

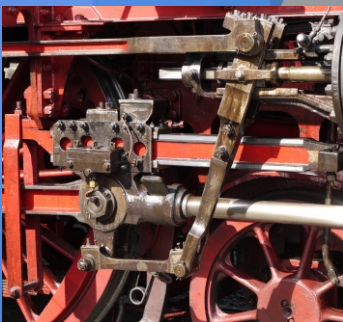
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QUALITY MANAGEMENT AND REQUIREMENTS OF THE FOURTH TECHNICAL REVOLUTION

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Abstract: Modern industry requires intelligent development of the product throughout its entire life cycle-from concept to recycling. These intelligent products (Smart Products) have information about their production processes, quality management, future application and recycling. They support active manufacturing processes (when will be produced, with what parameters, with what materials should be produced, when, what kind of modifications, etc.). Under these conditions the management of quality have to meet new requirements imposed by the fourth industrial revolution is discussed in this article.

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

1. Introduction

The history of industrial revolutions is as follows , the first industrial revolution was characterized by steam-powered machines, the second was characterized by electricity and assembly lines. Innovations in computing and industrial automation defined the third industrial revolution. The fourth industrial revolution is designing smart products through hyper-connected cyber-physical systems in environments where humans and machines cooperate to achieve goals, and use mega data to generate value.

This radically changed the manufacturing and business models by creating the conditions for greater flexibility and efficiency of resources.

For the first time there is an industrial revolution that predicted a priori and not to monitor its effects. It provides various opportunities to companies and research institutes to active participation and impact on production.

It creates the opportunity for the development of entirely new technological models, services and products. Fourth technical revolution represents not only a technical challenge-the technological change that will provide long-lasting organizational impact and creating opportunities for new production ,models, concepts and corporate, but a new concept of network world.

In the literature, the "Fourth Industrial Revolution" is used as fully equivalent in everything in terms of content and ideology to the term "Industry 4.0".

Quality assurance becomes a central point on the agenda of top management. But the traditional methods of quality management are no longer enough therefore new, innovative quality management approaches are implemented.

In ISO 9001:2015, quality is the "degree to which a set of inherent characteristics of an object fulfils requirements." (3.6.2) [1].

The purpose of this paper is systematization of problems of quality management regarding the requirements of the fourth industrial revolution.

2. Formulation and classification of the quality problems

The fourth technical revolution represents not only a technical challenge-the technological change that will provide long-lasting organizational impact and creating opportunities for new production ,models, concepts and corporate, but a new concept of network world. In "an intelligent world" Internet is at the service of all needs, and this leads to a change in the consumption of intelligent energy networks (Smart Grids), sustainable concepts to mobile (Smart Mobility, Smart Logistics), social welfare (Health Smart) and new technological solutions. [2,3].

A study in 2017 of the Bulgarian Chamber of Commerce and Industry (BCCI) about 500 companies expects to increase their export revenues but only 37% actually did it[7].

The most common questions for quality managers:

- are the certifications based on ISO, CMMI etc. going to be sought?
- does the quality take on a new meaning in Industry 4.0 organizations?
- what kind of trainings should a quality practitioner get so that they can prepare for rapid changes in their organizations (or at their customers)?

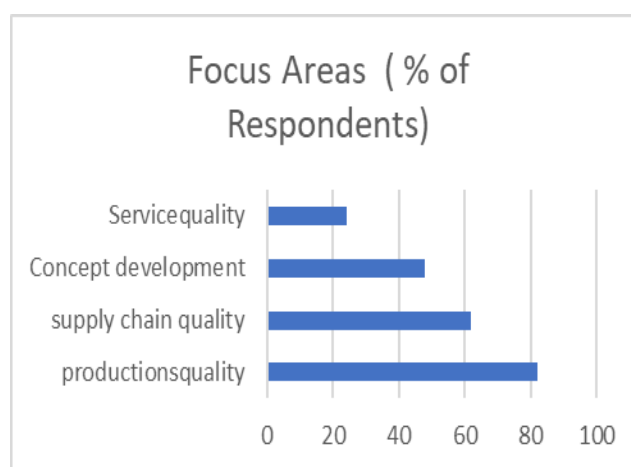


Fig. 1. Focus Areas of quality problems

Quality is not limited to the manufacturing process. To achieve the highest quality, it must already be created in the design process. 82% of respondents say that production quality plays a big role in their business, but in contrast, only 48% say their quality management also focuses on the concept definition phase.

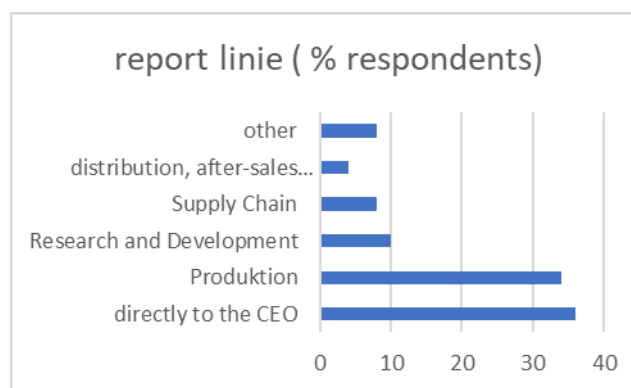


Fig. 2 QM Report Direction

Today, companies need to rethink that the quality is an important issue for the entire company. In about one-third of the companies surveyed, the quality manager now reports directly to the CEO.

The results show that companies are primarily concerned with two issues:

Quality foundations in the face of new challenges and innovative

Apply quality test management methods. It is particularly alarming that companies fail to secure a solid foundation of quality so far. The companies involved with traditional quality management approaches, quality gate processes and performance characteristics pay (KPI) have developed powerful quality management, are suddenly confronted with new realities. Four of 10 executives think that standard quality methods lose their effectiveness and almost half (48 percent) have quality problems observed in the past 10 years. 50 percent expect in the next 10 years another increase in quality problems.

Only 23% of them said that during 2018 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 2017 was around 30%.

Impact of different trends on the quality management of your company. Time, for 68 percent of respondents, this poses a major challenge. As another important factors are becoming increasingly complex products (58 percent) that continue to be around globalization (54 percent) and an increase in regulatory changes (54 percent) called.

Industrial companies in the country do not know the essence of "Industry 4.0" not currently intend to finance on this direction. However, they participate in European projects of the program Horizon 20/20, which essentially is an initiative of "Industry 4.0".

Unlike in Germany, where in 2015 a study was done in 235 companies of the German Chamber of Commerce, who in 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."

Interestingly, a vast number of existing quality-centered Industry 4.0 initiatives are not being led by quality, but by IT, operations, engineering, or sales and marketing.

Many conversations with quality leaders make it clear that a large portion of them do not possess a clear understanding of Industry 4.0 technologies, their application, and their importance.

Creation of conditions for effective application of the fourth technical revolution in the industrial companies in Bulgaria requires consideration of the aspects related to the unification and standardization of parts, assemblies, products and activities. The fourth industrial revolution, as an important feature in modern industrial environment leads to significant changes in terms of economic development strategies undertaken by national governments. The transformation of the global economy in the digital world affects all sectors of industry and services and sets new challenges

3. Challenges on the way to the fourth industrial revolution

Industry 4.0 certainly includes the digitalization of quality management. Technologies associated with Smart Factory – IIoT, Big Data, Machine Learning etc. -can all be utilized to improve quality[4].

More importantly it is the impact of that digitalization on quality technology, processes and people..

Manufacturers should use the framework to interpret their current state and identify what changes are needed to move to the future state.

On the basis of a literature review, the following principles can be defined:

- Interoperability: Machines, devices, sensors and people that connect and communicate with one another.

- Information transparency and Virtualization : The systems create a virtual copy of the physical world through sensor data in order to contextualize information.
- Real Time Capability und Service Orientation: the ability of the systems to support humans in making decisions and solving problems and the ability to assist humans.
- Decentralized decision-making: The ability of cyber-physical systems to make simple decisions on their own and become as autonomous as possible[5,6].

	Cyber-Physical Systems	Internet of Things	Internet of Services	Smart Factory
Interoperability	X	X	X	X
Virtualization	X	-	-	X
Decentralization	X	-	-	X
Real-Time Capability	-	-	-	X
Service Orientation	-	-	X	-
Modularity	-	-	X	-

Fig.3. Principles and elements of Industry 4.0

As a result, quality approach emphasize real-time visibility, intelligent decision support, and improved communication — between people, systems and machines. It describes the technological innovations that will help us more quickly assess compliance and customer satisfaction and optimize business processes through systems integration — whether the object we are working with is a process, a product, a person or an intelligent software system.

Companies that have built a solid quality foundation can do so with the help of a variety of new technologies to further increase their level: Data analytics, Industry 4.0 users, such as automation and cloud computing as well as new forms of customer interaction allow to improve the quality.

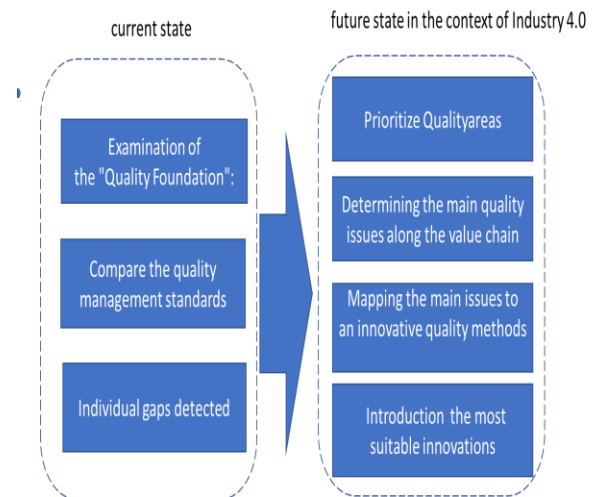


Fig. 4. Approach to the achievement of the next level of quality management

In a first step, a "quality baseline check" is carried out to a possibly to expose existing gaps in your quality foundation. By comparing the Quality management-the standards will be the main areas of improvement clearly visible. In a second step are qualities areas identified and innovative quality methods such as reliability testing, determining the main quality issues along the value chain und new innovative qualitative methods can be developed and implemented.

4. Conclusions

The article examines the characteristics and principles of Industry 4.0 and their impact on quality.

On the basis of done research, the state of Bulgarian enterprises revealed and outline quality problems. New innovative qualitative methods have also been analyzed. A comparison has also been made with international companies in Germany. On this basis, an approach is proposed for quality management and meeting the requirements of Industry 4.0.

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ESSENCE AND APPLICATION OF THE SPATIAL DATA INFRASTRUCTURE

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Abstract: *Spatial data infrastructure (SDI) is the infrastructure that facilitates the discovery, access, management, distribution, reuse, and preservation of digital geospatial resources. The aim of this paper is to present the nature and concept of spatial data infrastructures, which have helped to build understanding about the importance of the relationships within different levels of SDIs to support the interactions and partnerships of the spatial data communities.*

Key words: *GEOINFORMATION TECHNOLOGY, GEOGRAPHIC INFORMATION SYSTEM, DIGITAL ELEVATION MODEL, LIDAR TECHNOLOGY.*

1. Introduction

The emergence of spatial data infrastructures (SDIs) is closely associated with the efforts of collecting and producing geospatial data, as well as the advancement of surveying and computer technologies. In the past decades, a large amount of geospatial data, such as remote sensing images and GPS locations, have been collected by government agencies. Meanwhile, the fast development of geographic information systems facilitates the derivation of various data products from the collected data, such as topographic maps, land cover data, transportation networks, and hydrographic features.

Spatial Data Infrastructure (SDI) is an initiative intended to create an environment in which all stakeholders can co-operate with each other and interact with technology, to better achieve their objectives at different political/administrative levels. SDIs have become very important in determining the way in which spatial data are used throughout an organisation, a nation, different regions and the world.

Spatial Data Infrastructure is a strategically important issue for the countries of the European Union. Spatial Data Infrastructure (SDI) includes the following elements: technology, standards, policies and human resources.

The integration of information from satellite imagery with various other information layers allows:

- syncing a variety of data;
- verifiability check;
- updating and creating the opportunity to provide the basis for effective and sustainable governance.

The co-location of data from space and land-based sources, as well as permanent land-based monitoring (land cover and land use), enables information to be secure and reliable, end-to-end services and effective results from the accompanying analyzes, forecasting models and estimates.

2. Bulgarian spatial data infrastructure

The Bulgarian Spatial Data Infrastructure (BIPD) is a prototype geoportal as a free public benefit service. One of the main goals of BIPD is to present databases, services and operational capacity to Bulgarian organizations with priority:

- sustainable development strategy Europe 2020;
- Danube strategy;
- Earth Observation Program - Global Monitoring for Environment and Security; in integration with the development of the GALILEO satellite navigation system;
- European directives and regulations for the harmonization of spatial data, data quality assurance, land monitoring, risk management and security.

The initiative is part of a framework agreement between the Executive Agency "Electronic Communications Networks and Information Systems" (ESMIS), now State Agency for Electronic Governance (EAU) to the Council of Ministers and the Agency for Sustainable Development and Eurointegration (ASDE) as well as in the execution of tasks under an agreement between ASRE and the Joint Research Center (JRC) Commission. An experimental data geography [4], an element of applied research and development projects, including the 7th Framework Program of the European Union, has been developed. One of the objectives is to facilitate and accelerate the implementation of the requirements of European

Parliament Directive 02/07 / EC establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

The experimental geoportal is user-oriented. The user can open and observe different thematic maps as well as digital satellite images attached to the map of the Republic of Bulgaria. Apart from the thematic card material, attribute data tables are also included, and for more and more diverse information, a link to other websites (Wikipedia) is provided.

The database is continuously complemented by new layers of information coming from different state, scientific and municipal structures. They are presented in a timely manner electronically with the appropriate degree of accuracy.

The first phase of the pilot project - a spatial database for the trans-European transport corridors passing through Bulgaria - is based on satellite images with a 15 m and 30 m satellite resolution from the LANDSAT satellite.

To improve image accuracy, it is also necessary to take into account various types of interference. "The effect of disturbance impacts on the quality of the information processed, resulting in its destruction or aging, which increases the degree of uncertainty in the decision-making process"¹.

Currently finished layers of land cover from satellite images with 5 m resolution SPOT satellite, as well as very high resolution 0.70 m and 1 m from satellites Ikonos and Quickbird for cities, ports and other important sites.

3. SmartSDI Information System.

The SmartSDI system creates and maintains a database of geospatial data and services available in government, as well as information about their administrators. The system offers input, editing and intelligent search tools in the database, these functionalities being implemented in separate modules. The web-based professional implementation of the system, as well as its functional scope, allow use and development within the national geoportal. The main activities include:

- Performing quality control of the accuracy and reliability of spatial data;
- Validation of terrestrial and distance methods for measurement of areas according to ISO standards;
- modeling of requirements and business processes (administrative and system level) through UML;
- inventory of databases and creation of metadata using XML schemas;
- object-oriented analysis, classification and retrieval of geo-objects from satellite and airplane images;
- processing and interpretation of data from satellite and aerospace imaging, in visible, infrared, radar and radiometric spectra. To date maps of land cover have been prepared on different scales for the needs of the most important trans-European corridors with a 10 km buffer and functional urban areas;
- Performing ground observations with radiometric instruments for the assessment of soil moisture for the early diagnosis and reduction of the effects of soil over-wetting, dredging and flooding;

¹ Lazarov L.I., The basics of the electronic war, Veliko Tarnovo, 2018, p. 37

- Voice technology for monitoring, control, control and security.

The user can open and observe thematic digital maps [3] as well as digital satellite imagery from any point along the routes of the trans-European transport corridors attached to the map of the Republic of Bulgaria. The integration of information from satellite imagery with various other information layers allows the synchronization of various databases, verifying their authenticity, updating and enabling the basis for effective and sustainable management.

4. Web SmartCover GIS.

The SmartCover Information System and its accompanying architecture provides spatial data services in the web GIS environment. SmartCover is unique to Bulgaria and the European Union because it contains cross-border spatial data and services harmonized under the INSPIRE directive. On the other hand, SmartCover is based on a terrestrial layer (land use) layer developed under the global ISO 19144-2 (LCML) [8] standard, thus maintaining coordination and updating of different layers of spatial data and integrating thematic databases into a common harmonized information package. One of the main tasks of SmartCover Architecture is to be an information platform for integrated risk management, territory and citizens' protection as well as regular monitoring of changes and effective absorption of European, regional and national funds.

ASURE and ReSAC are involved in the development of comprehensive spatial planning resources in the border administrative districts between Bulgaria and Romania, covering a large part of the lower Danube region. The co-operation is under the cross-border cooperation program and under the project "General Strategy for Sustainable Territorial Development of the Romania-Bulgaria Region (SPATIAL)".

More detailed technical activities include creating and building systems and information services. The developed services allow the integration of new harmonized spatial databases and other services to be the basis for the creation of information systems at the state / local level. The database will provide the necessary information for a complete set of indicators at the statistical level - Fig. 1.

A specific result of the project is the creation of a comprehensive common land cover database for the cross-border area, based on the philosophy of Land Cover Meta Language - LCML (ISO 19144-2) and fully in line with the principles of the INSPIRE Directive. The Common Specification will provide more effective cross-border analysis and reporting.

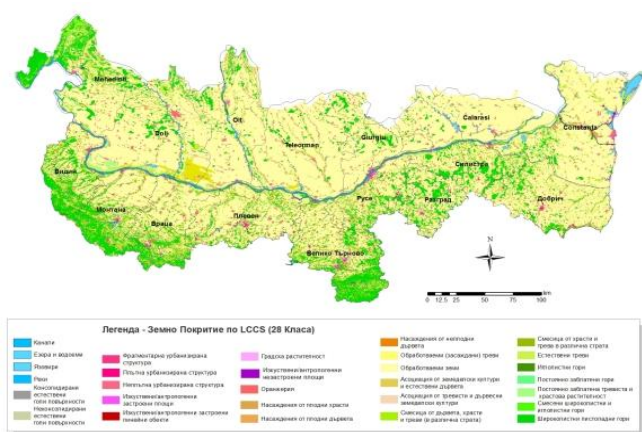


Fig. 1. Ground cover database.

