

ROLE OF THE HUMAN FACTOR IN THE FOURTH INDUSTRIAL REVOLUTION

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Abstract: Due to increasingly competitive is required the companies to provide personalized products and services. This contributes not only to ensure customer satisfactition, but also to require application of modern technical solutions like digitized solutions, specialized software, automation of production and services. All these changes are the foundation and the specificities of the fourth industrial revolution ("Industry 4.0)." This article performs the key features and principles of Industry 4.0, just like and the role and the requirements to the human factor. In this connection there are different scenarios applicable to companies in the light of the fourth technological revolution.

KEYWORDS: INDUSTRY 4.0, CPS, INTERNET OF THINGS, INTERNET SERVICES

1. Introduction

The development of the industrial revolution has passed through various stages. At the end of the XVIII century during the first industrial revolution was discussed the impact of the labor market and the role of the human factor. After three eras of mechanization, electricity and information technology in the early 21st century began the fourth industrial revolution. The term "Industry 4.0" (fourth industrial revolution) was first used in 2011 at the fair in Hanover [1]. Initiated in 2012 by the German government strategic initiative Roadmap for the fourth industrial revolution.

"Industry 4.0" became a top priority for many research centers, universities and companies within the last four years with numerous contributions by scholars and practitioners. As a part of this strategic initiative aims is the leading role of industrial information technology,. The aim is to create "smart factory" (Smart Factory), which is characterized with resource efficiency, ergonomic design, flexibility and integration of customers and partners in the business processes and value-added [2]. Its elements are CPS and the internet of things and services [7].

The Cyber - physical systems are "intelligent systems, covering hardware and software, and effectively integrated physical components that interact closely with each other to reflect the changes of physical objects, defined by the American Institute of Standards and Technology (NIST) [8].

In literature is viewed the technical aspects and the issue of staff and society . With the increasing digitalization is expected to impact not only on plant and businesses, but expect placing specific requirements on personnel, which will lead to impact not only on the labor market, but also on opportunities for social innovation and social progress.

This was and is a major theme of the World Economic Forum in Davos in January 2016 regarding the specifics of the "Industry 4.0". It is predicted that until 2020, 5 million work places are going to disappear. [7].

2. Scenarios

Based on studies in the context of "Industry 4.0" the role of the human factor explore the relationship between men and machine are viewed various scenarios [2], [3]:

- **Scenario of specialization:** With increasing automation and digitization of manufacturing processes, it

is considered that the human factor will play a role of an expert .

- **Hybrid scenario:** monitoring and control tasks are carried out cooperatively and interactively through technologies related facilities and personnel in network.

- **Scenario of automation:** CPS to monitor and to control processes on line , based on the collection of information and data, their aggregation with additional interpretation by the human faktor.fig.1[6].

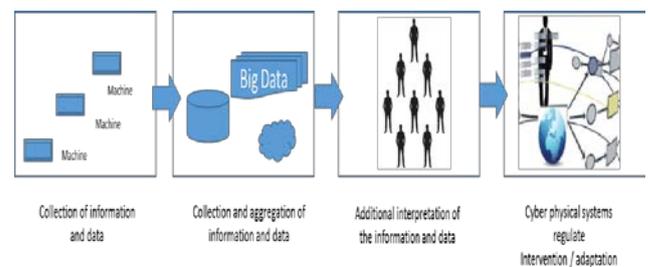


Fig.1: Scenario automation

On this basis, the role of humans is different in different scenarios regarding the management of processes, information and data. The basic requirements for the tasks of work, (Table 1).

