

Human factor in industry 4.0 and the role of inter-generational collaboration

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Abstract: The objective of the paper is to analyze pros and cons of different generations from the point of view of their readiness to satisfy the required labor skills criteria for the Industry 4.0 workforce and willingness to participate in the process of upcoming transformation. The basic conclusion is that *today's coexistence of different generations should be transformed into an active and efficient collaboration*. In many organizations teams consisting of workers belonging to different generations will be working and in these teams older (or even middle-aged) colleagues should share their professional know-how and practical experience with younger colleagues and younger members should use their digital capabilities to achieve common objectives of the organization.

KEY WORDS: INDUSTRY 4.0, NEW REQUIREMENTS ON LABOR SKILLS, MOTIVATION AND CREATIVITY, INTER-GENERATIONAL DIFFERENCES IN EXISTING SKILLS, AGE DEPENDENT DIGITAL LITERACY

1. Introduction

The Fourth Industrial Revolution (Industry 4.0) represents a fundamental change in the way we live, work and relate to one another. It is a new chapter in human development, enabled by extraordinary technology advances. These advances are merging the physical, digital and human worlds in ways that create both huge potential benefits and promises as well as potential peril and risks. The speed, breadth and depth of this revolution is forcing us to rethink how countries develop, how organizations work and create value and even what it means to be human [18]

It is clear that the 4.th industrial revolution is about more than just technology-driven change; it will impact everyone, including leaders, policy-makers and people from all income groups and nations. Human aspects of this transformation were first mentioned in connection with the potential losing of jobs due to robotics applications. It is expected that many routine and manual activities will be automated and people from these jobs can be fired. However, new jobs will be created, many existing activities will be transformed by radically changing labor skills requirements. [12] Practical experience shows that human skills and motivation are the crucial factor for the efficiency of smart factories and all organizations in the digital era [14, 12] The new business model requires rethinking of the whole HR functions, management style, organization culture, etc. [8].

The crucial role of education and training to prepare the workforce of the future is generally accepted. Not only radically new skills and knowledge will be important, but also the demand for different skills and their combination will change dynamically. Ability and willingness to learn will actually be a permanent requirement in almost all professions and is inevitable for adjustment to new dynamics of changes in environment [16].

The role of human factor in Industry 4.0 can be approached from different perspectives: regional aspects, professional and industry specificities, new demands on educational system, etc. In our paper we'll deal with the inter-generational aspects of this wide problem area. In the center of our analysis will be the question *what role can different generations play in implementing or even accepting the transformation to the Industry 4.0 economy and society*.

2. Why inter-generational aspects are important

Problems of intergenerational relations are not a new phenomenon. However, a significant increase in the share of seniors in the population of developed countries today, intensifies an interest in these issues.

New technology connected with the Industry 4.0 raises radically new dimensions of the inter-generational cooperation problems. Firstly, it is clear that digital literacy and high level of digital skills, important for Industry 4.0, are unequally distributed among

different generations. On the other hand, practical experience, tacit knowledge based on lessons from previous development of organizations, industries, etc. are more embodied in workers in their 40-ies or 50-s and sometimes even in seniors. These people can represent an important element of an intellectual capital of companies, mainly established firms. Also such skills required for Industry 4.0 workforce, as emotional intelligence, empathy, communication ability and experience with leading teams, are differently dispersed in the population. Of course, these features are strongly dependent on the type of a personality, but can be also supported by education system. However, the impact of an environment, in which a person has grown, is also important.

Life-long learning cannot be just a task of educational institutions. Companies should play an important role as well. Life-long learning does not mean just participation in training courses organized by employers, but to a significant degree it is based on learning by practical experience in teams or other communities. These teams include persons of different age, even belonging to different generations. For managers and companies, it is important to create such conditions that members of the team will effectively cooperate to achieve planned objectives. Transfer of knowledge (both explicit, but also tacit) between team members is very important and its role will even increase on the path to Industry 4.0.

3. How are different generations prepared and willing to participate in forming the Industry 4.0 society

New requirements on labor skills, loss of some routine jobs and the transformation of existing jobs, are differently accepted by different generations and also by different professional groups within the same generations. This is relevant not only for manual workers, but also some graduates of universities that are regarded as knowledge workers today, can become redundant due to automation. Much more higher flexibility and willingness to learn will be important in many professions. Flexibility can be a permanent feature of some individuals, it need not depend on their age. However it can be also learnt (but sometimes even reduced) by practical experience. Elderly people are mostly regarded as less flexible than the young generation. although there can be exceptions

It is well-known and statistically proven for developed countries, that digital capabilities of the population are decreasing with the age [17]. However, digital capabilities can't be the only criterion to evaluate the readiness of different generations to participate in forming Industry 4.0.

