LABOUR MARKET IN THE CONTEXT OF INDUSTRY 4.0

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Abstract

Industry 4.0 represents change of paradigm in industrial production leading to higher productivity and performance. The impacts of implementation of Industry 4.0 can be expected at the microeconomic and macroeconomic levels. The impacts of Industry 4.0 are not only in the technological level but also in the field of human resources. The objective of this article is to assess impact of the implementation Industry 4.0 on labour market in industry. The paper focuses on the assessment of anticipated impacts in two fields on labour market and labour productivity. On the labour market can be expected changes in the educational structure and specialization of workforce and in work organization. Integration of Industry 4.0 necessarily leads to the growth of labour productivity and business performance. On the other hand, we cannot exclude the influence of paradox productivity in the long term. Then the question is if the expectations of labour productivity growth are not exaggerated.

Key words: labour market, Industry 4.0, labour productivity, competitiveness

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Introduction

Industry 4.0 represents paradigm change in industrial production. Integration of ideas Industry 4.0 ideas will not only lead to changes in production, but big changes can also be expected in the labour market. Digital progress in firms' production accelerates the restructuring of the labour market. The objective of this article is to assess impact of the implementation Industry 4.0 on labour market.

Industry 4.0 is called as fourth industrial revolution. Some authors admit that the industry 4.0 will become a global driving force for ensuring sustainability of the industry (Nieuwenhuis & Katsifou, E 2015). Industry 4.0 is based on the use of cyber-physical systems, improving computer and communication systems. The analysis notes that the biggest future benefit of industry 4.0 for industrial companies will be greater cost efficiency and/or productivity. Manufacturing industry today must withstand increasing global competition on product quality, productivity and production costs, and one of the ways to solve this situation

is the application of the principles of Industry 4.0 (Brettel, et al. 2014). According to the study the European Parliament Smita et al (2016) sees the main effects of the integration of the principles of industry 4.0 in three dimensions and in areas of technological, social and business change in paradigm (Vrbova, et al., 2016). From the perspective of business economics integration industry 4.0 necessarily leads to the creation and use of new production strategies, leading to higher productivity business performance and growth of innovative potential (Sanders et al., 2016). Innovations have a big impact on business performance (Mura & Sleziak, 2015, Mura & Machová, 2015) . The Industry 4.0 can lead to turbulence on the labour market. On the other hand, it must be noted that the labour market is influenced by other factors such as the business cycle (Pavelka, 2015) or regional differences (Vrchota & Brezinova, 2014). An extremely important area in connection with implementation of Industry 4.0 will be the prediction of future labour market needs and focusing the fields and content of education on "professions of the future" or "positions for Industry 4.0" (Marik et al., 2016). The effects of new technologies on employment will be significantly affected by the decisions of employers. Most of the current analysis and researches are concerned with the technical aspect of the integration of Industry 4.0 into real economic life. There are many fields which are not explored yet the effects of integration industry 4.0 into real economic life. One of these areas is the impact on labour market and productivity.

Production function is the basis for measuring productivity and performance at macroeconomic or microeconomics (enterprise) level. The neoclassical production function takes the form Y(t) = F [K (t), L(t), T(t)] where Y (t) is the flow of output produced at time t. Capital, K (t) represents the durable physical inputs, such as machines, buildings, pencils and so on. The second input to the production function is labour, L (t) and it represents the inputs associated with the human body. The third input is the level of knowledge or technology, T (t) (Barro, & Sala-i-Martin, 2004). Other authors as Baumol, Romer, Coelli, Freid, Färe, Chen, Inklaar continued and continue with Solow fundamental work. Into the basic equation of production function Chen and Inklar (2016) today add letter R which represents R & D capital (research and development). It is one possibility how integrate Industry 4.0 into production function. Productivity is also a good measure of economic prosperity, standard of living and degrees of competitiveness of economies. There are many different productivity measures. The choice between them depends on the purpose of productivity measurement and, in many instances, on the availability of data. The simplest and the most frequently-encountered measure is labour

productivity. Labour productivity is defined as gross value added or gross output per. The importance of all factors of production summarises indicator of total factor productivity.

1 Data and methodology

The objective of this article is to assess impact of the implementation Industry 4.0 on labour market. The paper focuses on the assessment of anticipated impacts in two fields on labour market and labour productivity. The analytical part of article focus on Czech Republic industry.