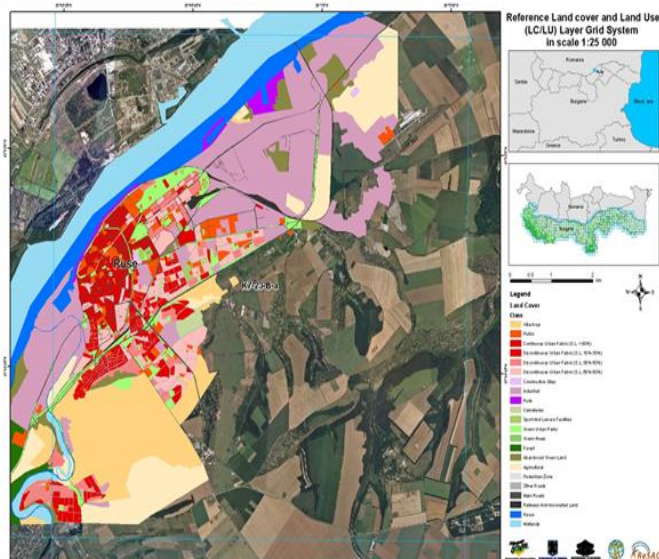


Fig. 2. Extract from land cover / land use (based on LCCS / FAO) for the city of Rousse.

5. Ground cover "reference layer - Bulgaria"

The Bulgarian initiative for the development of a national land cover database, using the FAO-LCCS methodology, is an example of applying good world practices in assisting in local (national) decision-making. The reference database - a layer of terrestrial coverage on the territory of the Republic of Bulgaria is entirely prepared by specialists from the Agency for Sustainable Development and Eurointegration (ASDE) and the application center for satellite imagery - ReSAC.

The Earth Cover Reference Layer is based on satellite images from Landsat satellite (USA) from 2011, with a resolution of 30 m. Information on the altitude and the slope of the area is provided on each spatial object (Figure 3.9). The authenticity of the interpreted data has been verified and an accuracy of 85% has been achieved.



Fig. 3. Land cover "reference layer - Bulgaria".

Bulgaria is the first Member State of the European Union to launch a land cover database based on the world-wide accepted LCCS methodology for the territory of the whole country, updated for the period 2009-2013.

The LCCS-based reference database for Bulgaria is one of the first attempts to be combined with a similar approach at local and national level to the global approach to land management and monitoring and land use.

This database is in line with the GLOBCOVER international project, in which, apart from the European Union, the United States, Russia, Canada, etc. (Figure 3.10) participate. The reference layer includes updated information on the relief (SRTM v.4, by DG JRC) and the main types of land cover, thus creating an appropriate product for planning and managing the site.

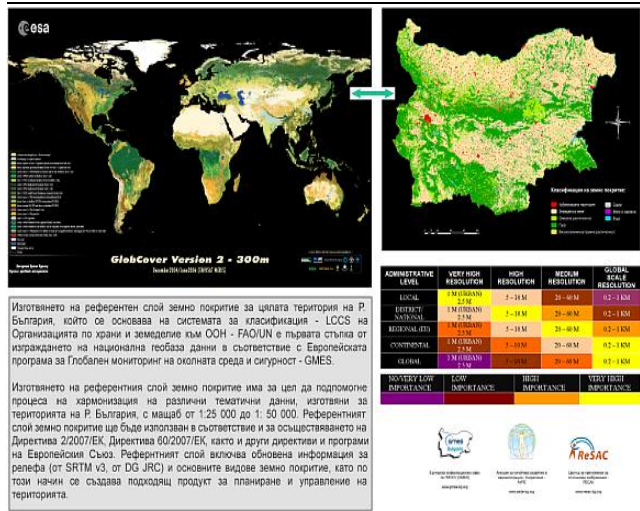


Fig. 4. The reference database for Bulgaria as part of the GLOBCOVER international project.

In partnership with the state administration, municipalities, civic associations, scientifically-applied organizations, universities and scientific institutes from the Bulgarian Academy of Sciences, ASURO participates in the progressive building of operational capacity to fulfill the requirements under Directive 2007/02 / EC and under the Global Monitoring for Environment and Security (GMES).

Global monitoring is also used in the field of intelligence. "Coordination is needed when planning and conducting intelligence in remote areas"².

One of the results is the preparation of maps of the terrestrial coverage of the regional cities in Bulgaria based on high resolution satellite imagery. The maps are 1: 5000 scale, using images with a spatial resolution of 0.5 to 1 m from different satellites - "Ikonos", "Quickbird" and "Eros".

Work on the preparation of more detailed maps of the land cover for the district towns, which will enable the map of the town, the regulation map, the thematic maps of the infrastructure, as well as the maps of the lands, the natural environment and the agricultural properties around the cities.

² Yankov Y.I., Human intelligence - essence, advantages and limits of info gathering, Collection of reports from the Annual University Scientific Conference, V. Varnovo, 2010, p.2

Conclusion

1. Spatial data infrastructure presents a solution to the problems of resource discovery and data redundancy. It provides a unified platform where people can go and search geospatial data, maps, services, and other digital resources. As multiple government agencies are sharing their data on one platform, SDI reduces data redundancy and the extra efforts in collecting duplicated geospatial data.

2. Spatial data infrastructures heavily rely on computer and information technologies, and are continuously evolving with the technological advancements.

Similarly, we may see the emergence of new technologies that can improve SDIs in various aspects, and some of these technologies are already being tested in research labs.

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HOME PAGES, DEFINITION AND CLASSIFICATION OF THEIR ELEMENTS AND THEIR DISPLAY ON THE USERS' COMPUTERS

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Abstract: *The subject of the research in this scientific paper is a description of the home pages in websites, with special emphasis on definition and classification of elements, which are necessary for the proper functioning of a home page, from the aspect of functionality and creativity. The important part of my paper is an analysis of technical methods of their displaying on various users' computers. Here the comparative analysis of similarities and differences between a home page and other pages of the same website is made. A special overview is made for the correlation between home pages and all the other pages on the website from a point of view of visual harmony and functionality of those websites. Additionally, here I give overall directions for using home pages when designing websites, and also a description of some opinions and advice on the same topic. After that, I analyze six problems which arise from displaying home pages on the user's computer and topics connected with that. I will come across a few solutions for all of them, as well as recommendations for when to choose which solution.*

Keywords: HOME PAGES, DEFINITION AND CLASSIFICATION OF ELEMENTS OF A HOME PAGE, THE COMPOSITION OF THE WEBSITES, WEB DESIGN

1. Introduction

The basic four rules of design that need to be considered when designing a website are:

- Contrast. The rule of contrast means that the placement of similar elements on the same page should be avoided. If the elements (font, color, size, line thickness, contour, interval, etc.) are not exactly the same, but only similar, then they should be shaped differently. Very often, initially the contrast attracts the attention of users of the site.
- Repetition. The elements of the design should be repeated through the entire edition. Colors, contours, textures, mutual relations, line thickness, fonts, proportions, graphic concepts, etc. can be repeated. Repetition helps for better structuring and enhances the sense of integrity.
- Alignment. Nothing should be placed on the page by chance. Each element should have a visual connection with the other elements. This gives to the page a clean, sophisticated and fresh look.
- Closeness. Elements that are in some way related to each other should be close to each other. So these elements represent one unity and not just a few fragments. It helps information's to be well organized and reduces overcrowding, providing the reader with a clear structure.

Although the four basic rules apply also in the web design, repetition is the basic rule when shaping a website. The other three rules also help, but repeating is what shows visitors that they are still on the same site. There must be consistency in the navigation and the style of graphic design, repetition of the color scheme, the use of the same fonts, the placement of one styled graphic elements in the same way on each page, etc. [1]

A well-organized website should have: a logical structure, constant navigation, and clear inscriptions.

When determining the style for websites, it's good to know these two rules: there should be consistency in using the features of the design, and in the overall style of the site less is better (sometimes the most effective design is simple but elegant).

Good websites are designed with the ability to increase so to meet the new needs of their users, as these needs change over time.

An important rule regarding the structure of the website is to have a structure built in a way that reflects the user's view of the site and its information and/or services. The basic mistake is the structure of the site to reflect the organization of the company, rather than the user's point of view. [15]

Good websites are more than just random collected pages. They have to create a coherent overall impression on the visitor. [18]

When visitors move from page to page, they should always feel that they are on the same site. Although small decorative changes are good, the style and structure of the page should not be changed at once. Especially recommended are permanent background and unchangeable color scheme. Although the content of the pages is

changed, the "containers" will be the same. On good sites, passing from page to page is unnoticeable.

Information that is repeated on many pages should be displayed in one and the same position. The structure and order of pages in a website should be logical. [17]

Each web page should have a clear visual hierarchy. Pages with a clear visual hierarchy are distinguished by three distinctive features:

- the more important a given element is, the easier it is to notice it (the most important titles should be larger, written in bold font, colored with a striking color, fenced with more than the usual blank space or placed close to the top of the page).
- elements that are logically connected, should be also visually connected (certain elements which are similar, when grouped under one title, will be displayed on a screen in a similar visual style or will be put together in a clearly defined area).
- it is good for some elements to be visibly put inside one another to see which is from what part (if a book is part of a given section, it is appropriate that the title of the section is located above the title of the book, encompassing visually the whole area for the content of the page).

Also, the good visual hierarchy saves time. [6]

Every page should have a focus (attention center), from which the reader should start. This focus is created by implementing visual contrasts, for example: large and small elements, dark and bright, rectangular and round, many and just a few, etc. [2] Websites are a set of different types of pages, but the home page is an inevitable part of all sites.

2. Study Area

The home page of a website can be considered as a "facade" of that site. Facade of the site should always be carefully thought about. The face of the website should be attractive and unforgettable in order to gain visitors attention. Business people say "the first impressions sell". [7]

Creating a good first impression is more than just looking good to everyone. The home page should seductively suggest the content of the site. [14]

The immediate goal of every home page is to answer the questions "Where am I?" and "What is this site for?"

The home pages are relatively permanent places that do not change their position, and with that, they help the orientation of the visitors on the site. [9]

Everyone wants a "piece" of the home page. This is the page that almost every visitor sees, and for some users, it remains the only seen page. Everything that is clearly emphasized on the home page is visited a lot more times. [13]

An attractive presentation of some of the content on the home page is an essential part of the information architecture because it

allows visitors to immediately find new contents instead of having to search for them.

Without it being a binding rule, most home pages tend to cover all content in one screen, which is without vertical scrolling. It is often a difficult task. [11]

The content of the home page should be regularly renewed. If the success of the site depends on whether it will be visited often, the home page will, in every probability, have to contain content that will often be updated.

The home page can be designed in a way that differs from that of the other pages. Of course, the home and the other pages should have the same style, but sometimes, depending on the conditions, there may be some differences.

However, the most common communication weaknesses on the home pages due to the growing need for increasing the information density, including "on the input", are excessive overload with elements, as well as poor architecture or complicated site structure, whereby users feel helpless as in front of an impossible intellectual task.

To achieve that all communication functions on the home pages are enabled is a complex task that requires excellent professionalism by editors, designers, and developers. Not only should the space constraint be overcome in online communication, especially in the design of the home pages, but also the time limitations. And not only in terms of the duration of the loading of the optical forming factors but also in terms of the limited capacity of absorbing information and the resource of attention by the user. [3]

3. Related Research

Defining all the elements of the home pages of websites is a very large task. Here are presented the most necessary elements and their possible different characteristics from the same elements in other pages of the same site:

- **Basic information about the functionality of the site.** It is needed to increase the efficiency of the pages by adding personal and contact information for the web designer. The basic information also includes the date of creation and the date of the subsequent or last update of the site.

- **Logo.** The logo of a website is usually placed in the upper left corner of the screen. The logo on the home page may sometimes be (but not necessarily) larger than on the following pages. I find it better if the size of the logo is the same for the whole website. From the aspect of advertising, less well-known websites can make the name and logo a bit larger compared to those of popular sites.

- **A characteristic phrase.** One of the most valuable parts on the home page is the space next to the site logo. When a phrase is visible, visibly related to the logo, it is known that it is a characteristic phrase, motto, and is therefore considered a feature of the entire site. In websites, a characteristic phrase stands directly under, above or next to the logo. [8]

The characteristic phrase should be a meaningful text that characterizes the whole venture - summarizes what it is about and what makes it so wonderful. Characteristic phrases are not from yesterday - for a long time they are involved in ads, entertainment and in printed editions.

Characteristic phrases are a very effective way to convey the message because they are the only place on the page where users expect to see a concise presentation for the purpose of the website and the company as a whole.

When selecting a characteristic phrase, the following thing should be taken into consideration:

- the good phrases are clear and informative;
- badly selected phrases are unclear;
- the good phrases are exactly as long as necessary.

Six to eight words are enough to express a complete thought and at the same time - just enough, so that they can be easily understood and remembered ("Let's make things better" - PHILIPS).

- **Something influential (impressive).** In order to attract the attention of the user, "something impressive" can be placed on the

home page: graphics, animation, interesting textual content, background music, sound effects, video... They enrich users' experience, effectively direct attention, emphasize certain moments of communication, define the beginning and end of important phases, create an impression of the unity of the composition...

Using all of these "tricks" to attract visitors' attention is not necessary, but they add to the attractiveness and clarity of web pages and because of that it is often recommended to use them, normally in adequate proportions.

- **An informative title.** As has been said before, the immediate goal of each home page is to answer questions about where the user is located and what is the purpose of the visited website. The answers to both questions require a clear and extended version of the site's name. The name of the company or site should be mandatorily placed in a prominent place. It may also be recommended to use a domain address and an adequate window title.

The most visible and most obvious element of the design on the home page should be the name of the company or the site. This does not mean that the name should be the largest element, but at least it should be in a place where it is easy to see. Most often it's on the upper left side on the web page.

If the name of the site and the relevant company is of no significance or its significance is not related to what is done in the company, more efforts will have to be made to help users understand it.

Websites, which are less well-known, need to put a small amount of additional identification information on each of the internal pages. [8]

- **Navigation.** Navigation is the most important element of the home page. The way how the site is divided and the section names in it can in large amount suggest its functionality.

For those who visit the site for the first time, the answer to the question "What does this site do?" is perhaps the most important feature on the home page, but for most other visitors the most important function on the home page is to serve as the starting point for the site navigation scheme. [16]

The navigation itself can be done in a variety of ways. In order to increase navigation efficiency, it is accustomed to a greater number of different types of navigational elements that suit the needs of a wide range of visitors. Navigation links and buttons should be easily visible and consistent in place. Text links usually appear at the bottom of the page. They are usually written in a small font and contain only the most important links. The text links that are put that way are usually the second set of navigation elements.

Some authors believe that the home page does not need to have a "Home" button because it is quite uncomfortable to press a button that doesn't lead to another page. [4] This recommendation should be accepted conditionally because preserving the design composition and no-disrupting the convenience of surfing for the users (easier to get used to the placement of links) suggests that it is better to keep the navigation the same. In other words, it's better the "Home" button to be on the home page as well.

Often, the question arises as to how the navigation on the home page should be the same as in the rest of the site. It may be different, but not too much. Common differences may be the following: section descriptions, different orientation, drop-down menu, and logo size.

Also on the home page, more often than on the internal pages, pop-up windows can also be found by clicking on a specific link. [3]

- **An emotional effect.** Emotional effect on users is achieved by means of words, color, font and other elements. The home page and internal pages should have the same style. The colors chosen are of great importance both for the definition of the brand as for creating a mood for the site. Standard, easily readable fonts should always be used).

A very significant feature of the home page is that it is one and the same for all tastes. Unlike the lower-level pages, the home page should appeal to anyone who visits the site, no matter how diverse their interests are.

- **Subheadings.** The subheadings divide long text, if it's necessary.

- **Search tools.** For most sites, it's good to have an easily visible search field on the home page. Most home pages require an option for searching in a prominent place because most users are prone to search and do not want to work hard to get to the connection they need, a link by link. For sites where a search is the main access mechanism, it makes sense to include a search field at the top of the home page).

- **Registration.** If a particular site is working with registrations, the home page should have links enabling new visitors to register, and old ones to gain access. It should also be clearly visible whether the user has entered the system. On websites where registration is necessary, if it is a new user, or if you need to enter with a username and password in the case of already registered users, the appropriate registration and logging places should be clearly visible).

- **Suggestions.** The home page should include all prepared advertisements, promotions, and offers. [12] Everyone wants a "piece" of the home page. It should not be forgotten that this is the page that almost every visitor sees, and for some users, it remains the only one seen. Everything that stands out clearly on the home page is visited a lot more times. Anyone who participates in a particular site wants to have an ad on the home page or a link to his section. The battle for territory on the home page can sometimes be quite fierce.

Unfortunately, the need to advertise "everything" sometimes leads to hiding and darkening important input points. The problem with advertising on the home page is that it works too well. The advertised section is pleased with a large number of visits, while from the overall loss of efficiency on the home page as a result of its overcrowding, all sections suffer.

Also, the home page is the place where all news or special promotions should be deployed, which is intended to attract visitors' attention.

- **Choice of language.** Many websites use manual language selection options. The main ways to implement language selection are: using an entry (introductory) page, by placing a language menu on the home page or with a language menu that will be on all pages.

It may be decided to use an entry page only when there is no easy way to make a decision to choose the default (standard) language on the home page. In the end, if a good default language is selected, anyone who prefers that language will be able to continue browsing the site without delay. Given slow navigation on the Internet space, everything that saves users from viewing an extra page is in favor of ease of use. Another argument regarding the standard language of the home page is that it often allows users who do not prefer this language, at least get an idea of what's on the site. So they can take a more objective decision whether they like the site and whether they are ready to wait for a page to be loaded in their language. When there is a choice between small numbers of languages, it may be advised to indicate the names of languages as words, by writing their names in their language, for example - English and Français. The most commonly used visual symbol for language is the flag.

Whether the initial language selection is made on the entry page or on the home page, the user should always be able to change his choice on the following pages. The main reason for this is that many people enter the site through its internal pages and not from the home page (whether from a search engine or because they follow a link from a bookmark or from another site). Users may also want to change their language if they are multilingual and feel that the translation of a particular page is not well made in the appropriate language. In general, bad translations should be avoided, but in practice users often prefer to read technical materials in their original language rather than in translation.

- **Social media icons.** With the development of social media practically we can very rarely encounter a website that is not accompanied by a profile in one of them. The right place where you need to have links to the additional site profiles in social media is

the home page. Very often these links appear on all other pages too, but their existence at the home page is almost obligatory. [5]

The listed and analyzed elements are the most important for one home page. Of course, there are always possible exceptions, but for them, there should be a clearly defined reason. In web design, as with all other types of design, written rules and recommendations should be considered flexible and, therefore, sometimes they don't have to be strictly respected.

Taking into consideration everything the home page needs to accomplish and fulfill, in one already complicated website, it is simply not possible to satisfy each of the above requirements. Creating the home page is inevitably linked to compromises.

4. Findings/Results

In this part of the scientific paper are six problems that arise from the displaying of home pages and their elements from websites on users computers. There are several solutions to the problems and making recommendations for when to choose which solution.