Let's start our excursion into generational aspects of the problem „How ready is the workforce for Industry 4.0“ by analyzing strengths and weaknesses of the youngest generation (millennials and Generation Z), which is usually regarded as the basic supporter and human driver of Industry 4.0. Our basic source of data will be The

Deloitte Global Millennial Survey 2019 [1, 2]. The 2019 report is based on the views of 13,416 millennials questioned across 42 countries and territories. Millennials included in the study were born between January 1983 and December 1994. The report also includes responses from 3,009 Gen Z respondents in 10 countries. Gen Z respondents were born between January 1995 and December 2002. The Survey was oriented on millennials' (millennials are sometimes called Generation Y) perception of the current economic development, business motivation and their relationship to technology, especially the advent of Industry 4.0. All the respondents from the millennial cohort were working. Most of the respondents from Generation Z were still studying; some of them were simultaneously employed.

The views of respondents are rather pessimistic, and the Survey called them "a disrupted generation". According to the Survey, young participants are increasingly pessimistic and mistrustful of both their careers and the world around them. Respondents expressed a strong lack of faith in traditional societal institutions, business motivation and macroeconomic perspectives. The top priorities of the respondents were: travel and seeing the world (57%), high salary (52%), buying a home of their own (49%).

For our paper, the most important is the attitude of millennials to the advent of Industry 4.0 and its impact. Forty-nine percent of millennials believe new technologies will augment their jobs; 25 percent expect Industry 4.0 to have no impact, and only 15 percent fear it will replace all or a part of their job responsibilities. Only about one in five respondents believe they have all the skills and knowledge they'll need for a world being shaped by Industry 4.0, and 70 percent say they may only have some or few of the skills required and will need to evolve their own capabilities to increase their value.

A serious problem for companies can be a high fluctuation rate of young people. 49 percent of respondents would, if they had a choice, quit their current jobs in the next two years. If companies invest in the training of this youngest part of their human capital, this will lead to a loss. Although labor mobility is regarded as one of the requirements of the new era, there must be some limits to the drain of talent. The basic reason of this fluctuation is dissatisfaction with the pay

According to the Deloitte Survey, millennials and Generation Z make up more than half of the world's population and, together, account for most of the global workforce. They can be – and should be – the crucial part of the workforce for Industry 4.0. They were educated for a digital society and wish to use and improve their digital capabilities to achieve their personal satisfaction but also some broader social objectives.

However, if we communicate and work with these young people, we can realize that they are very good in IT, are able to construct up-to-date mathematical models, etc., however they do not understand enough, what is behind these models, what simplifying assumptions are included in the model and what is the actual relation between virtual reality and actual economic, social etc. situation. To become more realistic and useful for actual problem solving, they have to systematically cooperate with more experienced colleagues. These colleagues can be sometimes even formally their mentors, but need not be. The knowledge transfer can be also spontaneous, informal in working communities.

What generation can play this supportive or even mentoring role? Another generation (passing from the youngest workers to higher age groups) is the Generation X. This cohort includes people born between late 1960s and the first half of 1980s. Due to a lower birth-rate at that time, this demographic group is not large (in comparison

with millennials) in many countries. As an opposition to their mothers' workholism, they prefer balance between work and personal (family) life; work should be interesting and creative for them and independence is among their most important values. Members of this generation have some common features with millennials: independence, need of creativity, being skeptical of authority. The basic difference is their longer work (and practical) experience.

Over 60 percent of the Generation X in developed countries have university education. They are technologically adept. They are comfortable with smartphones, e-mail, laptops, tablets, and other technology used in the current workplace. Technology is inextricably woven into their lives [7]. They are flexible, adapt to change, friendly and tolerant of alternative lifestyles. After some retraining in the up-to-date technology, they can be valuable members of the Industry 4.0 workforce.

However there can be some limitations. Due to institutional and even political environment in many countries (Slovakia included) this generation did not occupy leading positions in organizations, their experience with leading teams and organizations is not sufficient, they used to be more passive workers, respecting regulations, than active independent decision makers.

Next generation is the baby boomers – people born after the war, between 1946 and mid-1960s. It was the largest generational cohort in the USA up to 2015, and it still is an economically and politically influential generation. Many of them are even today at the top management positions. Most of them entered the workforce in the period when computers were in their rudimentary stage. Those baby boomers that were using IT in their professional careers have basic IT capabilities. However, today most baby boomers are approaching the retirement age or are already retired and represent (in the USA and some other developed countries) a relatively wealthy group of the „silver generation“ – they form an important component of a demand for new products and services .

The influence of this generation on the economy and markets is sometimes called „baby boomer effect“ [10]. This term was originally used in the realm of technology and referred to the importance of simplifying the interfaces of consumer electronics to encourage the wealthy baby boomer generation to upgrade. Although today the term is used in a broader sense, problem of simplifying the consumer-new products interaction can be topical for the new, Industry 4.0 era.