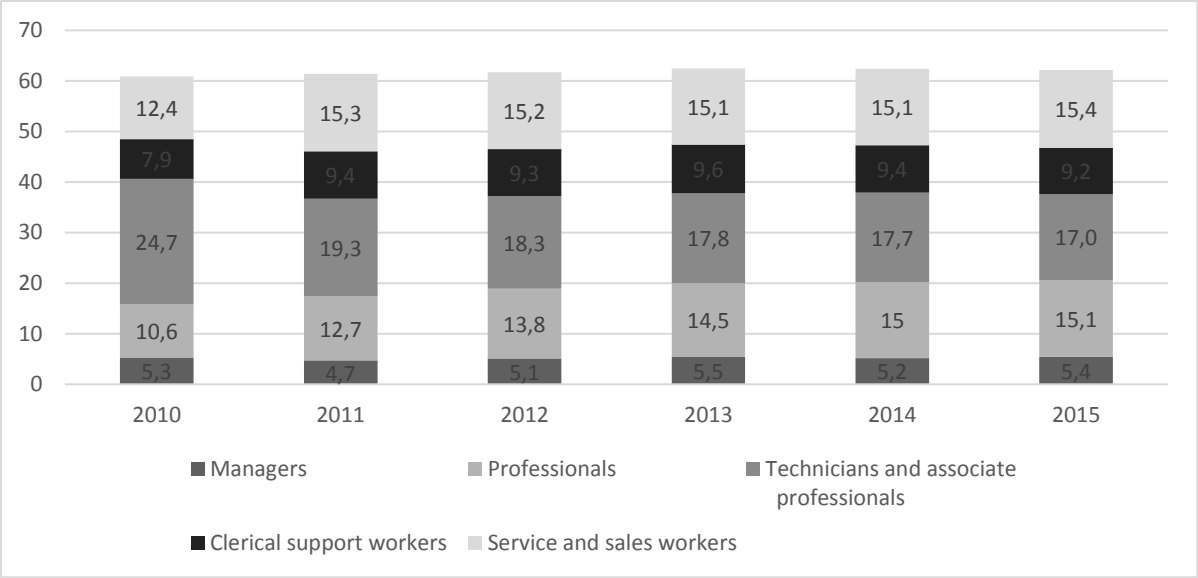
The data source was Eurostat (National accounts) and Czech Statistical Office. The observed data were from the period (2010-2015). Based on this classification of economic activities are divided into 5 groups: A1 (Industrie: High and Medium High Technology), A2 (Industrie: Medium Low and Low Technology), B1 (Knowledge-intensive market services), B2 (Less knowledge-intensive market services), C (Agriculture, construction and utilities). The definition and classification of economic activity activities is based on the definition created by the OECD. The article deals with 2 groups - A1 and A2. Labour productivity was measured as a share of gross value added and total employment. Based on the development and projected impact of Industry 4.0, a mechanical extrapolation of labour productivity dynamics was performed.

2 Results

2.1 Current situation on labour market in Czech Republic

The figure 1 illustrates the development of the structure of working people in the national economy in their main job. In the figure are only selected groups which are considered to be crucial for the implementation of Industry 4.0.

Fig. 1: Occupation - selected major group in %



Source: Own calculations based on the data Czech statistical office

It is clear from the chart that since 2010, the percentage of Professionals has increased each year, and in 2015 it is 15.1 % of the total number of employees. The largest share of employees is made up of technicians and associate professionals (17 % in 2015), but this share declines in the monitored interval.

If we focus on the share of employees in industry for groups A1 and A2 (see methodology), we find that there is a larger proportion of employees in the A2 group (about 16.5 %), which has not changed much in the monitored period. The proportion of employees in Group A1 has increased slightly over the years, so in 2015 it is about 12 % (Tab.1). The biggest effects of Industry 4.0 integration can be expected mainly in the manufacturing industry. Integrating Industry 4.0 into other industries can be expected with a time lag. Greater extensions will depend on the experience of integrating Industry 4.0 ideas into manufacturing.

