influenced by three main factors (Federal Ministry of Labour and Social Affairs, 2017, p. 4):

- digitization, which creates new technological foundations and possibilities for cooperation, production, organization of enterprises and distribution of goods and services;
- globalization, which, thanks to the Internet, has widened the scope of activities of enterprises, the movement of workers, and paved the way for the development of cross-border trade and communication;
- demographic changes, mostly related to the aging of the population, which reduce the number of working-age workers, generating shortage of labor supply.

The synergistic influence of these factors creates many possibilities in the field of work now and in the future, but also causes risks. The new opportunities are opening up, which — on the one hand, allow to increase the productivity and flexibility of work or its internationalization, while on the other — generate pressure for change, adaptation and innovation, to which employees have to adapt and face in order to stay in the labor market (Atkinson & Coduri, 2002, p. 45; Węgrzyn, 2019, pp. 32–43). Knowledge plays a great role in this adjustment, as it is one of the factors determining employee competences and a resource that establishes the development of the economy. There is a growing demand for highly qualified employees capable of modern competences. Global competition forces players to be innovative, and innovation is conditioned by the continuous improvement of the employees' level of education, competence and creativity. Knowledge-based economy (KBE¹, defined as the stage of the information economy, information revolution or the third industrial revolution), based on production, distribution and the use of knowledge and information

¹ KBE (known as the new global knowledge economy, the new economy) is a global economy based on knowledge and entrepreneurship, in which the extent to which knowledge, technology and innovation are embedded in products and services become key success factors.

(Atkinson & Correa, 2007, p. 39; Drucker, 1999, p. 79; OECD, 1996), requires constant stimulation and development of employees' competences.

The process of continuous learning in order to improve professional competences has become even more important as a result of the fourth industrial revolution currently taking place, known as Industry 4.0 or Economy 4.0². The basis of 4.0 economy is a combination of three main elements: ICT, industry and the Internet of Things (IoT) and their impact over the boundaries of traditional industry. The fourth industrial revolution does not concern a specific number of products or the redevelopment of the production process, but is an innovation of the whole system (Dzierżek, 2015). The essence of the ongoing industrial revolution is the use of the achievements of the scientific and technological domain which is the computer science, with the aim to introduce changes in industry to create the so-called smart factories built of intelligent cyber-physical systems.

It is obvious that revolutions in information systems and ICT, or new business models, involve, among others, changes in the labor market (Atkinson, 2005, pp. 50–80). The most important differences in the context of changes in the labor market of the knowledge-based industrial economy and 4.0 are presented in Table 1.

A comparison of characteristics of the labor market of three types of economies indicates a significant degree of labor market evolution. The knowledge-based and 4.0 economy labor market is characterized by a high level of risk and volatility. Thereby the expectations of employees are focused on quickly obtaining high income from work, generated through intensive development and commission programs. It is all the more justified as in the new conditions there is a constant imperative to develop, change, deepen, improve and adapt one's qualifications and competences to the changing conditions and requirements of the contemporary and future labor market. It can be assumed that the new dimensions of the labor market further emphasize the importance and use of knowledge and competences. The competencies required from employees have been redefined. They are expected to have competences needed in the knowledge-based economy and 4.0. Acquiring competences is determined, among others, by belonging to a specific generation of employees. Therefore, the next part of the study presents a synthetic description of generations with the view to career and development.

2.2. The character of generations of employees

The term 'generation' is defined differently depending on the science represented by the researcher. In social sciences this concept was explained by Gid-

² The term Industry 4.0, authored by the German physicist H. Kagermann, was adopted as the name for the general direction of changes in the field of industrial policy carried out by the European Commission promoting the idea of strengthening the competitiveness of industry.

dens & Sutton (2020, pp. 29–30), Klimczuk (2010, pp. 92–107; 2013, pp. 99–111), Mikułowski-Pomorski (1968, pp. 65–80), Olechnicki & Załęcki, (2002, p. 29), Ossowska (1963, pp. 45–65), Szukalski (2010, pp. 7–12; 2012, p. 12), Wiktorowicz & Warwas (2016, pp. 19–37). For the purposes of this study, a definition was adopted which is the effect of synergy of several terms. Namely, generation is the group of individuals born and living at the same time, with a common system of values, attitudes, worldview and experiences shaped by the socio-political and historical context.