4.1. Problems with Lack of Knowledge that the Site Logo Serves as a Link that Leads to the Home Page

The unwritten rule that the logo of the site also serves as a button, leading to the home page is increasingly imposed. This is a useful idea, which is good to be accepted from every website. That way it will be much easier to navigate through the site because users will always be able to go to the home page and start all over again. [10]

But a surprising number of users do not know about this rule. To improve that, the word "Home" (home page) should be discreetly added to the logo on the site everywhere. In this way, users will know that they can click on the logo. While this unwritten rule becomes common knowledge, there should be a link to the home page in sections and/or tools.

4.2. Problems with the Different Navigation on the Home Page and all other Pages in the Websites

One of the main rules for deploying navigation on all pages on one website is that it should be consistently equal. This rule has two possible exceptions. The first is the home page. It is not like other pages - it is burdened with other responsibilities and should be held to other promises. Sometimes it does not include permanent navigation.

The usual differences are the following:

- sections descriptions. Since the home page should show as much as possible from that what is behind it, it's not a bad idea to add a descriptive phrase to the name of each section, and even specify the subsections - something that not every page has space for.

- different orientation. The home page often requires a radically different layout compared to all others. This means that it may be more appropriate to use horizontal instead of the usual vertical navigation on site, or vice versa.

- more space for the logo. The site logo on the home page is sometimes larger than in the permanent navigation. It's good next to the logo to have a little free space for a characteristic phrase, which is not mandatory to appear on every page.

- drop-down menus. Because the space on the home page is severely restricted, web designers are constantly looking for ways to increase it. One of the most common ways to do this is by using drop-down menus.

It is also important not to make unnecessary changes. The home page navigation and permanent navigation should have enough common features so that visitors can immediately understand that it's about two different versions of the same thing. The most important thing is to preserve the same names of sections everywhere - sequencing, specific words, and grouping should not be different. It is also good not to change the visual features - the same font, colors, and registers of the letters.

4.3. Problems with the Visual Presentation of the Language on the Web Pages

The most used visual symbol for language is a flag, but, unfortunately, flags represent states, not languages. The problem

with the use of the flag as a symbol for language selection is that some languages are spoken in more than one country, and in some countries, the official languages are more than one. The example can be used with the English language. Using the US flag to mark the English language is the obvious insult for English people (they are in fact its creators), but that also irritates Canadians and many others. Of course, the use of the Canadian flag is also not appropriate, because they speak English and/or French.

Alternative icons with national stereotypes can be set as well, but there is a risk that they will be offensive (for example, not all Americans wear cowboy hats). It is usually the best to avoid icons and simply write languages with words. However, flags can be used that correspond to the geographical location of the service and its primary target audience. As an example, one tourist website in continental Europe can use United Kingdom flag for the English language, except if the website is primarily targeted for American tourists, and on the other hand, one tourist website in America could be using the USA flag if their primary targets are not European tourists. An English flag can be used, but it is not recommended, because not many people outside the UK know regional flags of England, Scotland, Wales, Northern Ireland, etc.

The other possible solution is using two flags in the size of one so that each flag will take half of the space. The separation can be made horizontally in the middle, vertically or diagonally.

4.4. The Dilemma with Presenting the General Information about the Site on the Internal Pages

The site name should be repeated on all internal pages because users can enter the site from anywhere, not only from the home page. Users entering the site using a search engine or tracking a link from another site should be able to clearly define which site they have entered. At the same time, however, the internal pages should focus attention on the particular content rather than presenting a general greeting or describing the site (these two goals should be reserved for the home page).

It is clear that there is a contradiction - on the one hand, between the need to make a presentation to people who have entered from any page, and on the other - the need to isolate general information and higher levels of navigation only on the home page. The solution to the problem depends on how often is expected users to enter the site from the internal pages and how much the site is impressive and popular. If the site is unmistakably recognized by most users, it is not necessary to place general information on internal pages. Only, each page should have a clearly visible link to the home page. It is recommended this link to be located in the upper left corner of the page, which is the recommended place for the name and logo of the site.

4.5. Problems with Overloading the Home Page with Ads

The problem with advertising on the home page is that it works too well. Everything that has a clearly visible hyperlink on the home page will surely have more visits (many more), which makes site owners think: "Why not add another hyperlink again?". The problem is that the advantages and disadvantages of adding more items to the home page are not distributed equally. The advertised section is impressed by a large number of visits, while from the overall loss of efficiency of the home page as a result of its overcrowding, all the other sections suffer)

Preventing that the home page doesn't get ad overload requires constant care, as it usually happens gradually, with the slow, but the unyielding addition of just one more thing. All website owners should be aware of the danger of overloading the home page and they need to use other methods to increase visits to their site, for example, their ad placed on other popular websites or rotating ads that use the same space on the home page.

4.6. Problems with Sounds on the Websites

An increasing lack of sound in web space is a complaint that is often met among media professionals. Some of them think that sound is the most powerful means of creating mood and manipulating emotions. The real environment of the users should never be forgotten. Unexpected sounds are frightening and violate the sense of privacy and control. However, many websites play with

the idea of integrating audio - to give the mood, to follow the action, to advertise the site, and so on.

Adding sound to the website (whether it's an easy-to-use surround sound for moods or sounds from the interface) is very often chasing users away, especially when they cannot turn off the sound. Of course, there are exceptions - certain types of sites are expected to have sound (like for example, congratulations online). But the ability to turn off the sound should always be available. Therefore, a visible On/Off switch should be placed so that users can get rid of the sound without having to leave the page.

Most often, the problem with audio on websites occurs upon first entering a specific site (usually home page). The user is not familiar with the sound component of the website and a variety of inconveniences can arise during its use. It's good the "On/Off" switch to be on every page of a certain website, but its existence should be mandatory on the home page. The sound settings (will the user hear the sound or not) should remain as same as it was at the first choice (it's usually made on the home page) while surfing the entire website, with the possibility to it change on each page.

5. Conclusion

Modern website design allows designers themselves to decide if and when will they use standard rules for a home page, of course, together with all the other standards and norms that exist when we want to shape one stylishly designed site.

The conclusion that can be made from all of the above mentioned is that this area is extensive and offers many opportunities for research and analysis. Due to a large number of problems which occur in this area, usually, there is not only one correct solution.

For the most appropriate solution to be chosen, a lot of data should be collected about desires and habits of potential users, as well as the technical features of their computers. The solution needs to be found based on those information's. Sometimes, depending on the situation, it is possible to apply a combination of multiple solutions simultaneously.

One of the decisions that will qualify the quality of that site and its aesthetics and technical aspects is how good the quality of the home page will be. The need to find the appropriate balance between designer visions, users' expectations, and technical possibilities is one of most common problems which all website designers meet.

Web designers must be aware of market needs and business expectations of a site owner if they wish to create a visually perfect website implementing all their ideas and imagination. The other segment of this problem is users and their needs and requirements when using the Internet. And at the end here are technical parameters and limitations that very often can represent a key factor in the decision if and which website should be visited and used.

Today, when there are millions of sites with the same or similar topics, the downloading time is one of the main parameters when choosing which website to visit.

All these aspects should be considered when deciding which solution to choose to resolve these problems.

The conclusion is that there is no universal solution for all the possible problematic situations. It should also be noted that the abundance of a variety of program languages and codes allows other solutions too, depending on the used languages and codes.

This subject, as well as everything else with web design, is very progressive. Some other possible solutions to the problems in this science area will be undoubtedly produced using many various new innovations and opportunities.

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SMART RESIDENTIAL HOUSE SAVING ENERGY SYSTEM

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Abstract: *The special design process of an efficient residential house energy saving energy system is presented in this work. The main objectives are to achieve major energy cost reductions, providing safe house and reliable service. Thus, the essentials tool of the system will focus on providing useful information for the user by continuous monitoring and recording of the consumption behaviour of the operating appliances, also will raise early alarms in case of fault detection by high temperature monitoring. The outcomes of monitoring and analyzing the real power demand of group of typical house appliances is then used as a case-study for proposing further tools such as consumption forecast, tariff comparing and scheduling tools. Rule based system was designed for efficient and reliable operation control of house energy system with distributed energy source and storage units. Lab-View software package is used for implementation of most of the proposed algorithms which have been tested by variation of possible operating conditions. The results have shown that 22.75% energy savings can be achieved by applying the proposed tools and control strategies on typical home appliances. Modification of the system is recommended to include wide range of consumer's types such as industrial and commercial sectors and to include more than one type of distributed energy sources.*

Keywords: ENERGY SAVING, SMART HOUSE, ENERGY MANAGEMENT SYSTEM, LAB-VIEW

1-Introduction: Recent developments in information and communication technology such as intelligent meter technology, intelligent smart electrical appliances and intelligent storage systems, has led to the establishment of the smart home concept, and aid in building the energy management system infrastructure (Dounis&Caraiscos,2009). Energy Management Systems (EMS) technology such as home or building energy management system which is recognized as the most important element in the smart grid appear in response to the continuous requirement of high reliability and demand of increasing safety measures for the traditional power grid to meet customer satisfaction. Smart houses are expected to help power companies by dynamically adjusting power consumption in response to grid conditions, allowing for lower peak power costs as well as energy and maintenance costs. These savings help to reduce capital investment and the purchase of excess electricity from additional generators at peak time. The company's strategies to reduce the amount of fuel consumed to produce electricity are the pricing rates and demand response strategies (Li, 2013). Intelligent demand-side electricity use has a significant role in improving energy consumption by home users, and also effects on their daily behaviors and activities. The smart meter receives signals such as the maximum level of power allowed in a specified period or real-time price signals (Yoon et al., 2014). The flow of information between suppliers of electricity and consumers helps the energy management system play a role in demand response strategies. Where the demand response allows the consumer to reduce or convert their use of electricity during peak time in response to changes in prices by controlling the electrical devices manually or automatically, especially for the appliances of cooling, heating, air conditioners and water heaters, which considered the most used electrical appliances for electricity (Augean, et al, 2015). Real-time optimization and scheduling schemes for power storage systems and household electrical appliances are planned by the end-users. The object of the scheduling scheme of the home Energy Management System (EMS) is to manage the power consumption of the appliances during the peak and off-peak periods, to reduce consumption costs and to improve energy use (Shariatzadeha, et al, 2015).

2-Data collection: Dataset of house appliances operating conditions and power demand are to be available for the purpose of system testing and evaluating, for the purpose of saving time, effort and financial cost. When generating a log-file, two rules must be followed: The first rule is avoiding any appliances data with missing fragments. The second rule is selecting what local users are

familiar with and avoid device duplicating. Table-1 shows the nine selected appliances for the present work house and figure-1 shows the suggested layout of the proposed house with appliances locations in addition to solar cells system with their storage batteries. When selecting development environment for the software, the followed rule was to search for a powerful programming software but user friendly at the same time, it is required to be able to communicate with external devices, able to send and receive data from the home system components. The Lab-View software package was selected for implementation of the system tools and functions.

3-Monitoring: Monitoring of house appliances will start form major part of the intended design objectives. Suitable monitoring tools are selected in this work for implementation. Their design criteria focus on automating instantaneous monitoring or saving data for later usage such as later analysis and comparisons for various appliances and delivering useful information quickly without effort even for beginner energy manager or ordinary user quite simply because it is going to be user every day partner. Figure-2 shows screen shot which represents the first system stage that the user will encounter when operating the software.

4-Individual consumptions: This feature is important and need to be included in any professional Energy Managing System (EMS). Although it could be difficult to be applied on all types and kinds of appliances in the house but at least it should be there for the important and heavy loads, those loads which need to be identified causing and driving the peak power demand and also it is important to identify cyclic loads whose operation could be delayed. In present work will simulate the case-study house which has nine major appliances, which are included in the individual loads power demand profile scheme. A small window of the registered devices list is included in the left side of the main window and shown in figure-3. Moving between the different items can be achieved easily using mouse clicks or moving by arrows in the key boards. One scheme of monitoring which is implemented in the main screen of the proposed system is the twenty-four-hour period of individual power consumption information. When an item name is selected, it will be highlighted and its load power demand profile will be updated automatically on the chart, which is shown to the right side of the list and on the upper side of the system main window. The chart will provide twenty-four-hour period of individual power consumption information. Continuous monitoring requires instantaneous updating with any change in the absorbed power values. The user will then have the freedom to select any device he

is interested in showing its load pattern. Following, some recordings examples are included for some loads to understand the general operating pattern and the power demand. The operating pattern of the fridge, kettle and freezer are illustrated in Error! Reference Source not found as shown in figures, 4, 5, and 6. The lines in the plot connect the data points and the data points were recorded at five minutes intervals. The figures show the active power consumed by the appliances. The operating patterns display the cyclic nature of the appliances and their energy demand. Another scheme of monitoring is suggested which is based on keeping record of each device cumulative consumption over a period of one day for example depending on the tariff type and details as shown in figure-7, which illustrates the system idea based on using the traditional total daily cumulative consumption meter.

5-Total power demand profile consumptions: Another scheme is similar to the individual loads power demand profiles monitoring scheme but it is monitoring the total home consumptions instead. The consumption sum is calculated on a minute by minute basis. A chart is continually monitoring and showing a period of twenty-four hours of the home load profile. The total consumption reading data for each minute represents the summation of all appliances consumption data, the summation was performed internally by the system and the total consumption is plotted with the time on the x-axis as shown in figure-8. This figure shows the home uses approximately 250 W/h during low power demand times and this rise and reaches approximately 2 kWh during peak power demand times. This is approximately eight times as much power required during the low power demand time. A similar power profile exists for different days, the minimum and maximum values will vary slightly but still in the same ranges.

6-Alarming systems: The previous section focuses on monitoring of home appliances to achieve one major design objective of providing home owner with important management advices and information. Another major design objective of present work proposed system is to provide alarming services. These services can be categorized in two main groups; first group design criteria focuses on alarming of high temperature detection and this is mainly for supporting safety measures in addition to achieving power savings, the second group design criteria focus on alarming regard detecting of any high or up-normal power consumption and although this is mainly for achieving power savings purpose and bill payments reducing but could also be used for supporting safety measures as well. It is important for the proposed system to have the ability of raising alarms to warn house owners of dangerous situations.

6-1 High temperatures alarms: Unlike power consumption data, real operating temperature from the REFIT electrical load measurements data set was not recorded. Hazard scenarios are essential for testing of the proposed management system ability for providing alarm if required and thus hazard scenarios need also to be simulated and stored on the system for testing purposes. Figure-9 shows an example of this approach block diagram connections. Here, the alarm monitor will turn color to red if temperature found to reach any value between 24.5-25 degrees. Of course, these values and threshold constants can be altered easily by the system programmer. Figure-10 shows the front panel of present work proposed house.

6-2 High power consumption alarm:

High power consumption may occur in the system during daily operations and having early alarm raise when such increase occur will be an advantage over traditional homes with no monitoring facilities. The alarm will help mainly in reducing bills, aiding safety measures of home owners, and increasing expected life of some part of the home system. High power consumption may occur due to faulty conditions, some of these faults may not be detected by home protection systems such as current leakage in high resistance. Figures- 10 shows the front panel of present work proposed alarm

and the monitoring meter, *Грешка! Източникът на препратката не е намерен*. Figure-10 shows an example where the consumed power is less than the preset threshold, while figure-11 show the same example when the consumed power exceeds the preset threshold. Alert is raised for the high consumption by converting its color from green to red.

7- Consumption forecast tools: The consumption forecast tool work on raising an alert to inform of possible high consumption. The tool is designed to involve current month usage and previous month consumption as well in its estimations. Figures-12-15 show the structure for the front screen of the designed consumption forecast tool and an example for the forecasting tool outcome. Figure -15 shows an example for the forecasting tool outcome, the selected block was 300kWh, the previous month used data was set to 500 kWh for testing and the calculated forecast is expected to exceed the allowance. Figure-16 shows a one day home consumption with peak time tariff, while table-2 shows the total cost reduction before and after dishwasher scheduling strategy. Figures-17 and 18 Illustrate the savings after applying scheduling on freezer and Scheduling savings calculations for freezer, respectively. Finally the Summary of estimated reduction percentage is shown in table-3.

8- Analyses and Discussion of Results: Extra reductions in bills for some tariff types can be achieved if some measures are considered at the time of the application, example of this application of the peak time tariff or the real-time tariff when combined with a well-designed scheduling strategy. To build the wanted scheduling strategy, some rules should be defined, starting by rules for appliances classification into two groups, namely; essential and nonessential load. Essential loads include loads where operation automatic control may negatively affects the user comfort, such as TV, PC or router. On the other hand, turning off or rescheduling some loads will not have big impact on the user regular life activity, these will be defined as the nonessential loads such as the dishwasher or the washing machine. For illustration example of the proposed scheduling tool, figure-16 shows a plot of a typical total home consumption for one day with details of the peak time tariff on the same figure. The plot found to be containing five major consumption spikes. The first three will be treated with by the shoulder rate and the last two will be paid by the peak rate. These spikes will effectively contribute to a large payment share of the expected bill. Information from the installed individual power meters will be passed on to the scheduling strategy in order to identify the source of these spikes. Error! Reference source not found, shows that the Dishwasher is responsible for the rest four of these spikes, the first two was during the shoulder rate period and due to the dishwasher usage, that starts at around 8:50am and finish at around 10:00am. The second usage of the dishwasher was encountered at a longer interval which starts at 6:00pm and continues until 7:40pm; the main point here to be noticed is that this usage was at the peak rate period. The scheduling tool function may be utilized regard the power spikes which was generated by the dishwasher as shown in tables-4. This device can be considered as a non-essential device since shifting its operation time will have no effect on the user. Error! Reference source not found, figure-19 is an example of this set power consumption. A simple control strategy is proposed for this set which is based on the master-slave principle. The TV will be the master device, the control strategy will be based on turning off the whole set if the master device was not in use and turning it on will signal the on-control order to the whole set of slave devices as shown in tables 5 and 6. Figures-20 and 21 show the already monitored freezer power consumptions profile (i.e. before and after suggested modification). Its cyclic operation is governed by two temperature limits; the total time for each cycle can be estimated to be in the range of two to two and half hours divided almost in half between the on-time and off-time. Similar cyclic operation behavior is also noticed in fridge power consumptions profile. The strategy algorithm can be built on the principle of controlling the on-times and off-times according to the rate of that period. Flowchart shown in figure-22 represent

summary of this proposed strategy steps. The idea is to keep fixed cycle time, monitoring the time will be used to identify the rate different periods and then selecting Ton1 for operating- time in the off-peak period, Ton2 for the shoulder peak period or Ton3 for the peak period. The following equations of 1,2 and 3 may be used to summarize the proposed algorithm.

$$\text{Time delay} = T_{\text{on}} + T_{\text{off}} \tag{1}$$

$$T_{\text{on}1} = 1.5 * T_{\text{on}2} \tag{2}$$

$$T_{\text{on}1} = 3 * T_{\text{on}3} \tag{3}$$

Although, following the previous strategy algorithm will serve achieving the scheduling purpose, but there are few aspects regard the safe operation of the device which if neglected may have serious negative consequences on the man life especially regard using of these vital appliances i.e. fridge and freezer. Healthy and food conserving safety serious issues may be encountered if operating of this equipment was determined and controlled by time constrains only. The low temperature limit in the shoulder time $T_{\text{low}2}$, will be little bit higher than $T_{\text{low}1}$, and the low temperature limit in the peak time $T_{\text{low}3}$, will be higher than both $T_{\text{low}1}$ and $T_{\text{low}2}$. The general rule will be to ensure that $T_{\text{low}3} > T_{\text{low}2} > T_{\text{low}1}$. Low temperature limits must be selected in a manner that ensure early turn off and thus means more power savings to avoid device long operation intervals in high rate periods. Flowchart shown in figure represent summary of this proposed strategy steps. For illustration, figure-17 shows an example of calculations for applying the peak tariff rate structure for day, month, year and ten years durations. The calculation is performed for normal operation without scheduling case and also on the scheduled operation of the device. Further increasing in the savings percentage may be achieved by further decrement in the shoulder and peak on times. For energy storing, a slight increase in the off-peak on-time duration may be suggested. Figure-18 shows a comparison between the previous example of time parameters set and a new set of time parameters and the increase in the savings percentage. Summary of estimated reduction percentage is included in year's durations. The calculation is performed for normal operation without scheduling case and also on the scheduled operation of the device. Further increasing in the savings percentage may be achieved by further decrement in the shoulder and peak on times. For energy storing, a slight increase in the off-peak on-time duration may be suggested. Summary of estimated reduction percentage is included in table-3.