The generation of "veterans" (people born before the war or during the war) is usually not mentioned in connection with the digital society and forming Industry 4.0, although with the ageing population, the share of people in 55+ in the total population, and even in employment, is growing. The share of people aged 55 years or more in the total number of persons employed in the EU-27 increased from 12 % to 20 % between 2004 and 2019.[6]. In V-4 countries in 2016, the share of people in the age group 55-64 years that were working, was 41.6 percent, with the highest number in the Czech Republic (almost 90 percent). In Slovakia, this share was a little lower than 50%, but most of these workers were employed full time. Older seniors, in the age 65+ have a much lower employment rate and usually are working at a part-time basis. In 2019, 48 % of all working men aged 65 years or more in the EU-27 were employed on a part-time basis compared with 60 % of women aged 65 years or more [6, 12].

Veterans that are still working are usually in jobs where digital capabilities are not required. Many of them have access to the internet but they do not use it in their work. However, in this age group, we can also find specialists that are actually knowledge workers (mainly researchers and university teachers) and that have

been forced to acquire digital capability. Due to their tacit knowledge and experience, this part of the older generation can be valuable in educating the future workforce.

In connection with the option to more include seniors in the employment, often the role of *home office type of work* is mentioned. Under pandemic and lockdowns, the use of home office as a type of work has been widely used in many countries. This was independent on the age.

The long-term impact of widely using the home office work is still not sufficiently evaluated. Many problems are open. They include not only the impact on productivity, meeting company objectives, difficulties to apply a teamwork, etc. but also many problems from the worker's point of view: a need of more intensive contacts with colleagues, a barrier to professional growth, another type of a disbalance between work and personal life, etc.

4. Human factor are not only employees

The human factor includes not only workers or potential employees, but it also represents all the citizens, including children, retired persons and other individuals that are not working for various reasons. All of them are tax payers (at least of indirect taxes); they have to communicate with government authorities; they will be included in the e-health system, and, mainly, all of them will be final consumers in an ever more digitalized society. In the era of Industry 4.0, some digital literacy will be necessary for all the people.

The digital divide, which exists not only between countries but also between different groups within the same country, is usually treated as the differing amount of information between those who have access to the Internet (specially broadband access) and those who do not have the access [13].

Let's look at some data from a survey on access to the internet and use of it in Slovakia, during recent years [11]. Respondents of the survey were 2906 Slovak citizens older than 18 years. 60% of them were women, and 40% were men. The respondents were from various regions and age groups. 68% of the respondents had high school education, and 31% had university education. Digital capabilities were self-assessed by the respondents, at the scale ranged from one (I am able to do very well) to five (I am not able at all).

There were 3 basic groups of criteria for the level of digital literacy: hardware (work with computers, mobiles, computer peripherals, access to the internet), software (work with various operating systems) and the way of using the internet (search for information, e-mail, chat, social networks, calling by internet, e-commerce, internet banking, communication with government institutions, etc.). In the 1st group of indicators (hardware), assessment of men is higher than that of women. About 10% of the whole sample are „not able at all“ to work with computers, and a similar share has no access to the internet. As can be expected, digital capabilities are increasing with the level of education and declining with the increasing age. In the age group 65+ there was the lowest value for almost all the indicators of digital capabilities. The lowest level of an individual indicator has been achieved for „the work with databases“, which is very important for the work skills in Industry 4.0. Just 10% of respondents said they were able to do it very well.

From the mentioned research and also from “a common sense” point of view it is clear that a radical improvement in digital literacy of the population is badly needed .

5. Conclusion

Forming Industry 4.0 is impossible without preparing the human factor for its creation. Human skills, motivation, creativity, flexibility, critical thinking and ability to make independent decisions are very important. Some of these features can be purposefully formed by education system (both formal and life time education, based also on practical experience). Other features are dependent on a type of a personality and can be to a certain degree formed by practical experience and transfer of tacit knowledge in working communities.

On the path to Industry 4.0, companies will hire talent from outside (graduates from universities, perspective workers with some practice in other companies or organizations) and retrain existing workforce to meet new requirements. In this process, often teams or working communities can be formed, consisting of workers of different age and belonging to different generations.

In our opinion, a precondition for an efficient working of such teams is an atmosphere of trust and respecting specific preferences and values of different age groups. Moreover, people of different age must be motivated to cooperate and the collaboration should be mutually advantageous. Young people can feel that the advice of older colleagues is useful for them and older members of the team can not only acquire higher digital skills in collaborating with young colleagues (so called reverse mentoring), but have the opportunity to better understand the actual preferences and life style of the young generation. However, it is important, that neither form of mentoring will be misused and lead to a manipulation.

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