It was assumed earlier, in the analysis of the society, that the generation changes occur “in the third part of the century, i.e. the father is averagely 33 years older than the children” (Klimczuk, 2013, pp. 92–107). Presently, the pace of changes in the environment makes generations to change quicker than before — even every 10 years. So not only three generations can live simultaneously, but also five or six. This situation also affects the labor market, where — considering the record age and working age — four generations of BB (Baby boomers), X, Y and C function side by side.³ There is for the first time in the history of the world, a great diversification of age groups in the labor market, resulting in significant generational differences manifested not only in the characteristics, behavior/attitudes towards work and career, but also in professional competences.

There are four generations of employees on the Polish labor market at the same time. On the basis of the literature on the subject and the social, cultural, economic and political context, the generation chronology as presented in Table 2 was adopted. It also includes the age of each generation in 2010 and 2019 in order to clarify the population constituting the research subject.

The development of ICT technology and the subsequent robotization are transforming the economic reality and new generations, verifying at the same time the usefulness of employees competences from individual generations in relation to the requirements of the labor market not only of the present, but also of the new economy (knowledge-based economy — KBE) and economy 4.0. Employees, as one of the key resources, determine the development of the economy. Thus, it is worth knowing their features with the aim to make appropriate development decisions, both for employees and the economy. For this reason, in Table 3 presents a synthetic characteristics of four generations of Polish employees in terms of career and development.

The characteristics of employees' generations are related to their competencies, which will be used to assess their adaptation to the competences of the future. However, a full overview of the situation requires a diagnosis of generational changes on the Polish labor market in the context of changes in competences.

³ An excellent list of all names of individual generations was presented by Wiktorowicz & Warwas (2016).

3. Methods

The evaluation of generations' competences in regards to their compatibility with the competences needed in KBE and Industry 4.0 was conducted in two stages. The first stage utilised a mapping method, which is a type of a non-systematic literature review. It consists of a quick search through the literature and the existing research on a specific subject. The method allows to identify research gaps and evaluate quantity and quality of the available literature. The quality of the analysed research is not verified during the review.

An initial review of 92 papers on the researched issue was conducted for the purposes of this article. After the initial selection, a more detailed analysis was conducted on 60 papers, the majority of which (90% of all) presented characteristics of generations of employees from the standpoint of management, sociology, or psychology. They regarded one, two, or rarely three generations of employees, while only 2 sources regarded four generations of employees. The other 10% of papers were on the subject of economy; they described contemporary situation and predicted changes on the job market as a consequence of Industry 4.0, as well as their influence on the economy, albeit without including four generations of employees. Descriptive works constituted the majority of the analysed literature and only a small percent of them presented results of a quantitative or qualitative research, which generally applied to specific characteristics or competences of various generations. Furthermore, the research results were presented in a wide variety of forms and were only fragmentarily relevant to the subject of this article. Therefore, the performed mapping revealed a research gap in regards to both the research subject and the method of comparing various forms of results.

The starting point of the research's second stage was ranking/ascribing significance to competences pointed out by various researchers on the basis of their repetitiveness/frequency (in descriptive and qualitative studies) or ascribed value (in quantitative studies). In order to standardize and rank various forms of results, a scale of plus (+) grades was utilised. A specific number of pluses (+) was assigned on the basis of competence rank resulting from the research on the employees' characteristics. The following grade scale was used: unsatisfactory (+), medium satisfactory (++), fairly satisfactory (+++), satisfactory (++++).