9-Conclusions: The functionality of the proposed design system is demonstrated by modeling and simulation of various scenarios for reducing bill payments; appliances operation controlling strategies are investigated. For some of the appliances, such as the fridge and kettle, application of storage-based strategy can achieve 12.7% cost reduction. For the washing machine and the dishwasher, a peak clipping based strategy by operating time shifting can achieve 22.4% cost reduction. For the TV set and the PC set, a master and

slave principle is selected. For the TV set, 44.4% consumption reduction can be achieved. The router controlling strategy is based on monitoring the presence of the home owner and calculating the expected reduction requires a study of his daily behavior. Applying suggested strategies can achieve total cost reduction of 22.75%.

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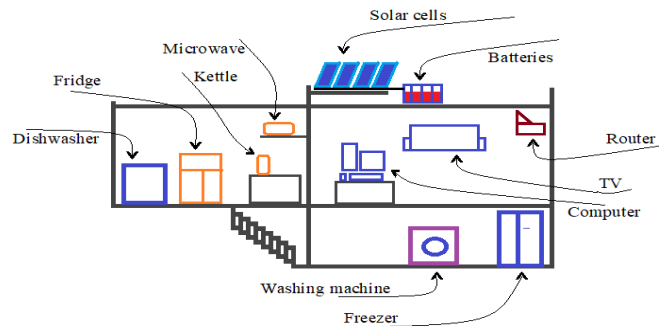


Figure 1: Layout of proposed case-study house

Table 1: List of appliances used in present work case-study

Number	Registered devices
1	Fridge
2	Freezer
3	Microwave
4	TV
5	Kettle
6	Dishwasher
7	Washing machine
8	Computer
9	Router

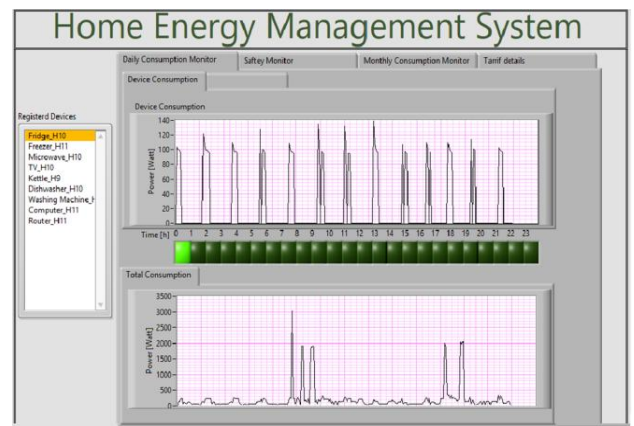


Figure 2: Desk top screen shot

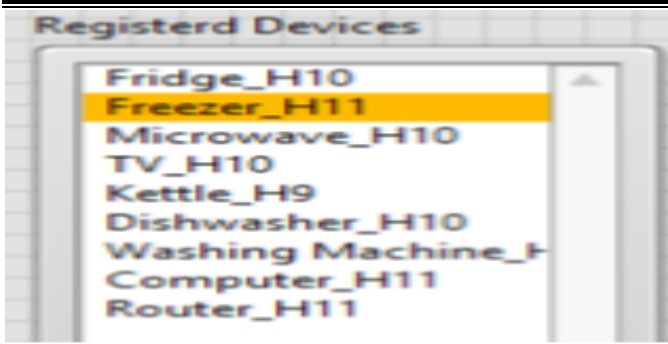


Figure 3: Registered devices list

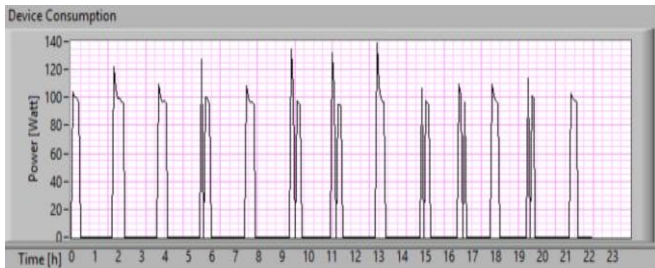


Figure 4: Example of the fridge consumption

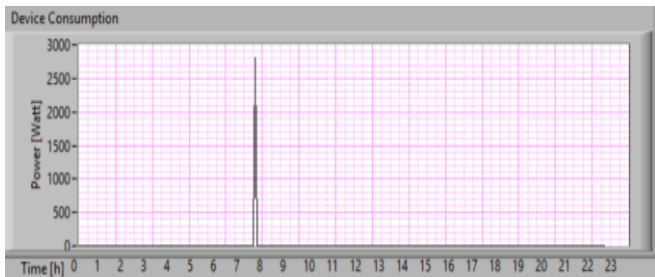


Figure 5: Example of the kettle consumption

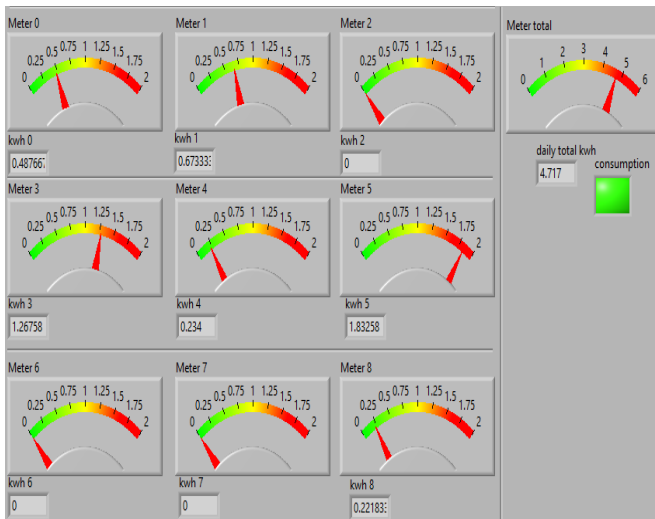


Figure-7: Cumulative consumption meter panel

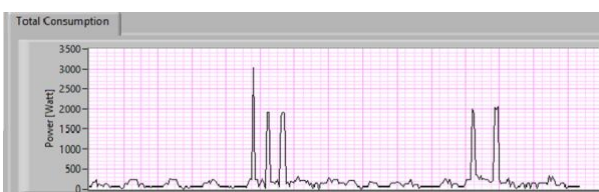


Figure-8: Example 1 of total consumption for a day

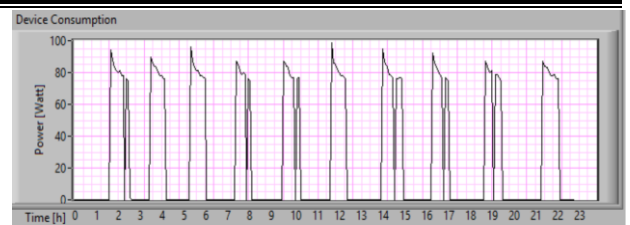


Figure 6: Example of the freezer consumption

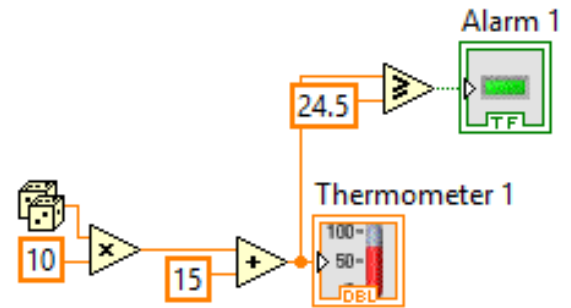


Figure-9: first approach block diagram connections

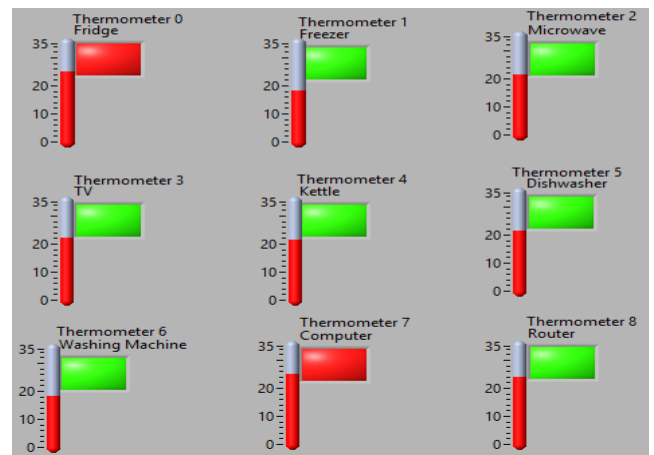


Figure -10: Alarm system front panel

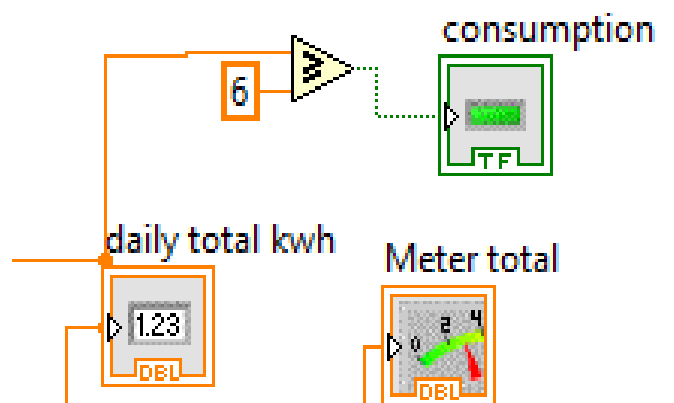


Figure 11: High power consumption alarm Block diagram connections

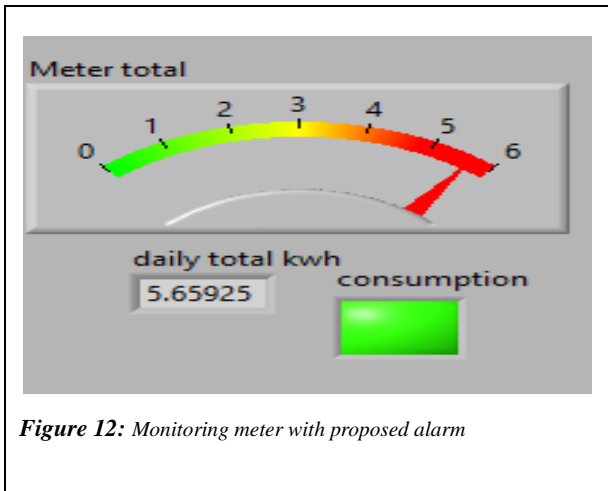


Figure 12: Monitoring meter with proposed alarm

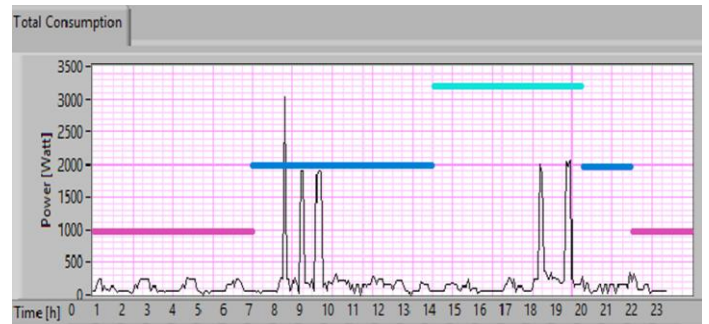


Figure -16: One day home consumption with peak time tariff

Table 2: Total cost reduction before and after dishwasher scheduling strategy

Total appliances operating cost with Time of day tariff	before Applying Dishwasher scheduling strategy	1.01 \$
	after Applying Dishwasher scheduling strategy	0.91 \$
		Reduction Percentage 9.9%

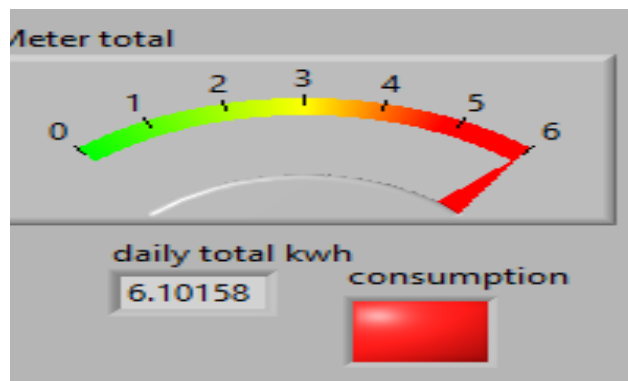


Figure 13: Raised alert for high consumption

How much savings?

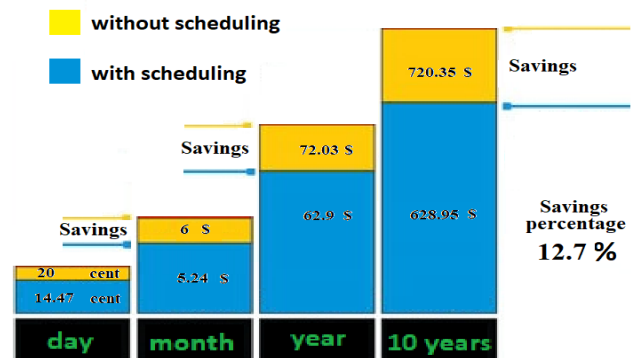


Figure-17: Savings after applying scheduling on freezer

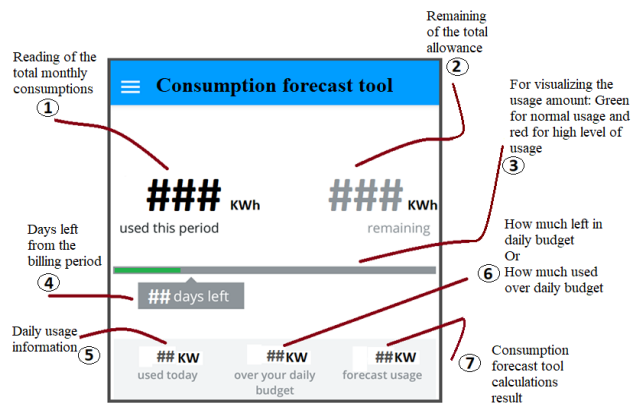


Figure 14: Consumption forecast tool front screen structure

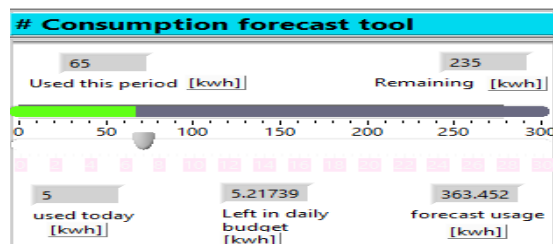


Figure 15: Forecast if normal usage and previous month consumption was 500 kWh

Time parameter set		Total costs over 10 years	Savings percentage
T _{on1} =90 minutes T _{on2} =40 minutes T _{on3} =20 minutes	Without scheduling	720.34 \$	12.7%
	With scheduling	628.95 \$	
T _{on1} =100 minutes T _{on2} =35 minutes T _{on3} =15 minutes	Without scheduling	720.34 \$	14.3%
	With scheduling	617.44 \$	

Figure-18: Scheduling savings calculations for freezer

Table-3: Summary of estimated reduction percentage

Appliance	before	after	Reduction percentage estimation
Freezer	0.2001 \$	0.1747 \$	12.7%
Dishwasher	0.42 \$	0.33\$	22.4%
TV set	0.27 \$	0.15 \$	44.4%

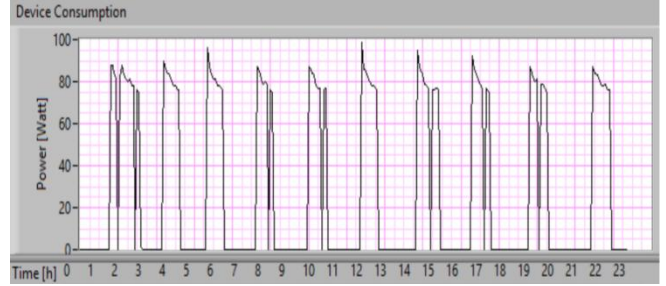


Figure-20: Freezer power profile before suggested modification

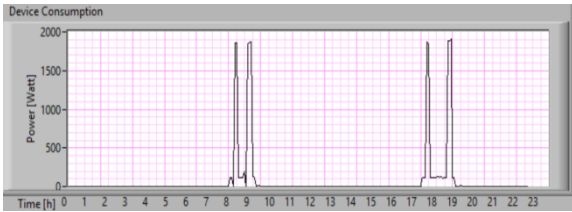


Figure-19: Example of the dishwasher consumption

Table 4: Dishwasher operating cost reduction before And after dishwasher scheduling strategy

Dishwasher operating cost with Time of day tariff	before Appling Dishwasher scheduling strategy	0.42 \$
	after Appling Dishwasher scheduling strategy	0.33 \$
		Reduction Percentage 21.4%

