The pilot survey of the industry 4.0 principles penetration in the selected Czech and Polish companies

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Abstract: The article deals with the aspects of the ICT innovation based on the development of the internet of things in industrial branches. This trend is known as the Industry 4.0, e.g. the forth industrial revolution. The article presents main results of the pilot survey done in selected Czech and Polish companies. They show the current status of the Industry 4.0 understanding and penetration in companies, incl. expected benefits and known obstacles of this trend.

Keywords: Innovation, information technology, ICT, internet of things, industry 4.0, smart factory, cyber physical system

1. From Enterprise 2.0 to Industry 4.0

1.1 Introduction

From the perspective of the long term trends of the global development the information and communication technology (ICT) will last one of the key innovation technologies. The current trends like big data and cloud computing are very popular topics now and it seems that they will be even in the next 10-15 years. The documents Global trends 2030 (National Intelligence Council, 2012) emphasizes this trend and also it confirms the surveys done by the OECD (OECD, 2015). The ICT is understood as one of the fourth key technological areas:

- technologies pertaining to the security of vital resources (food, water, and energy needs),
- new health technologies,
- new manufacturing and automation technologies.

Just because the manufacturing and automation area is crucial for the deployment of ICT and it represents also one of the key segment of the portfolio of the Czech economy with the high influence on the labor market this article is devoted to it.

1.2 Behind web 2.0 – Industry 4.0, farming 4.0, alma mater 4.0

The time when was trendy to talk about the WEB 2.0 or Enterprise 2.0 is partly behind us. At that time the Enterprise 2.0 was dedicated to the use of emergent social software platforms within companies, or between companies and their partners or customers. The tools and services that employ Web 2.0 techniques such as tagging, ratings, networking started to be used. These tool and services use many advanced social software features such as social bookmarking and linking, tagging, rating, user commenting and discussion, open creation and editing policies, syndication via RSS feeds, and so on (Report, 2008).

There is interesting that after years with dominated orientation on the web and services it has been more and more attention paid to manufacturing of real things lately. This new trend is known now as new revolution related with the ICT and it is called the Industry 4.0. The current ICT trends do not emphasize mainly the social network but it is looking for complex solution that beyond the potential and possibilities of the manufacturing branch only. This new industrial revolution has started the changes and movements that have never been in past. The following areas like automation, robotics or digitalization of everything are important but the key role plays the internet of things or rather internet of everything (Tao, Zuo, 2014), (Jing, Vasilakos, 2014).

Examples for Industry 4.0 could be machines which can predict failures and trigger maintenance processes autonomously or self-organized logistics which react to unexpected changes in production. Cyber-Physical Systems (CPS) are integrations of computation and physical processes (Wan, 2013, Lee, 2008). The basic principle of Industry 4.0 is that by connecting machines, work pieces and
systems, businesses are creating intelligent networks along the entire value chain that can control each other autonomously.

The Industry 4.0 is the way to improve production processes, to higher the productivity for batch size equal 1, to reflect the individual demand and short term wishes. It helps to reduce lead time and time to market. It helps to reduce product development time and ad-hoc networking within cyber-physical systems. It helps to transparent in the real time, to make faster and flexible decision making, to archive global optimization in development and production.

This is the reason why we also call the Industry 4.0 in terms like “factory 4.0” (Factory, 2015) or “smart factory” (Wang, 2016). This designation is a continuation of the term “digital factory” in previous years. But the “4.0 wave” is even bigger because it does not hit only manufacturing area. The “4.0” trends penetrate also in farming and education processes for example. The term “farming 4.0” - digitalization and ICT in agriculture and farming – means that agricultural machinery and the world of farming are no exceptions for the further penetration of the ICT (Report, 2014). It can be imaginable like precision farming and virtual testing for example.

Last but not least example is the Alma mater 4.0. The reason for the Alma Mater 4.0 is the new situation for the universities. They will be in the near future for the first time in the position when they will accept students from the new generation that has grown on the ICT tools mainly (both at home and at school). The growing importance will thus have the former trends of Massive Open Online Courses (MOOCs) applications. These educational trends were also discussed at CeBIT in March 2016 (Report, 2016).

