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«ҒЫЛЫМ ЖӘНЕ БІЛІМ – 2017»

студенттер мен жас ғалымдардың
XII Халықаралық ғылыми конференциясының
БАЯНДАМАЛАР ЖИНАҒЫ

СБОРНИК МАТЕРИАЛОВ
XII Международной научной конференции
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«НАУКА И ОБРАЗОВАНИЕ – 2017»

PROCEEDINGS
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«SCIENCE AND EDUCATION - 2017»

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The proceedings are the papers of students, undergraduates, doctoral students and young researchers on topical issues of natural and technical sciences and humanities.

В сборник вошли доклады студентов, магистрантов, докторантов и молодых ученых по актуальным вопросам естественно-технических и гуманитарных наук.

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delivered products to raw materials, and vice versa), including quantity checking.

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INDUSTRIAL REVOLUTION: SMART FACTORY

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Nowadays people live in the ever-increasing technological world. Yesterday’s dream smart environment is already exists in reality and almost everything is connected to each other by the Internet through different devices and systems. According to Gartner Inc., which is an American information technology research and advisory firm this phenomenon can be explained by use of the Internet of Things (IoT) and Services, (Figure 1 below) that is defined as *“a network of physical objects that contain embedded technology to communicate, sense, or interact with internal or external environments”* (Wilson, 2014).

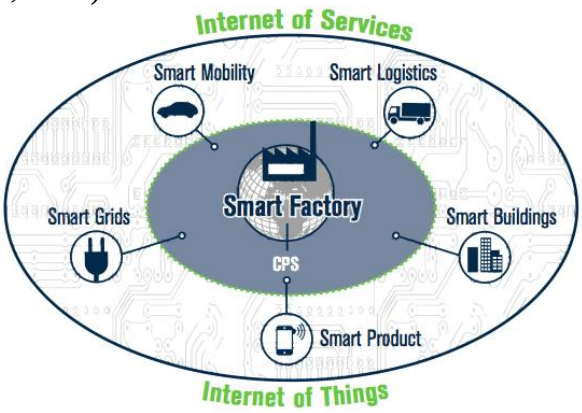

Figure 1 – Industry 4.0 and smart factories as part of the Internet of Things and Services
(Federal Ministry Of Education And Research, 2013)

In other words, everything is connected and self-organised without actual human interaction. This idea led to the so-called “fourth industrial revolution”, where *“self-organising factories, with machines and tooling “talking” to one other, planning systems and even the products they are making”* (Tinham, 2013). Particularly, Germany pioneered to realise and start such new revolutionary industrialisation called “Industrie 4.0” (Mittermair, 2015, Federal Ministry Of Education And Research, 2013).

The term “Industrie 4.0” made its first public emergence in 2011 at the Hanover Trade Fair. At that time the idea of advanced integrated manufacturing processes, where machines are able to actually communicate through IoT seemed like science fiction. It sounded really challengeable to connect virtual world, where data is processing to the real world, where manufacturing processes

take place (Mittermair, 2015). This integration project aimed to be realised through collaboration with Cyber-Physical System (CPS) that in terms of manufacturing environment contains self-organising smart machines, storing systems and manufacturing facilities. Particularly, in this context self-organising means that they are capable to trigger actions in an autonomous way, exchange information flow and also to control each other independently (Federal Ministry Of Education And Research, 2013).

According to Mittermair (2015) today industries already working with highly complex and sophisticated computer-aided systems and even computer-controlled processes were introduced. However, to combine them and at the same time avoid centralisation is a difficult task. Therefore, some experts named the Industrie 4.0 as *"harmonisation process"*,where every system of the manufacturing environment integrated in the independent harmonic way (ibid, 2015). In order to create harmonic environment in manufacturing environment and avoid centralised control, the so-called "intelligence" of the central control system can be divided to every piece of equipment, which is called as "miniaturization" (Lasi *et al*., 2014).