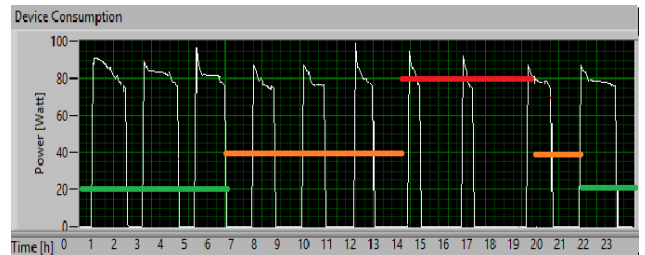


Figure-21: Freezer power profile after with energy storage

Table-5: TV control strategy consumption results

TV operating kWh	before control strategy	1.322 kWh
	after control strategy	0.722 kWh
		Reduction Percentage 45.3 %

Table 6: TV control strategy cost results

TV operating kWh	before control strategy	0.27 \$
	after control strategy	0.15 \$
		Reduction Percentage 44.4 %

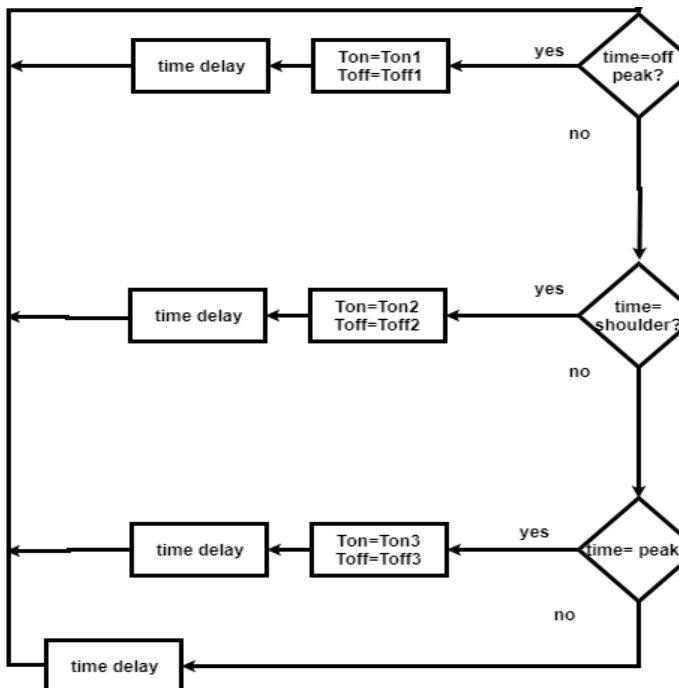


Figure 22: Time constraint-based algorithm

PERSPECTIVE DEVELOPMENT TENDENCIES OF ELECTRON BEAM TECHNOLOGY IN PRECISION INSTRUMENTS INDUSTRY

ПЕРСПЕКТИВНІ НАПРЯМКИ РОЗВИТКУ ЕЛЕКТРОННО-ПРОМЕНЕВОЇ ТЕХНОЛОГІЇ У ТОЧНОМУ ПРИЛАДОБУДУВАННІ

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Abstract: Perspective development tendencies of electron-beam technology in precise instruments industry were introduced and after them the following results were obtained: 1. Capacity expansion of electron-beam technology in the optical-electronic instruments industry for obtaining high-quality curved surfaces and the creation of functional microprofiles on them of different geometric forms. A new method of more accurate and reliable processing of curved surfaces of optical elements (concave, buckled, spherical, cylindrical, etc.) was developed for this purpose. 2. Electron-beam surfaces processing of elements from piezoelectric ceramics. Modern production technologies of piezoelectric products are based on the known methods of mechanical, chemical and chemical-mechanical processing of the surfaces of piezoelectric materials, in particular ceramics. The main drawback of these methods is the impossibility of getting high electromechanical and strength characteristics of products from piezoelectric ceramics, which requires additional processing of these products. Electron-radiation technology was used to exclude the mentioned negative defects on the surface of elements from piezoelectric ceramics. 3. Electron-beam processing of nanosized oxide coatings on optical elements. Nanosized oxide coating, which represent the composition of oxides SnO₂, Bi₂O₃, TiO₂, ZnO, SiO₂, Al₂O₃, are applied for improvement of wear resistance, reduction of radiation and convective components of thermal losses on optical elements of precision instruments industry. Thus, the resulting coatings are heterogeneous, contain hidden microdefects (cracks, chips, etc.), the surface contains significant microroughnesses and low microhardness, etc. All this reduces the performance characteristics of these coatings. Their electron beam processing was used for elimination of the mentioned shortcomings and improvement of the quality of these coatings.

Keywords: ELECTRON-BEAM TECHNOLOGY, PRECISION INSTRUMENTS INDUSTRY, PIEZOELECTRIC CERAMICS, NANOSIZED OXIDE COATINGS ON OPTICAL ELEMENTS

1. Introduction

The modern level of development of precision instrument industry claims increased requirements to the performance characteristics of their elements: microhardness of the surface; spectral transmission coefficient; resistance to external thermal and mechanical shocks, etc., which influence technical and performance characteristics of devices (pulse laser devices of sighting complexes, laser medical devices, infrared devices, etc.) [1-5].

Wide use of traditional methods concerning preparation and processing of surfaces of elements (mechanical, chemical, chemical-mechanical) showed that it is impossible to get simultaneously clean and flawless surface, and also flawless surface layers, which leads to deterioration of technical and performance characteristics of optoelectronic devices [1, 10-12].

As the practice has shown, the most convenient, ecologically friendly and easily controlled method of elements processing is the electron-beam method. Application possibilities of moving electron beam of tape form were shown for polishing elements from optical glass and receiving high purity surfaces with minimal roughness, as well as for strengthening elements from optical ceramics and obtaining surfaces with increased microhardness and thickness of strengthened layers by tens of microns [1, 6-9].

Thereat, the lack of research in the following perspective directions prevents further expansion of application of electron-beam technology in precision instrument making. These directions are:

- electron-beam processing of curvilinear surfaces and creation of functional microprofiles of different geometric forms;
- electron-beam processing of surfaces of elements from piezoelectric ceramics;
- electron beam surface processing of oxide coatings on the elements from optical materials.

Therefore the purpose of this work is to present the preliminary results of researches on the specified directions, confirming their development prospects for precision instrument-making.

2. Results and discussion

Expansion of the possibility of electron-beam technology in the precision instrument industry for obtaining high-quality curvilinear surfaces and creation of functional microprofiles of different geometric forms.

For this purpose a new method of more accurate and reliable processing of curvilinear surfaces of optical elements (concave, convex, spherical, cylindrical, etc.) was developed (Fig. 1, 2) [13].

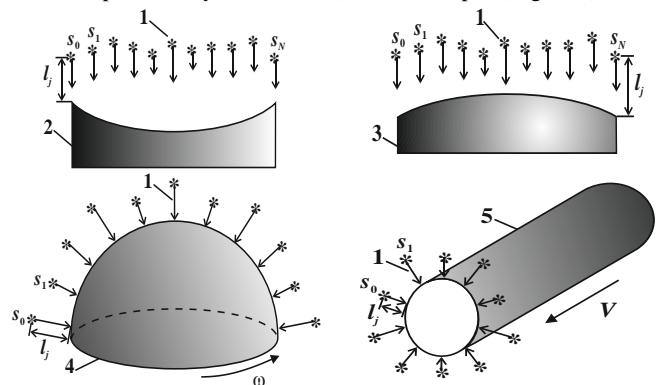


Fig. 1. Scheme of processing method of curvilinear surfaces of optical elements with the help of the system of discretely placed fixed electron beams (1): concave (2) and convex (3) surfaces; semi-spherical (4) and cylindrical (5) surfaces; s_0, s_1, \dots – the system of electronic beams, which are located at different distances l_j ($j = 0, 1, \dots$) from the processed surface; ω, V – angular velocity of circulation of the half-spherical element and the advance rate of the cylindrical element in the processing area, which provide the distributed thermal influences on their surfaces.

The point of this method is the following (fig. 3): the curvilinear surfaces of optical elements are placed at distances l_j ($j = 1, N, N$ – the number of beams) from the system of discretely placed occasional electron beams (s_0, s_1, \dots, s_N), which provide the specified distributions of thermal influences on the surfaces of

optical elements: concave and convex surfaces; spherical and cylindrical surfaces. Semi-spherical elements, for example, can move in the processing area with angular speed of rotation of ω , cylindrical – with the feed velocity of V .

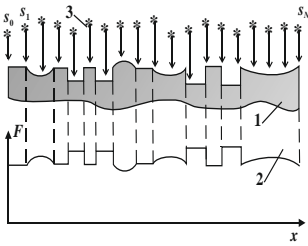


Fig. 2. The scheme of creation method of functional microprofiles on the surface of optical elements of complex geometric shape with the help of the system of discretely placed fixed electron beams: 1 – specified microprofile on the surface of the element that is obtained through its processing by the system of occasional electron beams s_0, s_1, \dots, s_n with different parameters; 2 – complex spread thermal influence along the surface of the element $F(x)$, which must be realized by optimizing the parameters of beams and their quantity.

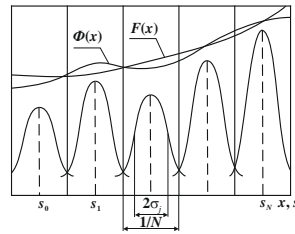


Fig. 3. Schematic representation of approximation to the given distributed thermal influence $F(x)$ along the surface of the optical element of the totality of discretely placed stationary sources $S_j (j = 1, N)$ of thermal influence of Gaussian type $\Phi(x)$.

According to the probing results the distribution of the density of thermal influence of j - ($j = 1, N$) of electron beam along x coordinate of the processed surface of the element is described by Gauss law:

$$F_{nj}(x) = \frac{1}{B \cdot \sqrt{\pi}} \cdot \sum_{j=1}^N \frac{I_{yj} \cdot V_{yj}}{\text{erf}(a_{rj})} \cdot \sqrt{k_{0j}(I_{yj}, l_{ij})} \cdot e^{-k_{0j}(I_{yj}, l_{ij})(x-s_j)^2} \quad (1)$$

$$\text{erf}(a_{rj}) = \frac{2}{\sqrt{\pi}} \int_0^{a_{rj}} e^{-t^2} dt \quad (2)$$

where B is the width of electron beams ($B = 6 \cdot 10^{-2} \dots 8 \cdot 10^{-2}$ m); I_{yj}, V_{yj}, k_{0j} are currents, accelerating voltages and beam concentration coefficients; $k_{0j} = \frac{1}{2\sigma_j^2} = a_{0j} + a_{1j} \cdot l_{ij} + a_{2j} \cdot I_{yj} + a_{3j} \cdot I_{yj} \cdot l_{ij}$; $a_{rj} (r = 0, 4)$

are empirical constants.

The amount of discrete sources N and parameters I_{yj}, V_{yj} та $l_{ij} (j = 1, N)$ are chosen such, that the approach to a specified distributed thermal influence $F(x)$ along the surface of the optical element by the totality of discretely placed fixed sources $s_j (j = 1, N)$ of thermal influence of Gaussian type $\Phi(x)$ would be minimal:

$$S = \sum_{i=1}^M \left[\frac{1}{B \cdot \sqrt{\pi}} \cdot \sum_{j=1}^N \frac{I_{yj} \cdot V_{yj}}{\text{erf}(a_{rj})} \cdot \sqrt{k_{0j}(I_{yj}, l_{ij})} \cdot e^{-k_{0j}(I_{yj}, l_{ij})(x_i-s_j)^2} - F(x_i) \right]^2 \rightarrow \min_{N, I_{yj}, V_{yj}, l_{ij}} \quad (3)$$

As a result of the conducted numerous experiments for the defined distributions of $F(x)$ (uniform, parabolic, hyperbolic, etc.) it is found that, for example, for $N = 5 \dots 7$ the approximation of the total $\Phi(x)$ from the occasional beams to the specified $F(x)$ is reached within 3...5 % in real-time. It is also shown that by increasing the number of sources of electron beams (up to 50... 70) high accuracy can be achieved (relative error to $10^{-4} \dots 10^{-5}$) and compliance with the specified distributed thermal influences along the processed curvilinear optical elements of the specified geometric shape.

Using the obtained dependencies (1) – (3) one can technically implement the developed method in the form of automated control system of technological process of electron-beam processing of surfaces in optical elements of different geometric forms and creation of functional microprofiles on them.

Electron beam processing of elements surfaces from piezoelectric ceramics.

Modern production technologies of piezoelectric products are based on the known methods of mechanical, chemical and chemical processing of the surfaces from piezoelectric materials, in particular ceramics.

The main drawback of these methods is the impossibility of getting high electromechanical and power characteristics of products from piezoelectric ceramics, which requires additional processing of these products. Thus, the imperfection of surfaces and the presence of micro and nanodefects in piezoceramic imposes restrictions on the effectiveness of the whole element base of piezoelectric elements of microtechnics. Above mentioned electron-beam technology was used to exclude the mentioned negative defects on the surface of elements from piezoelectric ceramics.

In the result of the conducted researches on the samples from piezoelectric ceramics ИТС-19 brand (disks with the diameter of $3,5 \cdot 10^{-3}$ m, 10^{-3} m thick) it was established, that microroughness of the surface decreases from 120...160 nm (fig. 4 a, b) to 95...105 nm (fig. 5 a, b) by electron beam processing.

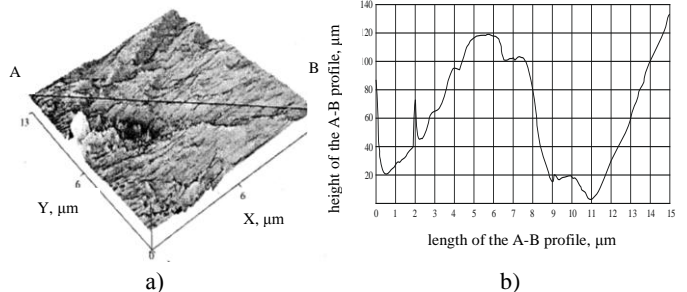


Fig. 4. Topogram (a) and the profile along A – B line of the scanned area ($13 \times 13 \mu\text{m}$) (b) of the piezoceramic element, which is not processed by electron beam.

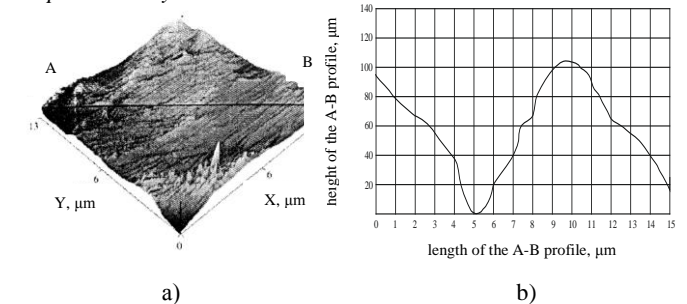


Fig. 5. Topogram (a) and the profile along A – B line of the scanned area ($13 \times 13 \mu\text{m}$) (b) of the piezoceramic element, which is processed by electron beam.

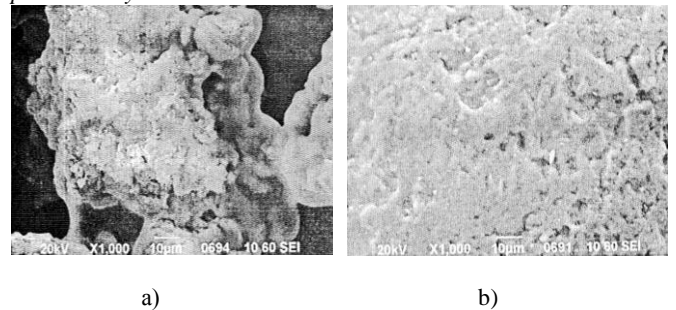


Fig. 6. Surface of piezoceramic element before (a) and after (b) electron beam processing.

It is shown, that after electron-beam processing there is a reduction of surface voidage of the piezoceramic element (Fig. 6): the average size of the voids of the output element is 15... 20 μm

and after electron-beam processing it decreases by 5... 8 μm . At the same time there occurs a removal of individual micro- and nanodefects on the surface of elements (up to 5... 10% microcracks with width to 5...7 μm and up to 50... 60% of voids), its microhardness increases by 0,5... 0,8 MPa. This results, finally, to the increase of their exploitation term, the increase of the electromechanical connection coefficient, the increase of the piezoelectric module and other operational characteristics.

Electron beam treatment of nanosized oxide coatings on the optical elements.

Nanosized oxide coatings, which represent the composition of oxides SnO_2 , Bi_2O_3 , TiO_2 , ZnO , SiO_2 , Al_2O_3 , are applied on the optical elements of precision instrument industry to improve wear resistance, reduction of radiation and convective components of thermal losses.

One of the methods of obtaining such coatings, which is widely used, is the method of thermal-vacuum deposition of materials, which allows to get nanosized (< 100 nm) coatings in the form of separate layers. The resulting coatings are heterogeneous, contain hidden microdefects (cracks, chips, etc.), the surface contains significant microroughnesses and low microhardness, etc. All this leads to a decrease in the performance of these coatings: their wear resistance decreases; the reflection coefficient in low temperature infra-red area and in the area of visible radiation reduces as well, etc.

For elimination of the mentioned drawbacks and improvement of the quality of these coatings, their electron beam processing was used.

As a result of conducted researches on the samples from optical glass K8 (the plates $6 \cdot 10^{-2}$ m long, $3 \cdot 10^{-2}$ m wide and $4 \cdot 10^{-3}$ m thick were used) it was found that after electron-beam processing of oxide coatings negative microdefects are not observed, and microroughnesses decrease from 30... 35 nm to 9... 15 nm (fig. 7, 8).

Conducted researches of the microhardness of the surface of optical elements with oxide coatings have shown its increase after electron beam processing: from 21,5...17,5 GPa to 24,9...23,7 GPa for Al_2O_3 coating; from 13,1...9,3 GPa to 15,9...14,7 GPa for ZnO coating; from 3,5...2,3 GPa to 7,1...6,3 GPa for TiO_2 coating (fig. 9). Thus for coatings, processed by electron beam, the influence of their thickness on to value of the microhardness surface diminishes by 30...40 %.

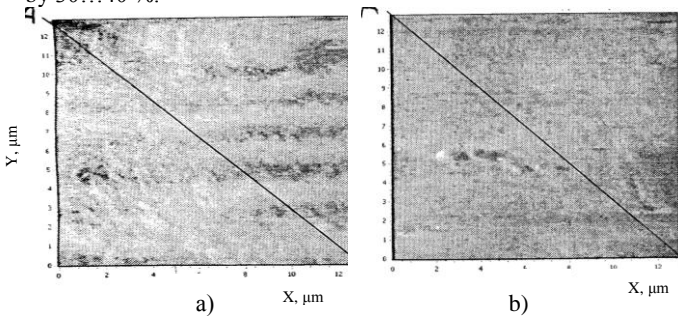


Fig. 7. Topogram of the surface area ($13 \times 13 \mu\text{m}$) of the optical element with TiO_2 coating before (a) and after (b) electron beam processing.