Tab. 1: Number of employees in the Czech Republic by OECD classification - Industry

	2010	2011	2012	2013	2014	2015
A1	442 156	476 160	486 479	485 939	496 694	522 196
Share in total number of employees in%	10.40	11.26	11.43	11.31	11.46	11.82
A2	686 852	697 060	697 372	698 254	703 256	727 532
Share in total number of employees in%	16.16	16.48	16.39	16.25	16.23	16.46

Source: Own calculations based on the data Eurostat

As regards the share of companies currently employed by ICT specialists in the sectoral breakdown (Table 2), it is not surprising that their largest share is in the Information and Communication activities (about 87 %). The other two sectors currently employed by ICT

specialists are the industry (24.3 % and Manufacturing 23.7 %). This means that every fourth firm in the industry employs ICT professionals. Even from this, it is obvious that the industry is best prepared to integration Industry, 4.0. However, from the point of view of the share of ICT professionals employed in the total number of employees in the sector, the situation does not look so favourable. In the industry, about 1% of all employees are ICT specialists. When introducing robotization and automation into production, the structure of employees must necessarily be changed.

Tab. 2: Share of ICT employees by sectors in 2015

	Share of firms employing ICT experts in the total number in the sector (%)	Share of ICT experts in the total number of employees in the sector (%)
Firms TOTAL	19.3	2.4
Manufacturing	23.7	0.8
Electricity. gas. steam and air conditioning supply	24.3	0.9
Construction	8.1	0.7
Wholesale and retail trade; repair of motor vehicles	14.7	1.0
Transportation and storage	9.2	0.7
Accommodation and food service activities	5.4	0.3
Information and communication	87.1	37.8
Real estate activities	18.2	1.3
Professional. scientific and technical activities.	26.5	3.3
Administrative and support service activities	14.8	0.4

Source: Own calculations based on the data Czech statistical office

2.2 Impact of Industry 4.0 integration on the labour market

The Industry 4.0 provides enterprises big innovative opportunities, new manufacturing materials, new processes, new production techniques and increased efficiencies. Change will not occur immediately but gradually. First, firms will only replace individual machines and only then will integrate other elements. The repercussions of Industry 4.0 on the labour market will be very contradictory. Therefore, impacts of the Industrial Revolution 4.0 will initially be gradual but increase rapidly as greater awareness of the benefits and market forces takes hold. Industry 4.0 is set to impact all stakeholders in the manufacturing industry, including the size,

composition and location of your workforce. changes in production will accompany changes to the labour market

Now we discuss about general trends in labour market in the context of Industry 4.0. The demand for low-qualified employees decreases. The impact of automation will necessarily lead to a reduction in low-skilled jobs, in particular in manufacturing. The demand for an upskilled labour force (software engineering, highly skilled creative workforce) increase. Automation and robotization reduce middle management (replaced by management software). Increases in a number of occupational fields and in particular in service professions, most significantly in ICT and scientific professions (Robinson, 2017). New job opportunities will be created by Industry 4.0. This will elicit strong demand for new professions that combine mechanical engineering with knowledge of electronics, cybernetics and informatics. Integration Industry 4.0 lead to changes in structure labour force between sectors. We can expect decline labour force in the manufacturing area and increase labour force in services. The traditional organisation of work will transform under the influence of new processes that are more interconnected and continuous from a strict division among professions (Walwei, 2016). It is clear is the fact that the character of work will change in the future, as will the overall number of job opportunities and their structure.

2.3 Current situation on labour productivity in Czech Republic and Industry 4.0

The level of labour productivity in industry is illustrated in table 3. As expected, the labour productivity in Industrie: High and Medium High Technology is significantly higher than the average level of labour productivity in the Czech Republic. The gap between these labour productivity figures is deepening over the years. Labour productivity in Industry: Medium Low and Low Technology (A2) is lower than the average level and reaches about 67% of the industry level: High and Medium High Technology (A1).