2. The Industry 4.0 as a new growing trend

2.1 The key technology ICT trends towards the Industry 4.0

The ICT therefore plays and will play the key role of the development of not only manufacturing, farming and higher education, but also of the whole society (Global Trends, 2012). The ICT will shape global economic, social, and military developments as well as the world community’s actions pertaining to the environment by 2030. Information technology is entering the big data, the cloud will provide global access and pervasive services; social media and cybersecurity will be large new markets. Among TOP 10 strategic technology trends at this moment belongs (Gartner, 2015):

- The digital mesh
  - The device mesh
  - Ambient user experience
  - 3D printing machines

- Smart machines
  - Information of everything
  - Advanced machine learning
  - Autonomous agents and things

- The new IT reality
  - Adaptive security architecture
  - Advanced system architecture
  - Mesh app and service architecture
  - IoT architecture and platforms.

The important question could be if all these strategic technology trends and elements like: hybrid cloud computing, internet of things, enterprise 3D printing, smart robots, machine learning, virtual reality are really a symptoms of the new revolution or it is only the set of important points as we can see at the known Gartner hype curves forecasting the future trends. Any way we live in time when digitalization impacts everything. It is transforming work, life and business models.

2.2 National strategies supporting the Industry 4.0

The Industry 4.0 means also the important efforts at the national level. The good example is the German government. The German Federal Ministry for Education and Research offers 183 different documents to this topic at the moment related. There is for example a project of future “assembly 4.0” among them that was awarded as the project of the month of 2016. The Industry 4.0 was also proposed and adopted as part of the “High-Tech Strategy 2020 Action Plan” of the German
government (Recommendations, 2013). The expectation is the general growth of Industry 4.0 in Germany till 2020 1, 7% each year – mainly in chemistry, manufacturing, ICT and farming branches.

The similar steps were done in other industrial developed countries like the USA - in “Industrial Internet” document (Industrial Internet Consortium, 2014) and China - in “Internet+” (Li, 2015) document and in the ambitious plan “Made in China 2025” (Kenedy, S., 2015)The Chinese government declares here that the country aims at the Industry 4.0 implementation.

There is very important that the Czech government also strongly support this global strategy in “The national strategy Industry 4.0” announced in September 2015 (National Initiative, 2015). It has been prepared and guaranteed by the Czech Ministry for Industry and Trade and not only technological trends are elaborated. The changes at the labor market are highlighted as well.

3. The pilot survey of the Industry 4.0 principles penetration

3.1 Motivation for the pilot survey

The important inspiration for this pilot survey was not only the tendency in the current political and technological trends but the published manufacturing study oriented on industry 4.0 penetration – on the global level (Infosys, 2015) and on the national level (Eiseret, 2014 and Perspective, 2015).

The most significant was the survey done by the Infosys - leader in consulting, technology, outsourcing and next-generation services and by the Institute for Industrial Management at the University of Aachen in Germany. The survey analyzed more 400 companies in industrial high developed countries – China, France, Germany, the United Kingdom and the United States. It shows the maturity level of the Industry 4.0 and the key findings of this study are following (Infosys, 2015):

- 85% of manufacturing companies globally are aware of the potential of technologies in increasing asset efficiency,
- however only 15% of enterprises surveyed have already implemented dedicated strategies to this end by analyzing machines data. It is interesting that this percentage is at similar level among analyzed Czech and Polish companies – see own survey results bellow,
- the research revealed that the largest improvements planned over the next five years are in the areas of information interoperability, data standardization and advanced analytics,
- interesting was the fact that one fifth of companies believe that by 2020 will now achieve anything beyond recognizing the potential of industry 4.0 concept.

The German attitude and wide support of the Industry 4.0 is for the Czech economy and companies very inspirational. On the other hand it should be also known that based on this survey China is the leading innovative country among five analyzed (China, France, Germany, the UK and the US) and has highest percentage of early adopters (57%). Germany is on the fourth place with only 21% of early adopters.