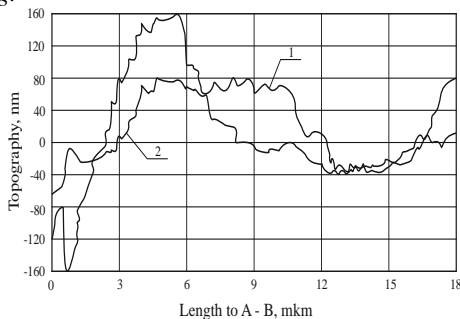


Fig. 8. Topogram along A – B line of the surface area $13 \times 13 \mu\text{m}$ of the optical element with TiO_2 coating before (1) and after (2) electron beam processing.

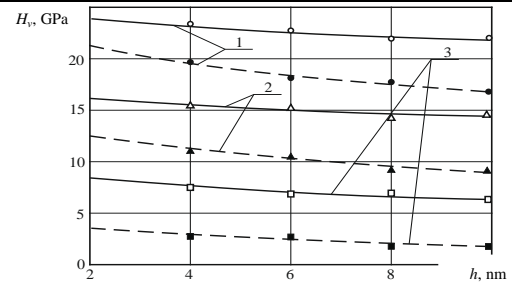


Fig. 9. Dependencies of surface microhardness of optical elements with oxide coatings Al_2O_3 (1), ZrO_2 (2) and TiO_2 (3) from their thickness: — — — after electron beam processing; - - - - before electron beam processing; Δ , \circ , \square , \blacktriangle , \blacksquare , \bullet – experimental data.

It is also found that after electron-beam processing of oxide coatings on the optical elements the term of their exploitation increases by 20... 30%. At the same time voidage of surface decreases by 5... 10% and their wear resistance rises up to 7... 12%.

3. Conclusions

Thus, in the spotlight of modern new technologies used in the optical-electronic instrument-making, electron-beam processing of elements from optical glass and ceramics, elements from piezoceramics, as well as optical elements with nanosized coatings from metal oxides is defined as potentially capable for quality processing of flat and curvelineal elements, obtaining functional microprofiles on their surfaces with the help of electronic beam system, which can be used as element base in microoptics, integrated and fiber optics, optoelectronics, functional electronics and other areas of precision instrument industry.

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CONCEPTUAL FRAMEWORK TO STUDY THE ROLE OF HUMAN FACTOR IN A DIGITAL MANUFACTURING ENVIRONMENT

КОНЦЕПТУАЛНА РАМКА ЗА ИЗСЛЕДВАНЕ НА РОЛЯТА НА ЧОВЕШКИЯТ ФАКТОР В ДИГИТАЛНА ПРОИЗВОДСТВЕНА СРЕДА

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Abstract: Nowadays, the dynamics of technologies development, as well as continuously growing customers' requirements, put industrial enterprises from around the world before the necessity of rethinking old strategies and building new dynamic business models, in order to successfully continue operating in today's conditions of a highly competent market environment. The digitalization takes a key position in this new scenario, where modern industrial enterprises should fit. Digital technologies, as well as the opportunities they create, are the main moving power, which enterprises should stake upon, to successfully raise their own efficiency. One of the biggest threats caused by the digital transformation of operations is for the people to be replaced by the machines. The present paper offers a conceptual framework of a methodology for investigating the role of human factor in a digital manufacturing environment.

KEYWORDS: HUMAN FACTOR, INDUSTRY 4.0, DIGITALIZATION, SMART MANUFACTURING, DIGITAL COMPETENCES

1. Introduction

The digital transformation, as a part of the Fourth Industrial Revolution (Industry 4.0), faces the industrial enterprises to the need for a change in the organizing and managing their operations system [1,2,3,4,5,6,7,8,9,10]. The driving powers of this change are Internet of Things (IoT), Internet of Services, Big Data, Cloud Technologies, Smart Objects etc. and they are the ones that transform working environment of the industrial. The people should be replaced by automated systems and robots in performing the routine and hard-work operations. This way, the flexibility and productivity of the operations system will be improved [11,12,13,14]. Namely, this exchange of people with machines/robots is considered to be one of the biggest threats caused by Industry 4.0. According to [15] during the period 2018 until 2020, 10% to 15% of the jobs are expected to fade away, which is a change much more serious than decades before – when, as a consequence of automation, 4% to 9% of jobs only have been dropped out. A recent research [15] shows that on an average of 71% of the total working hours in the different business branches are covered by people, and 29% – by robots. It is expected that by 2022 this average values will change to 58% for the workers, and 42% – for the machines accordingly [15]. In addition, according to [15], 62% of the tasks related to information search, processing and transmitting, are expected to be mainly assigned to and performed by the machines. Apparently, such fears have also existed during previous three industrial revolutions, which have caused perturbations of the labor market too, as well as emerging new jobs, professions and requirements for new qualifications.

Of course, the manifestation of this threat on a large scale now is caused mainly by the existence and application of the artificial intelligence. However, to reach the efficiency required, the artificial intelligence needs to be combined with the appropriate industrial experience, as well as the physical model of the machines themselves. That is, the role of the human factor should not be underestimated and neglected. It could be summarized that, as a result of the digitalization, a considerable change is expected in the field of jobs “distribution” among the people and the machines, having in mind following peculiarities:

(1) *Machines/robots acquire an increasing importance in running the operations system of the enterprise, as well as they become more and more autonomous (decision making at the lowest level) in performing tasks/operations they are assigned to;*

(2) *The place and the contribution of the human factor in the operations system is profoundly changed;*

(3) *The human-machine relationship goes to a new, “intelligent level”.*

Accepting the technologies as a threat for the labor is

becoming a key cultural issue, since inner opposition could be strong enough to vastly postpone putting operations into effect to the requirements of Industry 4.0. Industrial enterprises should elaborate a strategy to assist the process of digitalization in a way, avoiding stress for the working force.

It is important to note that digital transformation itself enables specific inherent human abilities to show up, such as *creativity, originality/innovation, initiative, agility, analytical abilities, criticism, abilities to intuitively solve complex problems* etc.

The abilities to convince and negotiate become more and more important. The emotional intelligence, leadership and social influence are incidental to the humans' qualities, and they are expected to be more deeply engaged in the professional areas since by now they could not be imposed upon the machines.

The above mentioned arguments require a research on the requirements laid by the digitalization over the working forces, and the way of their adaptation to the new environment.

The purpose of the present paper is to offer a conceptual framework for investigating the role and the place of the human factor in the process of transition to this new manufacturing model based on an intensive utilization of the new digital technologies.

2. Methodology Framework

An empirical study of the role of human factor in the conditions of the digital environment should be performed in two stages, as shown on Figure 1 [16,17,18]:

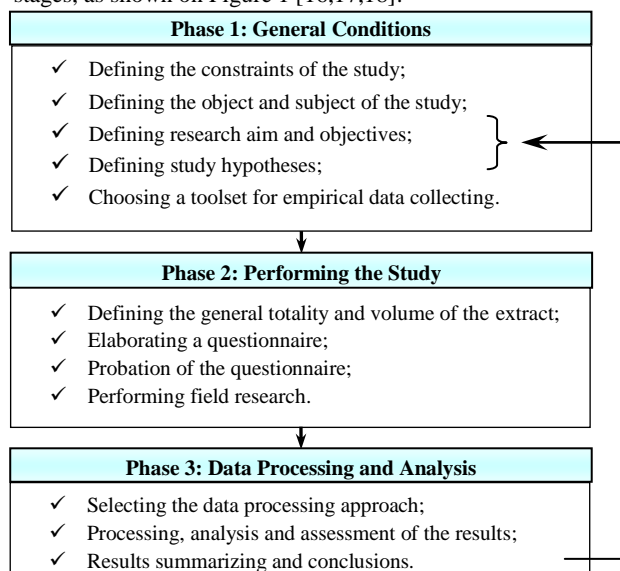


Figure 1. Common research methodology

Phase 1: General Conditions

✓ Defining Study Constraints

The study is intended to be held in machine-building enterprises. In order to narrow the focus of the study, a special attention will be paid on investigating the issues concerning system design, performance and management of the operations in a digital environment conditions and resulting from it peculiarities affecting the working force.

✓ Defining the Object and Subject of the Study

The *object of the study* is aimed to be the personnel responsible for managing and serving manufacturing operations, performed in the machine-building enterprises, such as production/operations managers, technologists, designers, machine operators etc.

Directly connected with the object is the *subject of the study*, namely – the issues arising from the role, place and requirements to the human factor in the conditions of a digital manufacturing environment.

Note: The decision to limit the study to investigate work force in the production/operations system of the enterprise is based on the fact that this system is affected to the greatest extent by the digital transformation and, as a consequence – its personnel.

✓ Defining research aim and objectives

By the present study, the author is aiming the following goals:

- To study the personnel's mood to the digitalization of manufacturing;
- To study the opportunities to lower the level of the risk for personnel's resistance to the digitalization of manufacturing;
- To investigate the factors enabling personnel's adaptation to the requirements of digitalization of manufacturing;
- To investigate the personnel's contribution in the process of digitalization of manufacturing;
- To investigate the human-machine relationship and its importance for an effective and efficient running of the operations system in a digital environment.

✓ Defining Study Hypotheses

With the present study, it is expected one of the following hypotheses to be confirmed or rejected:

- **Hypothesis 1:** „The effectiveness of the digital manufacturing system depends on the efficiency of the man-machine interaction“;
- **Hypothesis 2:** „The high degree of manufacturing processes digitalization requires a change in the human resource management strategy in order to achieve effective adaptation to the new manufacturing environment“.

✓ Choosing a Toolset for Empirical Data Collecting

For the purposes of the study, it would be appropriate a questionnaire to be used that is structured in a way to help achieving study goals.

Phase 2: Performing the Study

✓ Defining General Totality and Volume of the Extract

Defining the general totality of respondents and the volume of the extract is based on the well-known methods of mathematical statistics [19].

✓ Elaborating a Questionnaire

This chapter is going to ensure opportunity for a short presentation of the following groups of information:

Group A: Common presentation of the enterprise

Here, a short presentation of the factory under study is made – enterprise name, branch and performed activities, registration form etc.

Group B: Information about specifics of Industry 4.0

In this section some information is put about the need for knowing requirements, characteristics, technologies etc. that are prerequisites for achieving an effective manufacturing digitalization.

Group C: Information about manufacturing/operations system of the enterprise functioning

Here, a detailed information is included about technological infrastructure built, as well as to what extent any digitalization is achieved.

Group D: Information about personnel's readiness to accept the changes raised by the trend of manufacturing processes digitalization

This section provides information about personnel's perception for the changes and the extent to which it is ready for them. Also, it is important to provide information here about personnel's understanding about the need and effectiveness of the changes that are caused by the digitalization. This will enable an assessment of the risk for personnel's resistance to the changes.

As a part of this section, it is foreseen some instructions to the interviewer to be elaborated, as well as instructions to the respondents.

✓ Probation of the Questionnaire

The methodology advises a pilot study to be performed, aimed at testing the questionnaire, in order to make sure that the quality of the main field research will be guaranteed.

✓ Performing Field Research

During interviews, the instructions elaborated in the previous sections have to be fulfilled correctly, and respondents should also be introduced in general about the aims of the study.

Phase 3: Data Processing and Analysis

✓ Selecting the Data Processing Approach

To proceed and interpret the information gathered, methods from the mathematical statistics will be used, such as dispersion analysis, regression analysis, descriptive analysis etc., according to the situation specifics.

✓ Processing, Analysis and Assessment of the Results

Тук следва получените резултати да бъдат съпоставени с поставените изследователски цели, а също така да се потвърди или отхвърли верността на дефинираните хипотези.

✓ Results Summarizing and Conclusions

Here, the results of the study will be systemized, integrated and presented in a common strategy for a successful transition to a digital manufacturing through a collaboration by the personnel's side.

3. Conclusion

Instead of considering technologies invasion as a threat and replacement of human work force, it should rather be observed as a means enabling people to focus on these particular operations that add value.

Eventually, the man and the machine are not put on both sides of the barricade. Therefore, if both enterprises and workers get use of their chances, the co-existence of autonomous systems and people could initiate a new era in the world of labor, and the comprehensive approach to the planning, training and improving the work force is the key to the effective management and development of the trend to the digitalization.

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IMPROVING LOGISTIC PROCESSES IN THE PRINTING HOUSE IN THE CONTEXT OF THE "INDUSTRY 4.0" CONCEPT

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Abstract: The research in the field of logistic processes in the printing house will be focused on defined the improvement in the context of the „Industry 4.0” concept. In the industry, the growing complexity of production makes logistic processes more and more important. In every printing house industry certain processes which are implemented in the sphere of production can be systematized. The study will focus on the importance and goals of logistics processes; distribution; logistic chain; analysis of the efficiency of processes; selection of suppliers and organization of deliveries, creating networks of cooperators in the enterprise; computer support of processes at production; designing logistic systems. The study will present logistic processes in the printing house based on the „Industry 4.0” concept. "Industry 4.0" is often identified in the first place with the digital transformation of production systems - their digitalization. The production sphere is also moving towards increasing digitalization, first and foremost by using wider applications: data management (Big Data), and above all effective acquisition (via various types of sensors) and analysis of data; automation, e.g. the combination of traditional manufacturing methods with artificial intelligence, allowing to reduce errors and costs; communication using broadband links to connect the whole value chain; digital communication with clients. The conclusion of the research will be providing improvements of processes in chosen printing industry analyzing the solutions of the "Industry 4.0" concept.

KEYWORDS: LOGISTICS; LOGISTIC PROCESSES, PRINTING HOUSE; INDUSTRY; INDUSTRY 4.0

Introduction

The importance of the industry for global economies is enormous therefore companies are still looking for new solutions that simplify production processes and reduce costs and minimize the terms of order deadlines. For companies located in Europe where labor is a high cost, shortening the production cycle is very important from the perspective of the company's competitiveness.

Therefore, each of the world's distinctive economies runs its own industrialization strategy. In China, in accordance with the government FYP program (Five-Year Plan / 11-16) each "western" investment should result in a research and development center serving the development of the transferred technology. In turn, in the United States innovation is the main development strategy. In this country exists an efficient system supporting research and development based on cooperation between academic centers and business. Whereas in Europe, especially in Germany appeared the concept of creating a "smart factory" (digital factory), the assumptions which describe the concept of "Industry 4.0" which aims to connect industrial processes and digital technologies.¹

In the logistic sense, this means moving away from the value chains and preferring temporarily created virtual physical cyber networks.² The production sphere in printing houses is heading towards digitization, using the following facilities: Big Data efficient data acquisition and analysis; automation is the integration of artificial intelligence into traditional production in the printing industry, will be discussed in greater detail later in the article; digital communication with clients.

The quintessential concept of "Industry 4.0" is the Internet of Things, which is to integrate people, products and machines into one unit in order to deliver the packaging which is final product expected by the customer and with satisfaction for the printing house in terms of production and cost.

Currently, it is estimated that the implementation of the "Industry 4.0" concept will achieve by 2025 an additional total profit of 260 billion euros.³

The table shows the Industry section from 1.0 to 4.0 with assigned duration, technology, production system and different markets.

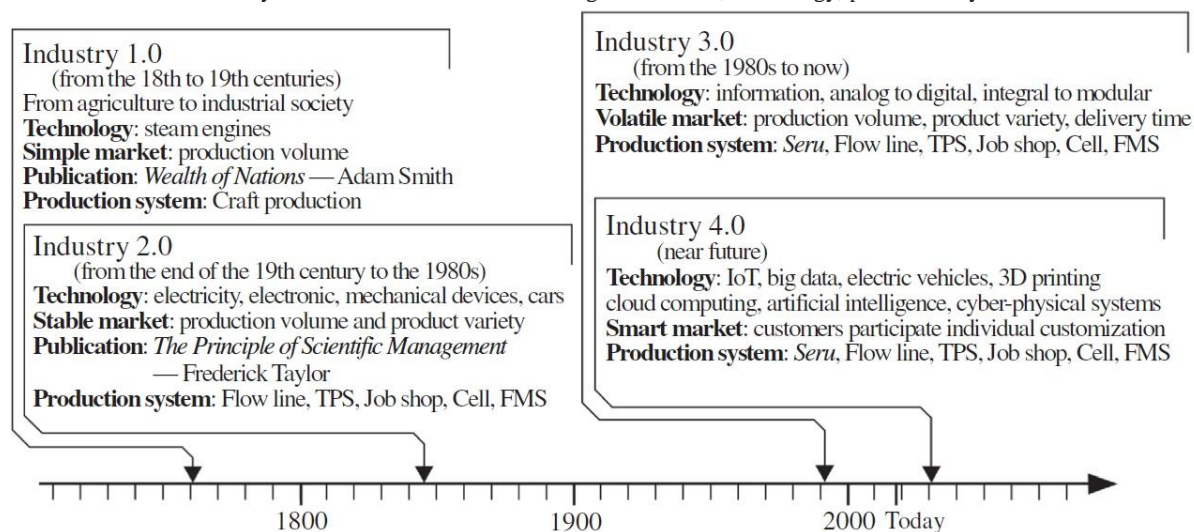


Figure 1. Time line of Industry 1.0-4.0⁴

¹ B. Woliński, The concept of "Industry 4.0" as a strategy for reindustrialisation and implementation of next generation production processes

² M. Wyrwicka, Revolution or evolution in logistics?

³ Consultants R.B.S. (2015) The Digital Transformation of Industry, Roland Berger Strategy Consultants, Berlin

⁴ Yong Yin, Kathryn E. Stecke & Dongni Li, The evolution of production systems from Industry 2.0 through Industry 4.0

Logistics processes in printing industry

In order to meet the demands placed on the market, new technologies are being created to increase efficiency, decrease the price and improve quality. Most of data in printing house is sent via Internet. A modern printing house is one that is equipped with a modern machine park but is it only that? What is also important is a tightened relationship with the customer, flexibility to meet client's requirements and environmental protection including lower energy consumption. In doing so, it is necessary to improve the logistic processes existing in the enterprise, on the most important ones we will focus below.

Distribution of ready-made packaging in the packaging printing house is delivered directly to the final customer or to the buffer warehouse. Often, deliveries are defined, for example, 2x a week under customer demand. Once a week, the customer sends an EDI call to the current call off which often changes the day before the planned delivery. Therefore it is essential role to be in close contact with the customer and change the demand depending on the customer's planned production and analyze data EDI and compare it with packaging which are on stock. The analysis of the EDI sent by the customer with the planned collection of packaging plays a significant role and decrease inventory levels secured in the event of sudden changes in production plans.