4. Results

The competences (qualifications of the personnel) are defined in the literature of the subject in various ways, although in every one of them the participation of the three basic components — knowledge, skills and responsibility is repeated. According to Becker (2009, p. 79), the creator of the theory of human capital, every person is endowed by nature, upbringing and education with specific competences, which increase with the increase in expenditure on for-

mal education and non-formal education. The better the education, the greater the professional competences and earning potential. Professional competences are specific to particular professions, they develop as part of a broader social process, and in a particular organization only the details usually change. Professional competencies are a complementary part of employees' competencies, which in turn are the main element of the organization's competences. Knowledge and skills, creative thinking, ambitions and commitment, as well as the ability to cooperate, shape and develop enterprises, products and technologies, build the brand of the company and its products, influence customer interest and production capacity. Hence, it is so important to hire competent employees.

Regardless of the profession or organization, there are certain universal competences expected from all employees. Until the knowledge-based economy, such a set of competences included: experience and practical skills, independence, responsibility, professionalism, decision-making, discipline, effectiveness and efficiency, interpersonal communication, cooperation, ethical behavior, intelligence, personal culture and work culture. The third and fourth industrial revolutions modified the desired employee competences, which of course affects the labor market. Although the third industrial revolution began over 20 years ago, its effects in the form of transformations in the Polish economy, employment structure and education are shifted time. It has to do with with the previously discussed specificity of generations of employees operating in the labor market, which determines their competences. Not all workers had the competencies specific to KBE when the fourth industrial revolution took place, bringing another modification of the required set of competences. For this reason, the task of assessing the adjustment of competences of generations to the requirements of KBE and economy 4.0 was undertaken.

In accordance with the adopted research methodology, at this stage of the research, the adjustment of competences of generations of employees to the competences of the economy of KE and 4.0 was assessed by means of ranking and a scale of plus marks. Table 4 presents the number of (+) that can be acquired by the individual generations in the context of KBE competences and the 4.0 economy, while Table 5 presents a synthetic assessment of this adjustment.

The outcomes of the evaluation of generations in the context of having key competences for the KBE and the 4.0 economy confirm that they are affected by the characteristics of the generations. Generation BB received a satisfactory grade in both cases, generation X good in terms of KBE competences, but sufficient for the 4.0 economy. Generation Y had the highest assessment of competency matching in KBE — very good, but at the lower end of the range for it. However, the rating for this generation dropped in economy 4.0 to the level of good. On the other hand, generation C is rated good in both cases, but with the highest degree of adjustment to the 4.0 economy. The grades awarded for individual competences clearly reveal not only the generational differences, but also the types of competences, the development of which should be supported

in order to provide the economy with the labor resources desired in the 21st century.

In the light of the ongoing discussion about the characteristics of generations and their finding in the contemporary labor market, this is not a surprising result, but rather confirms the popular opinions on this subject. It can also be stated that the social regularity is confirmed — each new generation is better, more educated and adapted to the present day than its predecessors. Each generation has its own time — now there comes the time for generations Y and C, which will function on the labor market for the next several dozen years.

5. Conclusion

On the basis of the conducted research, one may formulate the following conclusions:

1. The third and fourth industrial revolutions have significantly transformed the labor market relatively to the industrial economy. The set of universal competences required from employees has changed dramatically, which generates the need to adapt them to the requirements of modern times.
2. The characteristics of individual generations of employees impact upon their competences, not only the current ones but also the future, determining thus the level of professional activity and employment.
3. Changes in the number and structure of employees, their professional activity, as well as the number and structure of employees in occupational groups that have occurred on the Polish labor market in the last 9 years reflected changes in the competences of generations, their usefulness and the ability to perform specific jobs.
4. One should not forget about the employees of the X generation, who constitute a significant part of the labor resources in the economy, whose competences are less adapted to the present day. Their characteristics will make it easier for them to acquire new skills with the adequate support.
5. The BB generation has competences that are the least suited to modern requirements, but in conditions of labor shortage, they also need to be used. This only requires the development of solutions for including not only 55+ but also 65+ employees in the labor market, which is confirmed by the concepts of age and diversity management in the enterprise.