Tab. 3: Labour productivity in thousands of CZK per worker

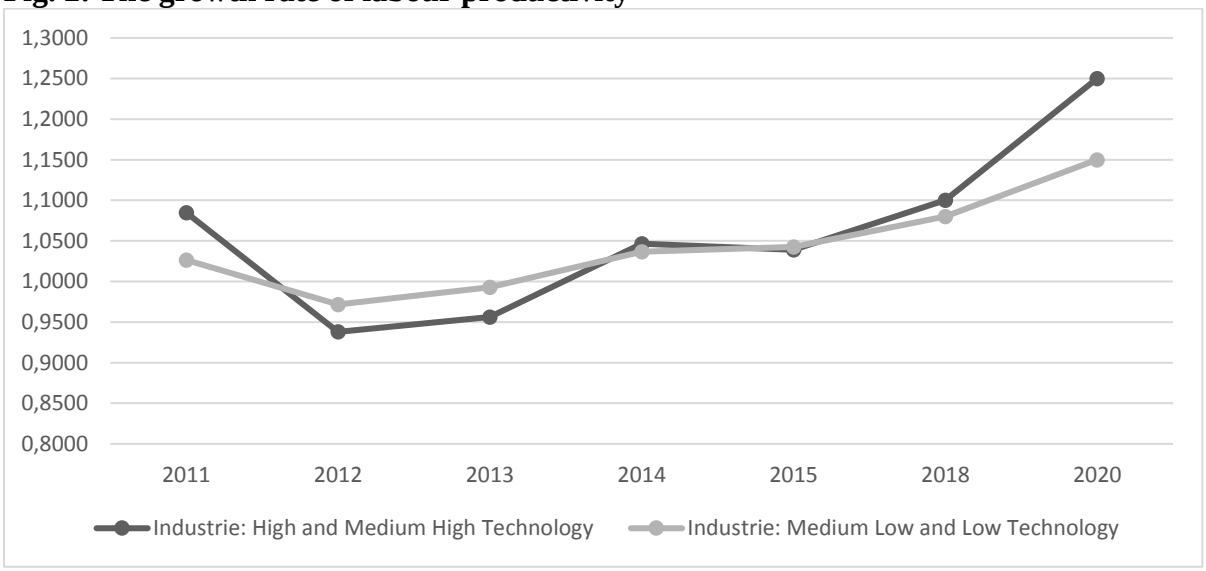
NACE	2010	2011	2012	2013	2014	2015
Industrie:High and Medium High Technology (A1)	879.6	954.1	894.8	855.7	895.6	930.4
Industrie: Medium Low and Low Technology (A2)	585.9	601.4	584.3	580.1	601.5	627.1
Average Labour Productivity	713.5	728.7	721.9	717.7	737.3	756.9

Source: Own calculations based on the data Eurostat

Figure 2 shows the year-on-year development of labour productivity for industrial groups (A1 and A2), including an estimate of the impact of implementation Industry 4.0, which is reported

in the studies (an increase of about 25 %). It is also clear from Fig. 2 that the rate of implementation Industry 4.0, will depend on the development of the real business cycle. During the stagnation of the economy 2012, the growth rate of labour productivity is declining and thus enterprises have not invested too much in this period. In this period, output levels have also fallen, while the number of employees has not changed much. Integration Industry 4.0 can lead to reduction in the number of employees, but this change does not necessarily mean a reduction in personnel costs (more educated employees). At the same time, production efficiency can be improved, ie reducing energy and material requirements, improving logistics, etc., which can save costs and hence make production more efficient. Companies that are passive in the implementation of automation and robotics will be pushed out of the market in the future.

Fig. 2: The growth rate of labour productivity



Source: Own calculations based on the data Czech statistical office

Productivity can also increase through various Industry 4.0 effects. Declining use of human labour in favour of the work machines and robots can lead to the growth of labour productivity. Manufacturing firms can avoid machine failures and cut downtime by using advanced analytics in predictive maintenance programmes. Human workers can be used more effectively, for those tasks for which they are really essential.

Integrating Industry 4.0 brings enterprises not only to increased demands on the qualifications and education of employees, but also means significant investment costs that will only take effect in a longer period of time. Substitution of labour by capital is possible only to a certain degree, a human factor will still be necessary, even if its position changes. It is possible that the

expectation of growth in labour productivity is too great and there may be a situation where companies will introduce industry elements of 4.0, gain competitive advantage eg by increasing the quality of their products but their labour productivity will not change much. The question is whether they are not exaggerated expectations of growth in labour productivity due to integration of Industry 4.0. This assumption demonstrates van Ark (2016) say that the new digital economy (mobile technology, the internet, and cloud) has not yet generated any visible improvement in productivity growth.

Conclusion

Industry 4.0 changes the current labour market. Industry 4.0 will increase labour productivity, but at the same time there will be significant labour market shifts, especially jobs with less skilled workers will be at risk. Industry 4.0 will bring new jobs with high skill requirements, especially in the area of digital and information technology. Integrating Industry 4.0 for businesses can mean increasing their production efficiency, reducing material and energy costs, and reducing transport costs. Companies that have a developed digital and internet environment are better prepared for the introduction of Industry 4.0. Integration of Industry 4.0 necessarily leads to the growth of labour productivity and business performance. On the other hand, we cannot exclude the influence of the paradox of productivity in the long term unless the expectations of labour productivity growth are exaggerated.

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