Analysis of the efficiency of processes using the ERP Print Manager System which is one of the most implemented system in printing houses in Poland, it is possible to analyze the profitability of each production orders and the efficiency of individual machines. Every station in each process in the printing house: printing machines, die-cutting and gluing machines are equipped with a computer with Print Manager system where all the data are collected and is associated with the entire system. Therefore, customer service have current access to data in the system and can check in what production process the order is located at the moment. Additionally, when the production order is completed, it is possible to analyze the reason in case the production costs were too high.

Selection of suppliers and organization of deliveries The company needs to have a systematized group of suppliers. The main suppliers for the packaging printing houses are paper manufacturers and wholesalers. Depending on the order and the date of its implementation, the technologist or person from the customer service department decides where the raw material will be delivered from. Inks, varnishes and other articles directly related to printing are ordered on a regular basis within 24 hours delivery. Providers of industrial services (die-cut, matrix etc.) must establish partnerships with cloud solution providers and data analysis so that processes can proceed smoothly.

Creating networks of cooperators in the enterprise there is a common system in the enterprise which allows the employees to have access to the different modes of system depending on their permission. The communication within the company is conducted using instant messaging. Calculations in the system regardless of the person from customer service are made on the same formula previously created and constantly improved by the specialists. Technology cards for each product with access to technology, type and method of packaging, inventory of individual clients that interact and synchronize with system files from customers make it easier to check the position on the production for both side customer and customer service in the printing house. There is a platform available for customers to check stock levels, a list of structure drawings, each client has access to it after log in at any time.

Computer support of processes at production in the case of uncertainty regarding any of the processes, e.g. packaging, the knowledge can be copied from the existing product cards. In the case of the printing process and resumed work, all parameters are already in the system. In the case of new works, the knowledge of

the printer as well as the measurement of the color intensity of the densitometer are necessary. In the case of die-cutting and gluing machines the knowledge of the operators of machines is required, machines do not automatically adjust themselves.

Designing logistic systems Creating a system database and then adding data and streamlining processes by analyzing these data is essential to start improve communication and processes. The printing process is always preceded by checking and processing the artwork by graphics in Prepress department. With the help of solution- PREFLIGHT artworks are distributed to individual graphic due to the level of difficulty. However, the printing process is closely related to the data on the printing machine in the case of printing resumption this process is more efficient and the data is collected from the system. Automatization may apply to this sphere but only in theory. While printing the entire printout, optimizing the ink- color, type of different varnishes checking the sheets every 10-15 minutes is compulsory. Each of printing stages has a lot of inflammatory elements which may occur errors. The printing process for packaging is the most important process because of the raw material (cardboard) often accounts for more than 50% of the whole package price. Therefore, incorrect printing and significant color difference which may be visible on the shop shelves cannot take place during production process. Example is to check all the files prepared by the customers. Early detection of any errors can secure at the initial stage before further consequences: waste of time, material and money. To achieve that is essential to know the realities of the printing house in order to optimize the entire production process.⁵ Of course, there are existing printing houses where the transfer of graphic files takes place directly to the printing machine without work of people, on the responsibility of the customer.

Other solutions that streamline processes include placing sensors on gluing machine to verify barcodes and packaging identical assortments. This is used to eliminate errors in manual packaging when the graphics are similar, therefore the bar code is the only determinant that the packages differ from each other.

After sending packaging from the warehouse the invoices are automatically issued in the system, the worker must only check them. Then, some clients have platforms on which they want to have invoices attached. In the future, there will be probably possibility to combine these systems and invoices will automatically pop on the client's platform.

As stated, in advanced technology, we are dealing with technological improvements in Research and Development Industry such as **3D Printing**, usage of **codes** from **GS1** standards to help to unify and streamline processes within the company or implement technological solutions to **automate production processes** such as inserter or conveyors and industrial trucks.

3D Printing is the process to create three dimensional object with material. Is used on a logistics system for spare parts to avoid stocking and is useful in Research and development industry to create e.g. appropriate packaging model.

Under the new regulation of the counterfeit prescription directive, from February 2019, the labeling of the packaging of these products will change. The bar code symbol will change from linear to two-dimensional and the individual serial number of the packaging will be added. The use of this solution in the supply chain will guarantee greater transparency of all stages of the supply chain and will give the opportunity to verify the origin of a particular product and will protect the patient. Inconsistent identification systems increase the operating costs, reduce the effectiveness of activities aimed at protecting European borders against counterfeits. GS1 standards are compliant with ISO and communicate with other standards in the field of health and e-health and are in line with trends in the European Union.⁶ The use of

⁵ <https://www.printnews.pl/znaczy-nowoczesna-drukarnia/>

⁶ A. Gawrońska-Błaszczyk, How to effectively and effectively implement the requirements of the so-called false directive in the field of a unique identifier.

conveyors and industrial trucks, inserters helps in shortening production processes, eliminating errors and reducing costs.

In doing so, we cannot ignore the essential role of technology, which allows the consumers received information very easily and fast to reduce errors. On the demand side, customers will increase their awareness through easy access to information from the printing house. The solution for further improvement of logistic processes may be applied neural networks, which will map recorded data in order to repeat process activities.

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THE IMPACT OF BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGY ON FINANCIAL SERVICES

ВЛИЯНИЕТО НА БЛОКЧЕЙН И ТЕХНОЛОГИЯТА НА СПОДЕЛЕН РЕГИСТЪР ВЪРХУ ФИНАНСОВИТЕ УСЛУГИ

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Abstract: *Blockchain and distributed ledger are terms that were "born" only in the last decade. Their appearance and growing popularity are associated primarily with the rapid development of Bitcoin and other cryptocurrencies. However, the capabilities of blockchain technology based on distributed ledger far outweigh the cryptocurrencies. The new technology is expected to trigger revolutionary changes in the financial services sector. The comparative profile of potential possibilities of and limitations on the application of blockchain in the financial sphere frames the nature of expected changes. Nevertheless, there are still a number of unresolved issues of technological, legal and ethical nature ahead of the mass application of blockchain technology. The formulated conclusions and recommendations provide guidance for successfully overcoming objective barriers to the application of blockchain and summarizing the prerequisites for a possible evolutionary leap in the development of the financial services industry.*

Keywords: BLOCKCHAIN, DISTRIBUTED LEDGER, SMART CONTRACT, FINANCIAL SERVICES, BANKING, FINANCIAL MARKET, PAYMENTS, TRADE FINANCE, INSURANCE, COMPLIANCE

1. Introduction

The effect of the future use of blockchain and distributed ledger technology in the financial industry is often compared to the revolutionary changes in the development of communications brought about by the Internet and social networks [14; 19]. These comparisons are based on the potential of this technology for increased transparency, cost-effectiveness, security and traceability of transactions. Tayeb & Lago define three key drivers for the expected "boom" in the application of blockchain in different sectors of the financial industry: reduction of costs, risk management and regulatory compliance [20]. The purpose of this paper is to clarify the capabilities of the application of blockchain and distributed ledger technology in selected segments of the financial services industry. The methodology of the study is based on an overview of the specialized literature and secondary data, based on which a comparative analysis of the current state and the expected changes from the application of blockchain in the selected segments is carried out. The results of the analysis show unambiguously that the financial services industry needs technological change, and blockchain undoubtedly has the characteristics of a creative technological tool with the potential to make these changes.

2. What are blockchain and distributed ledger and how they work?

There is a very close relationship between the terms Distributed Ledger (DL) and Blockchain, but the two concepts are not quite identical. *Distributed Ledger Technology (DLT)* is associated with an innovative approach to recording, sharing and storing data in multiple registers (ledgers). Moreover, this technology allows for the simultaneous synchronization of recorded and stored data among different users on a shared network. In fact, the idea of a distributed database is not new. "What is new with DLT is that multiple organisations are now further inspired to work together on a shared common, auditable database" [4]. *Blockchain* may be described as a technological data structure, used in some DL, which stores and exchanges data packed in separate blocks and interconnected in a digital chain. At least in theory, not all DL use blockchain technology by default [12]. The functional essence of a blockchain-based DL is that of a shared digital register which maintains identical copies of multiple computers controlled by different users. Blockchain uses encryption and complex mathematical algorithms for irreversible records and data synchronisation, which are protected against subsequent

manipulation. In the field of financial services, the responsibility for credibility, confirmation and storage of information about transactions is usually borne by third parties. These are most often institutional intermediaries carrying out clearing and settlement services. They maintain centralized databases with controlled access to information. The idea of using DLT is to make the history and complete chronology of transactions accessible and visible online for all authorized users on the network [3]. Each participant in a transaction has a valid copy of the records on the network, which may for example concern ownership of an asset and the full history of transactions carried out with it. The ledger operates as a fully decentralized system containing chronologically traceable information on each transaction [15]. In practice this means that there is no need for an independent centralized authority or an institutional intermediary to perform clearing, settlement, etc. [24]. Another important advantage of DLT is the accelerated settlement and the shortened time needed to perform transactions. This results in a significant reduction of transaction costs, because "operations are performed peer-to-peer between the corresponding parties rather than indirectly through trusted third parties" [10]. Another important point is the need for reconciliation, when transactions are posted in different ledgers. On this basis alone blockchain could reduce reconciliation and other infrastructure costs by \$ 8-12 billion a year among investment banks [1]. A fundamental principle of blockchain/DLT is the shared storage of information, with practically zero risk of data loss. The security of the transactions is achieved through the processes of authorization and encryption. If an individual so-called *node* in the system malfunctions, the information will not be lost irretrievably: it will be preserved in its completeness and integrity, because all other participants possess a copy of the exact same database. Moreover, DL records the chronology of the transactions, not just the end results (e.g. current balances), which protects the system against manipulation or falsification of data. The validity of a transaction is certified by the digital signatures of the parties to it. Signed transactions are arranged in separate blocks, and each block in the chain is assigned a unique *hash-code* generated by computers under a complicated mathematical formula. Any change to a transaction will alter the hash-code of the block where it is stored. Furthermore, such changes are simultaneously reflected in all blocks of the chain. Thus any change is immediately registered and becomes immediately identifiable and traceable by all participants on the network. The automation of the *Know Your Customer (KYC)* process is considered to be one of the most important advantages of using blockchain in the financial industry. Currently the average time spent by financial institutions on KYC-activities and on-boarding of

customers is more than 26 days [21]. This period can be substantially shortened through the use of digitized databases. Participants may conduct KYC activities in real time by establishing the digital identity of the corporation using the functionality of the DL database [11].

The idea of using *smart contracts* in blockchain fits appropriately in financial transactions where there is a link between performance of the contract and performance of real transactions. Nick Szabo coined the term "smart contracts" and used the comparison to a vending machine to illustrate the principle of their operation [18]. In the context of blockchain technology, smart contracts are computer programs recorded on DL, which are executed automatically by nodes on the network. According to Natarajan, Krause & Gradstein, "any instruction that could be executed by a computer could theoretically be run by a smart contract" [12]. What makes the use of smart contracts valuable is the possibility to remove the need for third parties, such as a trustee or an agent, to intermediate between the contracting entities. The combination of blockchain and smart contracts forces execution of transactions in accordance with the terms and conditions of the contract. This minimizes the likelihood of conflicts between the parties and opens the doors wide for automation of payment processes [4]. This autonomy, which lies at the base of smart contracts, allows for their independent operation without the need for routine control on the correct and proper performance of their clauses. Besides autonomous, "smart contracts are self-sufficient, which implies they do not depend on funding from their originator" [23]. From the foregoing it becomes clear that smart contracts constitute a series of self-executing contractual commitments which function by generating computer codes of contractual models of the type "if-then" [2]. One significant advantage is that they provide greater security and traceability of legally valid transactions, which also simplifies the tasks of regulatory authorities [15]. The key features of smart contracts are autonomy, self-sufficiency and decentralization. Along with automated execution of real transactions, the use of smart contracts in DL "seizes" the functions of the central register as there is no need for an intermediation to perform clearing and settlement through independent information confirming the transaction. Instead, smart contracts can be programmed to control the entire cycle: from negotiation to execution of the transaction without human intervention, while regulators receive up-to-date information on the relevant activity.

3. Results and discussion

Which are the areas or segments of the financial industry where there are preconditions for the application of blockchain? Table 1 is an attempt to summarize the criteria for applicability by key characteristics and parameters of the technology.

Table 1: Preconditions for applying blockchain in various sectors of the financial industry and expected benefits by key criteria

Key criteria	Preconditions for applicability	Expected benefits
Intermediaries	The presence of intermediaries is the result of distrust between the parties to the transaction Delays caused by the participation of intermediaries High fees	Removing or reducing the role of intermediaries Accelerating processes Reduced costs
Transparency	More than two parties are involved in the transaction Greater transparency would be beneficial for participants	Records in blockchain are irreversible and prevent manipulation and falsification
Data	The same information is stored in different locations by many participants Synchronization is a problem	Storing data in blockchain ensure the conformity and synchronization of data
Manual processing	The processes require manual data processing High costs for verification of data conformity	Automation of processes reduces manual processing and solves the problem of data identity
Trust	Various participants can change	Smart contracts

	the terms of the transaction There is a risk of fraud and falsification	prevent improper actions by a participant
Paperwork	Paper documents are predominant Burdensome document turnover	Much of the paperwork is rendered unnecessary
Time	Transactions are not executed in real time or require additional processing (settlement, clearing)	Transactions are executed in "near real time" or the time for settlement is shortened

Source: Adopted according to Deloitte (2017) *Blockchain in Banking*

It is believed that a particular sector of the financial industry has the preconditions for use of blockchain if the defined preconditions exist for most of the selected criteria (in column 2 of Table 1). For example, a segment of the financial market would be suitable as a "field" of application of blockchain, if the following circumstances exist: burdensome document turnover between parties, predominantly manual processing of transactions, slow settlement, possibility for different parties to change the terms of the transactions and lack of transparency in their negotiation. Based on this approach, the following text deals with certain specific segments of the financial industry which are expected to implement blockchain. Table 2 summarises the problem areas in selected sectors of the financial industry, and the positive effects expected from the application of blockchain.

Table 2: Comparative profile of the current state in selected sectors of financial services and the expected effects of the application of blockchain

Current state	With blockchain
<i>Trade Finance</i>	
Cumbersome procedures Complicated documentation Multiple stakeholders involved Burdensome document turnover between parties Manual processing of transactions	Automation of processes Automatic refreshment of clauses Operational security Reduce time and costs Expedited deliveries Unnecessary intermediaries
<i>Global Payments</i>	
Serviced by a third-party clearing mechanism Heavy procedures: payment initiation, bookkeeping, transaction reconciliation, balance reconciliation High expenses Lengthening the payment process	Track the full transaction history Define the role of all parties involved Reduced operational costs High security processing Faster execution of transactions Greater clarity and transparency
<i>Capital Market</i>	
Many different external clearing and settlement systems High counterparty risk Existence of a chain of intermediaries in some transactions Slow issuance procedures Slow and inefficient reporting of transactions	Speeding up and ease the execution of contracts Reduced counterparty risk Higher efficiency and transparency Conceptual change in issuance, clearing, settlement and reporting More efficient investment management and data storage
<i>Syndicated Loans</i>	
Low degree of transparency concerning the syndicate formation and loan pricing Too slow settlement High costs of servicing Manual processing of documentation Manual synchronization of data	Increased transparency Reducing transaction complexity Increased operating efficiency Automatic compliance with local regulations Enhanced KYC procedures and fighting money laundering
<i>Insurance</i>	
Many stakeholders are involved A complex procedure for declaring damage and paying insurance Heavy document turnover Predominant manual processing of the documentation	Lightening of procedures Use of smart assets Faster movement of the claims Elimination of intermediaries Minimization of insurance fraud Automated payment
<i>Regulations and Compliance</i>	
Growing transfer of information Difficulties to synchronize data Difficulties in AML processing Processing multiple reports from participants is required	Providing up-to-date and reliable information Easy tracking of origin of funds Minimize manual processing and analysis of information

Source: author's construction

Basic *Trade finance* instruments such as Letters of credit, Bills of exchange and Commercial papers currently are characterised by cumbersome procedures, complicated documentation, multiple stakeholders involved, burdensome document turnover between parties and the predominantly manual processing of transactions. The advantages of blockchain in this industry, where short-term bank intermediation in the trade is estimated at 6-8 trillion US dollars, are indisputable [20]. The implementation of blockchain and smart contracts would have a very positive impact on the spending of time and resources, by simplifying procedures through automation. Part of the intermediary chain such as multiple correspondent banks becomes unnecessary, which results in higher operating efficiency and reduced costs [6].

In the field of *Global payments* the advantage of blockchain is the possibility for each participant in the payments to track the full history of a transaction and the role of all parties involved. Current payment systems achieve this at the cost of higher expenses for exchange of unencrypted data and messages between participants in the payment process. Interbank payments currently rely on the services of third party providers of clearing mechanisms. Intermediation in clearing and settlement extends and makes expensive the payment process, as it requires activities such as data storage, coordination, initiation, validation, execution and reporting of transactions, etc. [9]. The process of data exchange in DL is significantly relieved from administrative procedures and manual processing of information, which reduces substantially the operating costs. In addition, the payment process is much safer and faster thanks to the encrypted identification of participants and the inability to deliberately manipulate data.

Modern *capital markets* are based on multiple clearing and settlement systems. A study by Goldman Sachs Investment Research shows that capital markets can save 6 billion US dollars annually through the use of blockchain [7]. The study was limited to four cash instruments, and therefore the real cost savings are expected to be higher. Transactions using blockchain could radically transform capital markets trade, which is built on tools with standardized attributes, such as maturity, nominal value, coupon, payment date, etc., all of which in turn can be components of a smart contract. This will contribute to forcing and facilitating the performance of arrangements and agreements between the parties to the transaction. Derivative contracts are also built on specific parameters, which can be transformed into a smart contract through algorithms for calculation of mark-to-market value, margin, options and conditions for exercise. In the case of swaps and over-the-counter derivatives, where each contract is unique, their specific algorithm can be embedded in certain smart contracts. The use of DL could be appropriate for trade in certain hybrid instruments such as "CoCo" bonds (contingent convertible bonds), which are characterized by a complex structure that combines elements of debt financing and own resource [6]. Blockchain changes conceptually the issuing activity, the processes of notifying and updating current balances, clearing, settlement and reporting, which increases the efficiency of investment management and information storage.