To sum up, the results of the assessment of the degree of matching competences of generations point out the areas that require improvement. Therefore, they should inspire decision-makers to take systemic endeavors that will minimize the problem. Moreover, they constitute a starting point for further research, for example in the context of assessing the costs of such an adjustment. It should also be emphasized that the simple competency matching assessment method used is not perfect. It is only a guide to using other methods for this purpose.

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Appendix

Table 1.
The comparison of labor market characteristics of three types of economies

Specification	Industrial economy	Knowledge-based economy	Economy 4.0
Labor market	Stable, with stages of change and evolution, local competition	Dynamic, unpredictable, global competition, progressing computerization. Digitization and automation of work	Dynamic, unpredictable, global competition, robotization/artificial intelligence, and machine learning. Change in the employment structure, decline of the need for physical and routine simple work. Cloud computing, augmented and virtual reality
Labour market policies	Full employment	Increasing the scope of using labor resources and increasing their productivity. Higher real salaries and income	Preparation of a remedy for possible unfavorable effects of the economy robotization process (the need to reallocate labor resources between sectors). Higher real salaries and income, flexible and negotiable working hours, remote work
Qualifications/competencies	Limitation and specialization connected to the position, well-established, experience	Extensive qualifications, useful for various projects, multi-faceted training	Multi-qualifications/competences for the economy 4.0, multi-faceted training, work in a multicultural environment
Success factors	Capital and labor, the effect of production scale, cost lowering	Innovation and knowledge, quality, investments in research and development	Knowledge, innovation, robotization
Education	Competences specific to this economy, the importance of formal education	Lifelong learning, recognition of experience and competences acquired during non-formal education	Life Long Learning involving fast assimilation of knowledge and information. Flexibility, openness, competences of the future. Changes in the ways/methods of education
Form of work/nature of employment	Full-time, stable, based on traditional organizational structures, providing a sense of security	Temporary, flexible, variable, high risk of losing employment. Greater importance of market opportunities	Temporary, flexible, variable, high risk of losing employment. Freelancing, digital nomadism
Method of working	Functional, process of activity, single task	Innovation in action, multitasking	
Working environment	Physical and defined	Virtual and distributed	
Labor market regulations	The state imposes solutions, supervision and control	Developing growth possibilities, market tools	Creating growth possibilities, market tools. Active support of employees in the process of change and adaptation. Investing early in raising qualifications and improving career prospects



Specification	Industrial economy	Knowledge-based economy	Economy 4.0
Work management	Directive-like (the group's will or decision was expressed by the manager, control by supervision). Delegating powers (control by monitoring). Formalized and deferred evaluation Conflict management	Participatory-like, human resource management, quick feedback. Ongoing/dynamic assessment and rewarding. Cooperation management	Managing cooperation in teams formed for the needs of a given project. Networking, partnership. Agile organization, agile management, turquoise management

Source: Own preparation based on Atkinson & Correa (2007, pp. 39–41); Balcerzak (2009, pp. 3–22); Kawka (2018, pp. 117–131); Piątkowski (2020, pp. 1–30); Rękas (2019, pp. 45–58); Schwab (2018).

Table 2.
Generations in the workplace

Generation	Date of birth	Age in 2010	Age in 2019	Age in 2030
Baby boomers (BB)	1946–1964	46–64	55–73	66–84
X	1965–1979	31–45	40–54	51–65
Millennium generation	Y	1984–1989	21–30	41–50
	C	1990–	19 and under	40 and under

Source: Own preparation based on Wiktorowicz & Warwas, (2016, p. 22).