Consequently, every sole part of equipment will have a certain level of in-built intelligence. For example, finished products will know their history and processes that were used to produce them and they will memorise and maintain the information in their Internet Protocol (IP) addresses which is created for communication among the system. Apart from this, mobility of the devices will help to communicate wirelessly and remotely without any human interaction and centralised master programs for controlling.

Therefore, it can be said that Internet of Things (IoT) can be lead to the Factory of Things which is included Internet of People (Figure 2 below) where manufacturer, operator and even supplier will be able to exchange the data with each other and also with other connected devices within the created Internet network and smart factory environment (Zuehlke, 2010).

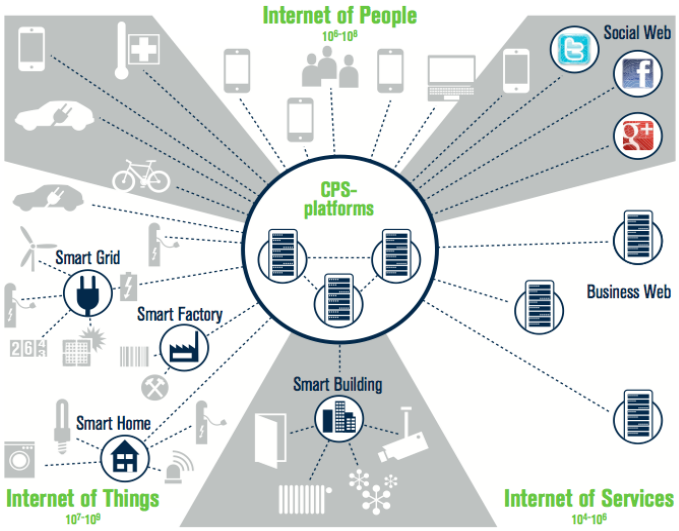

Figure 2 - The Internet of Things and Services – Networking people, objects and systems (Federal Ministry Of Education And Research, 2013)

Industrie 4.0 is a relatively complex project that integrates many different components through the network communication. There are seven fundamental concepts of Industrie 4.0 platform, which are capable to embrace entire manufacturing environment (Figure 3 below).

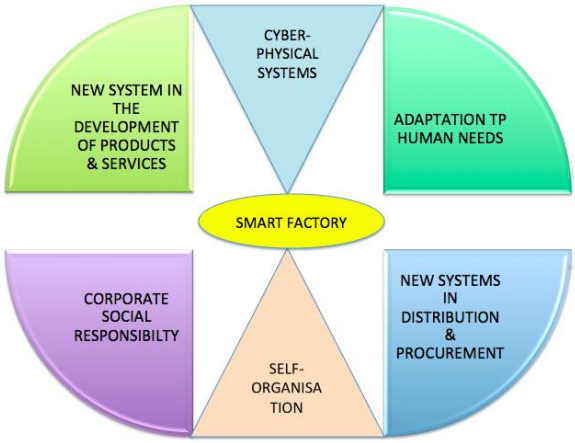

Figure 3 – Fundamental Concepts of Industrie 4.0 (Lasi *et al.*, 2014)

In fact, aforementioned particular problems can be related to each of these fundamental concepts of Industrie 4.0 and perhaps, afterwards solved. For instance, the concept of Smart factory and Self-organisation can help to tackle one of the most crucial problems not only in Heimlich Industries, but also in all German organisations, which is high labour cost. In other words, labour cost can be reduced by further increasing mechanisation and automation in the realm of manufacturing. Particularly, Smart Factory will provide smart technology that does not require any human interaction and control, where equipment will be autonomously controlled (Lasi *et al.*, 2014).

Besides, the concept of Self-organisation will solve the main problem of the traditional ETO production in HI and it will help to decentralise and decompose the classic control system. If the factory contains smart devices and intelligent equipment that capable to self-regulate and control, it might not need all 700 people that are in HI now (ibid, 2014).