Table 1. Basic requirements

	Scenario specialisation "The man used systems"	Scenario automation "The systems use the Man"
Content of work	Interestingly distribution of tasks with the possibility of distribution of shaping and objectives	Closely division of tasks with a high level of standardization/ external management
Organization of work	Opportunities for collaboration with agreed objectives and participation	High responsibility in a small degree of impact
Network creating	Impact of standards and interoperability in a transparent link	Availability of standards without transparency in terms of network and use of knowledge
Automatisation	Exemption from loading and unattractive work	Time for automation; factories without staff
Qualification / Competency	Linking training with a broad competence development	Only qualified job
Data	Access to information and knowledge in problem solving, data partitioning for staff and technology	Use of data to control the behavior and achievements

The exchange of information on line and networking devices is a prerequisite for the development and transformation of traditional jobs with mobile monitoring, management and taking decisions

This increases the role of humans in smart factories to increase its responsibility and impact. This human factor is expected to be the most flexible part of CPS production systems and traditional relations with machine-machine receives new man-machine such as virtual reality using multimodal interfaces, is shown on Fig.2

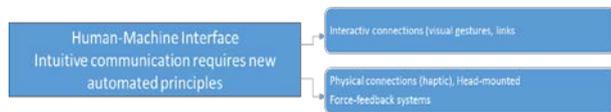


Fig.2: Man-machine interface

A radical change in the interaction between man and technology and human environment is going to happen. The introduction of "Industry 4.0" as a strategy should be enshrined in the managerial approach of the fact that the organization should be oriented to better meet the needs and desires of consumers.

In this respect there are the following questions :

- What are the opportunities for introduction?
- Which of these scenarios is most suitable ?

3. Concept for the selection of the scenario

In the special literature there is not definition for "Industries 4.", but it could be viewed as identification of objectives, analysis, selection of scenarios and measuring achievements in this regard, is shown on Fig.3.

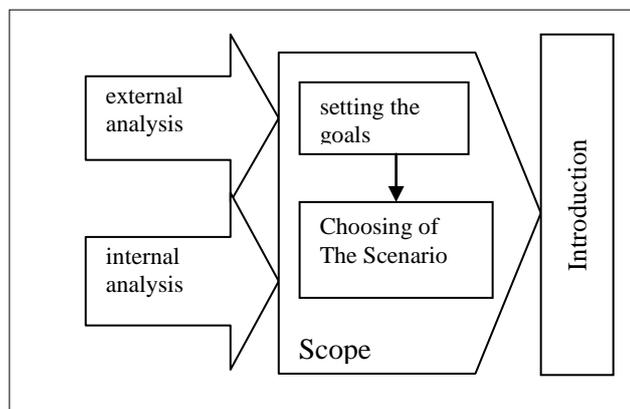


Fig. 3: Elements of concept for the selection of the scenario

Due to the rapidly developing digital technologies in industry and especially in the sectors of business services constantly new forms of work organization and employment and skills are updated.

A study in 2015 of the Bulgarian Chamber of Commerce and Industry (BCCI) about 500 companies expect to increase their export revenues. Like any other company had forecast growth of exports in 2015, but only 37% actually did it. Only 23% of them said that during 2016 are planned investments in new capacity and 27% in new products and innovation. The focus of investment

firms is placed on the development of human potential. About 25% of them plan to hire new staff, while the share for 2015 was around 30%. With respect to the scenarios would be appropriate scenario specialization.

Industrial companies in the country do not know the essence of "Industry 4.0" not currently intend to finance in this direction. However, they participate in European projects of the program Horizon 20/20, which essentially is an initiative of "Industry 4.0". In 2015 all of the Bulgarian projects were rejected (unconfirmed data they are over a thousand) of the EU.

Unlike in Germany, where in 2015 a study was done in 235 companies of the German Chamber of Commerce, who for five years are going to invest 3.3% of its annual turnover in "Industries 4.0" technical solutions. This represents 50% of investments in new facilities or amounted to 40 billion euros and thus meet the requirements, principles and selection of appropriate scenarios "Industries 4.0."

These transformations should be monitored carefully. We need a robust framework for social dialogue and active participation, also in view of innovation centers for education and training at firm, sectoral, national and European level which takes into account the frequent restructuring of companies in the rapidly changing service sector [6].

This proves that "Industry 4.0" is not only a technological project and a specific effort to increase the competitiveness of the manufacturing sector in the future.

4. Conclusions

The problem of human factor and choosing of optimal scenario is analyzed and its characteristic special features are defined. Industry 4.0 is not only a technology project but also a way to increase the competitiveness of the firms in the manufacturing sector for the future.

The key of Industries 4.0 is to pay more attention to the social aspects of this new development. It affects not only the management and employees of the firms, but also the whole society.

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