Table 3.
Characteristics of generations — career and development

Qualities	BB	X	Y	C
Number of employers	2–3	2–8	8–16	over 16
Prevailing education	Vocational	Secondary	Secondary and higher	Higher
Learning and career process	It was not planned in advance, more often occasional/accidental	The educational process was planned, but less often a career (the saying was “you will be good, they will notice you”)	The educational process, development planned in advance, long-term career building	Learning process, development according to the principle of just in time learning, they want to have and know everything at once, preferably online. They also have a specific approach to gaining knowledge. It is difficult for them to come to terms with the vision of building a long-term career in small steps
Vocational work while studying	It was rarity		Frequent combining of working and learning process (unpaid internships and apprenticeships)	Very common combining working and learning process (internships and paid internships)



Qualities	BB	X	Y	C
Loyalty to the employer	High; willingness to sacrifice	High; dedication to work, but less than BB	Low, but they can be involved in work if it meets their expectations and needs	Very low
Style of working	Commitment to work, acceptance of the rules imposed by the organization; preference of individual work or cooperation rather than competition	Fitting to the form — humility and respect for work make them conscientious employees who appreciate what they have. Independent in making decisions, professionally and socially active	They need independence to make their mark, but they are looking for someone around to be a mentor to them. They need a sense of purpose in undertaken actions. Poor decision making, hence they like team work, which they value more than independent work; lack of patience and self-discipline, being demanding. They do not care about job stability, they are looking for diversity, run away from routine; constantly want to change something, or improve, exercise new methods of work	
Career goal	“I am working to survive” (Hard) work as a source of earnings and maintenance. Career is less important — it is a tool for the realization of passion, providing livelihood. According to the Pracuj.pl (2020) survey, 81% of BB chose the expert path as their career path, and 19% — the managerial path	“I live to work” Work is a priority for them; they can work hard and patiently wait for promotion, prestige, gratification (“portable” career); less leadership-minded than the subsequent generations. According to the Pracuj.pl (2020) survey, 77% of BB chose the expert path as their career path, and 23% — the managerial path	“I work to live” Work is a right, not a privilege. The expectation of a quick and boundless career. Developing parallel careers. According to the Pracuj.pl (2020) survey, 67% of BB chose the expert path as their career path, and 33% — the managerial path The “me, for me” generation, looking for fame and fortune. They recognize the problems of corporate social responsibility	“I work to live” Waiting for quick development, preferably without any effort. Developing parallel careers. A career for generation C is more important than for the previous ones. According to the Pracuj.pl (2020) survey, 67% of BB chose the expert path as their career path, and 33% — the managerial path The generation “we”, more socially oriented and interested in corporate social responsibility and global problems (climate change, hunger, wars)
Expected gratification	They expect a good working atmosphere, recognition, job stability/security and adequate earnings	They derive their motivation from the feeling of job satisfaction, high position and prestige, which will be accompanied by an attractive salary. High remuneration is put as top priority	They expect concrete results quickly — well-paid work, development, creativity and openness at work. They are least likely to look for good relations with their supervisors	They expect an attractive remuneration (their salary expectations are higher than their skills) and appreciate the effects of their work (salary increase, bonuses, promotion)



Qualities	BB	X	Y	C
Balance work-life	They didn't know such a term; on the other hand, they were familiar with the phenomenon of "social action" and sacrifice for others	They concentrated on work. The need for balance, but only in retirement; work addiction and professional burnout are common because there is a desire to receive higher remuneration at the expense of free time. At the same time, they care about the quality of private and professional life	Work is not everything, they strive for work-life balance (WLB), what matters is what gives them happiness besides work. They pay attention to private passions than careers more often than C	The professional and private life make the whole in which they want to be themselves and be guided by the same values. Honesty and non-discrimination are more important to them than money, status
Change of job	It soaks you with fear, concern and anxiety. The threat of losing it is a motivation to act. They are more likely to retrain than to change the employer	Viewed as a necessity; fear of losing the obtained positions, security, stability. More likely to change jobs than BB	Normality — high professional mobility, easy adaptation, openness to changes. Most often they look for regular uprising	Normality — high professional mobility, easy adaptation, openness to changes, not afraid of risk taking. However, in the context of professional activity, they are afraid for their future and the least likely to change employers in case of problems with uprising
Training and development	Necessity They are more likely to retrain than to change the employer	A tool that guarantees promotion and making an "anchor" of the employment. They would also choose to re-qualify to keep the position	Continuous learning as a way of life; positive attitude to changes in specialization/profession in the future (according to the Pracuj.pl (2020) survey, 53% of respondents from the Y generation have a positive attitude to the prospect of working in a different profession than the current one)	Lifestyle, according to the Pracuj.pl (2020) survey, 50% of the respondents from generation C have a positive view of the prospect of working in a different job than the current one)
Leader position	Respect, regard, hierarchy, discipline	They don't like hierarchies, but recognize the authority of the bosses	Competence is what matters, the leader must deserve respect and recognition. They prefer managers with an educational approach, being their coaches, positively oriented, motivating towards gaining achievement and cooperation	Competence is what matters, the leader must deserve respect and recognition. They also await respect for themselves and a good atmosphere at work
Self-confidence	Low	Mean	High	Very high (other generations find it even too high as compared to the skills)