Apart from this, the issue that related to the cost of the communication between Hanover and Hamburg cites will be addressed within the concepts of Industrie 4.0. Both cites can be connected through the created Internet network and the information will flow without any request and delay, because of the fact that all the devices will be smart enough to get the information to one another despite the distance between the cities and even countries. In other words, it can provide more flexibility and agility to the manufacturing processes, which are the key characteristics for ETO production unlike standard production. Because of the fact that in ETO business the customers is directly involved into the entire production process and design, where they can require engineering changes at any steps of manufacturing (Lasi *et al.*, 2014, Husejnagić and Sluga, 2015, Tinham, 2013).

According to Husejnagić and Sluga (2015) in ETO production materials are purchased not for inventory but for a particular order by the customer, consequently the material costs usually assigned to a certain project. Therefore, the issue about material costs and particularly material handling cost is essential. First of all, material handling that done by hand in HI now will be changed and all the control process will be done by smart and self-organising machines. Moreover, those intelligent machines will be able to plan and control, measure and maintain the information. It is generally accepted that people are vulnerable to the external impacts, however the machines are more precise and accurate and they do not have feelings that makes them more powerful in working in the manufacturing environment compared with human beings (Federal Ministry Of Education And Research, 2013, Tinham, 2013, Mittermair, 2015).

In terms of total utilisation of the organisational capacity in Heimlich Industries, it can be said that there are plenty of the potential opportunities. Being a reliable large company with high quality products in ETO business is already a good status, however, the market is not reliable and there is always uncertainty. Moreover, ETO environment is truly customer-oriented and requires high customisation that can be provided by Industrie 4.0. According to Federal Ministry Of

Education And Research (2013) Industrie 4.0 gives an opportunity to include customer-specific criteria in different stages, such as design, ordering, development, production and it also allows to accept last-minute changes. Therefore, it can be said that Industrie 4.0 is able to cope with all issues that took place in Heimlich Industries.

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POTENTIAL BENEFITS AND PROBLEMS OF INDUSTRY 4.0 IN MANUFACTURING COMPANIES

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With the rapid globalization of market, more and more companies attempt to benefit from updated possible technologies. In turn, technology is being improved very fast, thereby encouraging industries to change quickly as well. For example, only while ago people encountered 3rd industrial revolution which was about using computers and PLCs in order to make production automatically[1]. However, manufacturing world is growing fast and becoming smarter. Therefore, the new term "industry 4.0" was already launched in 2011 Hanover Trade Fair[2]. There are many high-tech industries which are attempting to experience the new method. The concept of the new industrial revolution is that machines interact with each other through Internet of Things (IoT). Although the idea of smart companies seems unbelievable, there are companies which already make use of that. Consequently, the essay aims to identify the opportunities of Industry 4.0 for manufacturing companies, and then explain preparation issues and problems.

One of the main aims of Industry 4.0 is to establish smart product and manufacturing processes through integrating data and process[3]. Cyber-Physical Systems helps to transfer the data gained from monitoring physical processes through computer and network systems. Simultaneously, decentralized decisions are carried out. German industry, where Industry 4.0 started, concentrates on customized market and on market which needs to respond quickly. Moreover, integrated networks give an opportunity to combine core competencies[4]. Subsequently, if process and supply chains are virtualized, then it will turn to better communication between operations, thereby accessing to right product. Furthermore, the communication will be carried out with people equally as well[5]. Next, it is a great chance in terms of business as well, as keeping track of inventory and raw materials will be relatively easier. Moreover, because, systems like RFID (Radio frequency Identification Devices) are used, products can be controlled easily at any stage.

Opportunities

Having identified what is Industry 4.0 in general, now essay seeks to find out what kind of opportunities could be drawn from implementing Industry 4.0.

One of the main problems is expensive labour cost. Therefore, it is said that it is a great