3.2 Own pilot survey of the Industry 4.0 penetration in selected Czech and Polish companies

Author of this article therefore decided to analyze the Industry 4.0 trends how they are applied by companies. To make suitable comparison the survey was done partly in the selected Czech companies and partly in the selected Polish companies. To get similar and comparable results the group of external students of the University of Economy Prague (CZ) and the University of Zielona Gora (PL) were selected. The conditions for both groups were following:

- students were in the final year of study,
- students were from the wide variety of firms and their positions in these firms were also representative,

The survey represents the first pilot results. There were asked 31 students in the Czech group and 28 students in the Polish group. General the Czech group represents mostly the automotive branch which is also significant for the whole Czech economy. The Polish group reflects the mechanical and electrical engineering companies mostly.
3.3 Main results of the Industry 4.0 survey in selected Czech and Polish companies

The answers for questions in the survey have brought a basic overview of the current understanding and application of the Industry 4.0 principles among selected Czech and Polish companies. The following text represents the most interesting findings for the selected research questions:

Question 1: Does your company deal with Industry 4.0 topic?
The important fact from the survey is that 45% of the Czech companies and 75% of Polish companies have never met the term the Industry 4.0 so far. There were 18% Polish and 9% Czech companies knowing the term Industry 4.0 but they admit that they do not know what to understand exactly under this term. The positive was that 18% of the Czech companies are in the process of the Industry 4.0 implementation. This number by the way is relevant to the results of the Infosys survey (Infosys, 2015) mentioned in the above text.

Question 2: If the Industry 4.0 is not applied in your company, which factors have an impact on your business why you do not apply the principles of the Industry 4.0?
The low level of knowledge about lean IT (Czech – 40% and Polish – 92%) is the most significant factor for both groups of companies. The second factor is not so clear benefits of the Industry 4.0 solutions.

Question 3: If the Industry 4.0 is applied in your company, what is the meaning for your business?
The both groups emphasized that the Industry 4.0 is understood as a key step for further development (19 % ) but the Polish companies further more understand that Industry 4.0 has the crucial influence on the realization of the strategic goals of companies (again 19%)

Question 4: Which factors support the application of the Industry 4.0 in your company?
The following four most important factors support the application of the Industry 4.0 in selected Czech companies are – economic reasons (cost reduction) (54%), activities of competitors (54%), market demand (45%) and customer pressure (45%).
The Polish companies prefer following three main reasons – activities of competitors (37, 5%), market needs (37%) and economic reasons (cost reduction) (25%). It is interesting that the economic reasons (e.g. cost reduction) are not the main leading factor for Industry 4.0. But we should keep on mind that results reflect the low number of those who have the awareness about the Industry 4.0

Question 5: Are indicators for the benefits of the Industry 4.0 applied in your business?
Czech companies mostly do not have Industry 4.0 (36%) indicators and Polish companies completely do not have them (100%). But the big portion of companies cannot observe the improvements and contributions yet (27% Czech and 25% Polish companies)

Question 6: Does your company have a strategy for the Industry 4.0 in your company?
It is understandable that situation described in the question A1 has consequences that majority or companies have no special business strategy for Industry 4.0 yet (81% of the Czech and 80% Polish companies).

Question 7: What is the relationship of employees to the Industry 4.0?
Neither employee in the Czech companies (50%) nor in Polish companies (68%) has big awareness about the topic of Industry 4.0. The positive is that the 36% of the employees of asked firm have already the awareness about this topic.
The survey results show many similar aspects of Industry 4.0 penetration in the Czech and Polish companies and also not so great a distance both from the leading global countries like Germany. There are some differences on the other hand - implementation level seems to be higher in the Czech firms.

4. Conclusion

The topic of the Industry 4.0 seems to be a topic with high potential especially in time when the digitalization of production and the whole life is growing. There is a significant low level of understanding and even low knowledge of Industry 4.0 topic in both countries. This fact is crucial from the perspective of the Industry 4.0 because of their influence on the labor market.
References:


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**JEL Classification: L60, L86**