Qualities	BB	X	Y	C
Attitude towards life — the dominant feature	Conscientiousness, independence, commitment, optimism, thinking in terms of globality	Skepticism; pessimists disillusioned, distrustful of power, very vigilant when it comes to incompetence and inconsistency in the people around them	Optimism, curiosity about the world, sense of freedom, assertiveness, reluctance to long-term commitments	“To live before I start to work” They are more realistic, cautious and materialistic about life. Full of fears for a professional future. At the same time, they are characterized by relaxation, optimism and curiosity about the world
Attitude to change	Unwilling, they will judge those who think differently. They need support in the process of making changes in the organization	Skeptical, are not multitasking	The flexibility and openness to changes are greater than in the case of the predecessors, ease of adaptation, multitasking, readiness to learn	Openness, the expectation of a dynamic work environment, creative, innovative, unconventional in thinking

Source: Own preparation based on Arsenault (2004, pp. 124–141); Goldsmith et al. (2007, pp. 1–7); Hysa (2016, pp. 385–398); Pracuj.pl (2020, pp. 1–7); Roguska (2018); Shragay & Tziner (2011, pp. 143–157); Smolbik-Jęczmień (2013, pp. 90–97); Woszczyk (2016, pp. 133–134); Yang & Guy (2006, pp. 267–284); Zabel et al. (2017, pp. 301–315); Żarczyńska-Dobiesz & Chomątowska (2014, pp. 406–415).

Table 4.
The number of pluses that can be acquired by generations

Type of evaluation	Knowledge-based economy	Economy 4.0
unsatisfactory	1–8	1–10
satisfactory	9–16	11–20
good	17–24	21–30
very good	25–32	31–40

Source: Own preparation.

Table 5.
Synthetic assessment of key competences of generations in the context of KBE and the 4.0 economy

No.	Competences	BB	X	Y	C
Knowledge-based economy competences					
1	communication in the mother tongue	++	+++	+++	+++
2	communication in foreign languages	+	++	++++	++++
3	mathematical (the ability to count) and basic scientific and technical competences	++	+++	+++	++
4	IT	+	++	+++	++++
5	ability to learn	+	++	+++	+++
6	interpersonal (social) and civic	++++	++++	++	++
7	sense of initiative and entrepreneurship	+	++	+++	++
8	cultural awareness and expression	+	+++	++++	++++
	total	13	21	25	23



No.	Competences	BB	X	Y	C
	4/0 competences				
1	sense-making	++	+++	+	+
2	social intelligence	++++	++++	++	++
3	cross-cultural competency	+	+	+++	++++
4	virtual collaboration	+	++	+++	++++
5	new-media literacy	+	++	++++	++++
6	novel and adapting thinking	+	++	+++	+++
7	cognitive load management	+	+	+	+
8	design mindset	+	+	++	++
9	transdisciplinarity	+	+	+++	+++
10	computational thinking	+	+	+	+
	total	14	18	23	25

Source: Own preparation based on Appelbaum et al. (2005, pp. 1–33); Bachman (2019); Bakhshi et al. (2019); Filas (2018); Gayle (2019); Górnjak (2013); Krueger & Kumar (2004, pp. 167–207); Polakowska (2020); Pracuj.pl. (2020); Pyöriä et al. (2017, pp. 1–14).