Several studies share the belief that blockchain will find favourable conditions for use in *syndicated loans* [17; 22; 2; 13]. These expectations are based on factors that adversely affect the performance of this market, namely the low level of transparency of the processes of forming a banking syndicate and pricing of loans; the slow settlement procedure and the higher costs for administration and maintenance of syndicated loans [2]. By using the DL architecture of the blockchain technology banks can combine into one block heterogeneous tasks such as local regulations, KYC or prevention of money laundering. The banks in the syndicate will benefit from increased transparency and reduced complexity of transactions, reduced KYC time and costs, as well as compliance with local regulations. Overall, the benefits of blockchain for banks participating in syndicated loans include enhanced security, shortened time for carrying out transactions, lower transaction costs and increased operational efficiency [16].

The application of blockchain in some areas of *insurance* is also possible, as this activity is characterized by the financial risk of loss and damage. This is particularly relevant in the field of property insurance, which currently involves, besides insurer and insured, a variety of other stakeholders such as reinsurers, brokers, supervisory and regulatory authorities and data processing organizations. Verification of submitted data, the presence of intermediaries and the possibility of fraud burdens the process of assessing the amount of damages and payment of the sum insured. The administration of these processes could be eased through the use of smart assets, which through sensors and other external sources can automatically report any damage and lodge claims for compensation. On the other hand, the use of smart contracts would lead to the removal of middlemen in the chain and contribute to the faster administration and processing of claims. Perhaps the most significant advantage of this new technology is minimizing the attempts to commit insurance fraud and falsification. The insurer will have guaranteed access to integrated information sources about all details of the history of the claims and the origin of the insured asset, which is a prerequisite for identification of suspicious behaviour on the part of the insured [11].

Last but not least, blockchain is expected to streamline the activities of the authorities and institutions of the financial market in the field of *Regulations and Compliance*. Maintaining compliance with the standards and regulations has become a daily routine for financial institutions. Audit, tax reports, stress tests and harmonization of activities with regulatory requirements are an important part of the functioning of today's global financial market. The constantly growing transfer of information obtained from various sources, participants and channels hampers its processing and synchronization by regulators. Blockchain could significantly ease the work of regulatory and supervisory authorities by providing them with constantly updated and reliable information about the transactions [8]. One of the greatest socially significant benefits from the introduction of the new technology for the supervisory activity is associated with Anti money laundering (AML). Regulators will be able to easily track the origin of the funds and the history of the transaction in DL, without their having to request and process the numerous statements and reports of the participants in the transaction.

Despite the expected positive effects from the application of blockchain and DLT, some concerns for the disruptive potential of the new technology cause tension among financial intermediaries. For example, the introduction of a new technology such as blockchain, which threatens the status quo of the so-called "systemic" market players, is expected to meet their fierce resistance. There are concerns among financial intermediaries, quite correctly, that the application of blockchain may push them away from the market and result in financial losses and even bankruptcies. In addition, large-scale application of blockchain faces other unresolved issues of technological, legal, regulatory and ethical nature. These challenges can be summarized as follows:

- Although DL records are credible and irreversible, there is still no detailed legal regulation of the matter. If, for example, two financial institutions are in dispute or litigation, it is unclear how this will affect the status of their transactions in DL. The necessary legal framework will also enable regulators to exercise effectively their supervisory functions.
- Automation of KYC activities can be achieved only if the partners reach agreement on the building of a unified rating system.
- The assessment of the costs and benefits of the use of this new technology may substantially differ between different financial players. This may call into question the benefits of cooperation between the participants and the return on investment in technology.
- Many issues of moral and ethical nature concerning the substitution of computer algorithms for the human factor remain unresolved.

4. Conclusions

The financial services industry needs technological changes and blockchain undoubtedly has the potential to make these changes. The specific procedures required by certain complex financial products, which include a chain of intermediaries, and the still prevailing manual processing of documentation, burden the transactions with additional costs and make the process inefficient. The results of the analysis of key functional parameters of blockchain and DLT show that they have gradually transformed from a purely technological tool into a concept of survival and an important part of the development strategies of the financial industry. The comparative profile of the potentials for and the limitations on the application of blockchain in the financial sphere frames the nature of the expected changes. The successful overcoming of obstacles to the application of this technology is a challenge and a prerequisite for an evolutionary leap in the development of the financial services industry. From this point of view, appropriate measures can be taken in the following order:

- 1) Test pilot projects in real market conditions using DLT in selected segments of the financial industry;
- 2) Establish the necessary legal and regulatory framework for the functioning of blockchain;
- 3) Launch initiatives to develop a unified rating system that allows automated KYC process.

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FIRST WORK ON COLLABORATION BETWEEN HIGH SCHOOLS AND UNIVERSITY BY HOLDING WORKSHOPS

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Abstract: In May 2018, we held the 1st International Workshop. In this research, we reported the case of collaboration between high schools and universities on holding workshops together, and the effects of learning through participation from high school age through to university students, and lecturers.

Keywords: INTERNATIONAL WORKSHOP, UNIVERSITY, HIGH SCHOOL, COLLABORATION

1. Introduction

In recent years the field related to engineering, electrical and electronic engineering has been rapidly developing throughout the world. As the humankind has continued to develop leading-edge technologies, students who graduate from universities in engineering and start working for companies or laboratories as engineers, require the opportunities to acquire new skills and develop new devices globally. In the process of development of technology, engineers need to attend meetings, discuss matters, make presentations, and negotiate with people from various countries. It is necessary for engineers to have not only professional knowledge and technical skills but also communication ability, the ability to think for themselves, and the skills to exchange their ideas to create something new with their colleagues. Recently, many educational institutions in Japan have been seeking to introduce new types of classes for improving the communication ability, logical thinking ability, problem-solving ability, and expressiveness of students through training in making presentations.¹⁾

Today, with the dramatic progress of science and technology and due to the rapid globalization, engineers and researchers are requesting more capabilities than before such as wide range of scientific knowledge, logical thinking and problem-solving skills, expressive ability, communication skills, presentation skills, etc. The "communication ability" is the one that many companies emphasize on.²⁾

Workshops on Education and Research of Electronic Device, Circuits, Illuminations, Systems and other fields, sponsored by the Chugoku Branch of the Illuminating Engineering Institutes of Japan, co-organized by the Chushikoku branch of the Japan Society of Applied Physics, Chugoku district and the neighboring universities and academic organizations with the cooperation of the Shikoku region, were conducted - a domestic workshop³⁾ and an international workshop in May 2018.⁴⁾ In the workshops where university and company lecturers and students attended, we were able to answer questions after presenting at participating college and graduate students at local workshops. Since that year, we started planning an international workshop so we could increase the number of venues and start collaborating with high schools. In this work, we reported cases of collaboration between high schools and university when holding workshops, learning effect on high school students by university students' and lecturers' attendance.

2. Purpose of the Workshops

We hold workshops on educational research in electronic devices, circuits, lighting, systems and other fields. First, as a domestic workshop for neighboring universities, we mainly conducted oral presentations related to educational research by students, graduate students, and social workers, as well as poster sessions in electronic devices, circuits, lighting systems and in other fields, discussions on the methods of educational research. As a

next step, we will hold domestic workshops to discuss the education and research methods in these fields concerning companies, universities, junior high schools and high school science, technology and industry.

Through holding workshops, presenters can exchange information on the present situation and problems of science and technology, education and research at junior and senior high schools, including enterprises, universities, etc., and their solutions and goals. In addition, it is an opportunity to share information on various teaching materials used for education and teaching materials produced by themselves, how to create and utilize them. Furthermore, mutual collaboration with junior high schools, high schools, universities and companies will deepen, and it will be expected that momentum will be developed and expanded to promote science and technology, education and research throughout the region.

3. Program and implementation status

An international workshop held in Hiroshima venue, Kure venue, and Fukuyama venue as follows:

1. December 7, 2018, Kure Venue (Yamato Museum) including:

- Opening Declaration 14:00~14:03 h
- Keynote Speech 14:04~14:34 h
- Oral Presentations 14:35~15:22 h
- Poster Session (in Japanese) 15:23~17:00 h

The workshop at the Kure venue began with the opening declaration by the executive committee, and 72 people participated (1 from Thailand, 1 from Taiwan, 70 from Japan). There were one keynote lecture, four lectures in English and five poster presentations in Japanese, followed by active discussions (questions and answers) on electronic devices, circuits and systems, other education and research methods, etc. The workshop activities at the Kure site ended with a greeting by the chairperson.



Fig. 1 Lecture in English.

2. December 8, 2018, Hiroshima Venue (Hiroshima Institute of Technology):

- Opening Declaration 10:00~10:03 h
- Keynote Speech 10:04~10:34 h
- Oral Presentation (in Japanese) 10:35~11:46 h
- Poster Session (in Japanese) 13:00~14:00 h



Fig. 2 Keynote lecture by S. Anantathanasarn of Furukawa FIFTEL (Thailand).

The workshop at the Hiroshima venue started with the opening declaration by the executive committee chairman, and there were 56 participants (1 from Thailand, 1 from Taiwan, 54 from Japan). The presentations included: 2 keynote lectures, 2 general lectures in English, 6 lectures in Japanese and 14 poster presentations in Japanese, there also were many questions and interesting discussions on electronic devices, circuits and systems, research and educational methods, etc. A greeting by the vice chairperson was at the end.

2. December 8, 2018, Fukuyama Venue (Hiroshima Prefectural Cultural Center Fukuyama)

- Opening Declaration 14:00~14:03 h
- Keynote Speeches 14:04~15:05 h
- Oral Presentation (in Japanese) 15:06~15:17 h

The workshop at the Fukuyama venue started with the opening declaration of the executive committee chairman, and seven people participated (2 from Taiwan, 1 from China, 4 from Japan). There were two keynote lectures and one lecture in Japanese, together with questions and answers on the workshop topics and at the end there was a greeting by the vice chairperson.

In this international workshop, special prizes were given to Thai S. Anantathanasarn for the Keynote lecture, to Frederick Chan from Taiwan and to Professor Takeshi Tanaka from the Hiroshima Institute of Technology for the support of the participant's teacher relationship and careful deliberation. As a result, since the following announcement was recognized as an excellent announcement, an encouragement prize was awarded from the Chugoku branch of the Illuminating Engineering Institute of Japan. (General / University Student Division and High School Student Division).

Some high school students were also awarded the Encouragement Prizes as well as their teachers were awarded excellent teacher prizes: Hiroshima Prefectural Kure Mitsuta High School - Shohei Nakata, Yoshimasa Kawamoto, Midori Mukai, Hiroshima Prefectural Hiroshima Minami High School - Mayumi Tanaka, Hiroshima Prefectural Gion-kita High School - Katsumi Chiba. Finally, an excellent group prize was awarded to Hiroshima Prefectural Kure Mitsuta High School (Principal Marimi

Shojiguchi) which gave great cooperation in oral presentations by high school students, poster presentations and workshop planning and operation.

4. Status of workshop participation from high schools

4.1. Hiroshima Prefectural Hiroshima Minami High School

The students told the group that they won the award, "We have elaborated over time and made posters a number of times, but it was a lot of learning by summarizing the research. In the poster session, exchange with college students, college studies I got a chance to see it and it became a reference for those who came to see it and it gave me the opportunity to learn sanitary nursing department of Minami High School. Also got a lot of advice on research and got opportunity of participation for which I am grateful for." A group of hand massagers who seemed to throw in the middle also said, "I am thankful that the first grader got together and I was able to go to the presentation and it would be interesting to measure the pulse at the same time for those who came. I was trying to measure the surface temperature of the skin with a thermography and asked if I could hear that there was still room for improvement. "I felt a sense of accomplishment that I worked on until the end.

Six posters were presented at Hiroshima University and Hiroshima Institute of Technology and for students the contents closest to us were to be studied by way of holding perspectives, to summarize in the form of posters, to direct visitors. It was a valuable learning opportunity different from school, such as sessions can be done, for which I am thankful.

Also, from the students, "It was a valuable experience, leading to deepening my knowledge by requiring ingenuity to explain easily to people."

"Since I got a lot of opinions and questions at this poster, I wanted to make use of it for future activities."

"I myself did not make a poster presentation, but when I saw posters of other people, I found out the research of each group and the features of the poster, which I got help and I was doing interesting research. It was fun to listen. I thought about making the next poster more attracting to people."



Fig. 3 Poster presentation of students from the Hiroshima Prefectural Hiroshima Minami High School (general course).



Fig. 4 Poster presentation of students from the Hiroshima Prefectural Hiroshima Minami High School (Sanitary nursing department).



Fig. 6 Discussion during the oral presentation session (in English) with students from the Hiroshima Prefectural Kure Mitsuta High School (general course).

4.2. Hiroshima Prefectural Kure Mitsuta High School

Hiroshima Prefectural Kure Mitsuta High School and other schools are conducting "Social Exploration Project Learning (Social Exploration PBL)" in the comprehensive learning time of the second grade. In this activity, the students discovered the problems which Kure city has, and are exploring solutions. Also, Study by social exploration PBL, students learn how to approach "questions without answers" and cultivate thinking ability, judgment ability, expression power required for problem-solving in the real world.

With the participation in the academic conference this time, the students were able to improve the communication skills and presentation abilities to have others understand their thoughts. Also, by receiving indications and advices on the contents and presentation method from teachers and students, experts from companies and universities from Japan and abroad participated in the conference, I looked back on their learning and I felt motivation for deepening inquiries and sense of accomplishment for my learning in the future.

Initially, the students felt tension by making a presentation in English at the international conference, but we felt a sense of fulfillment strongly by challenging and appraising it boldly. In addition, through such announcement, learning and daily connection with society I feel attached and motivated toward realizing my own course is expanded. I strongly feel that I would like to cherish the opportunities for students to disseminate what they have explored in the future.



Fig. 7 Poster presentation of students from the Hiroshima Prefectural Kure Mitsuta High School (general course).



Fig. 8 Poster presentation of students from the Hiroshima Prefectural Kure Mitsuta High School (general course).



Fig. 5 Oral presentation of students from the Hiroshima Prefectural Kure Mitsuta High School (general course).

4.3. Hiroshima Prefectural Gion-kita High School

The Hiroshima prefectural Gion-kita High School Science Research Division has five teams of physics, chemistry, biology, earth science and mathematics, with about 30 members deciding themes in their favorite fields and conducting research.

At the research presentation such as universities and academic meetings held outside the school from autumn to winter, each group participates in high school students' department etc and challenges multiple presentations. Among them, students receive surprisingly transformed questions and advice from university teachers. In particular, understanding the intention of the questioner such as "why the questioner did such a question", the ability to think and organize and respond to themselves with their own heads will surprisingly grow. And as we look back on our research and excellence again, we are increasingly aware of the importance of research in the first place and realize that it has led to the realization of the course after graduation.



Fig. 9 DNA analysis experiment at the university laboratory and students from the Hiroshima Prefectural Gion-kita High School.



Fig. 10 Fossil collection at the Saijyo River and students from the Hiroshima Prefectural Gion-kita High School.

6. Conclusions

This work reported the outline of the 2nd International Workshop on Education and Research related to electronic devices, circuits, lighting and systems sponsored by the Chugoku branch of the Illuminating Engineering Institute of Japan. 4 speeches (lectures in English), 4 general lectures (in English), 7 general lectures (in Japanese), and poster presentations (in Japanese) were presented at the Hiroshima venue, the Kure site and the Fukuyama site. It was thought that interesting discussions and comments were held at all oral and poster presentations and the obtained results correspond to the purpose (section 2). Through high school students presented own learning outcomes in the session of high schools, it is thought to have had a good influence on them. In the future, it is expected to examine this good influence on both high school and university students.

In the future, we would like to make an international organizing committee of this workshop and to develop the international workshop. In addition, we would like to promote information exchange between high schools and universities by a system using secret sharing with high information security⁵⁾.

Acknowledgment

Support from The Ministry of Economy, Trade and Industry, Kure City, Shimane Prefecture Hiroshima Office, Shikoku branch of the Illuminating Engineering Institute of Japan, Hiroshima Institute of Technology and the sponsors- the Chinese Ministry of Economy, Trade and Industry, Hiroshima - Bulgarian Association, The Japan Society of Vacuum and Surface Science, Japan Society of Infrastructure Sensor System Security Special Investigation Committee are highly acknowledged. We would like to express our deep appreciation for the Kumaizasa Shuppan Co., Ltd. for cooperation. In addition, we would like to express our gratitude to the Hiroshima Prefectural Kure Mitsuta High School (Principal Marimi Shojiguchi), the Hiroshima Prefectural Hiroshima Minami High School (Principal Hiroo Onzawa), and the Hiroshima Prefectural Gion-kita High School (Principal Akinori Taruma) and ask them for cooperation in the future workshops. We would also appreciate the executive committee members by writing their names on the workshop website⁶⁾.

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NETWORK TECHNOLOGIES FOR E-LEARNING

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Abstract: In this paper are presented some conclusions on the selection of the LMS to be used. The results of this study give readers information to make their own decisions when choosing an LMS platform based on the needs of their institution. The process of LMS selection is a multi-criteria decision-making problem and an Analytical Hierarchy Process (AHP) was used to assist in building the model and draw decisions. The paper presents an environment "Network technologies for e-learning"(NTEL) using the offered Model for describing, structuring, and organizing the ontological representation of learning objects through providing a semantic infrastructure. Strategies and methodologies in ontology development and implementation are also discussed.

Keywords: LMS, LEARNING OBJECTS, ONTOLOGY, AHP

1. Introduction

The main goal of the research is to describe and structure ontology based learning objects and use for developing a uniform learning support environment considered with the requirements of the existing Learning Object Metadata (LOM) of IEEE Learning Technology Standards Committee (LTSC) [7] and the specification suggested by the Instructional Management System (IMS) [8].

The most serious problems are caused by the semantic evaluation process. There is a great variety of LMS. As far as evaluation is concerned, current platforms may be helpful to acquire tacit knowledge in organizations, but they do not solve the problematic of doing automatic semantic information. Thus, cooperative cognitive processes are not efficient and not found matching between LOs and student information. This makes the learning process to be impersonal, and not many users can keep track properly of their students' progress [1].

A possible solution might include a component model for network technologies for e-learning and its applications in NTEL to deal with this issue.

2. A Component Model for Network Technologies for e-Learning

The Component model for network technologies for e-learning was developed on the grounds of the existing standards, specifications and ontologies for creation, management, development, and interchange of learning objects and means and the existing instructional design theory. The key aspects of the learning support environment "Network technologies for e-learning" (NTEL) have been presented in the following components of the model:

2.1. A model for describing, structuring, and organizing the ontological representation of learning objects

Figure 1 depicts the composition of the model and the relationships between its modules. At the top of the figure, the Learning object is connected to the Metadata and Knowledge. The Standard Learning Object Metadata (LOM) contains various metadata describing the learning object. The LOM categories are connected with module Categories. A learning activity could be published (using LOM) and integrated in a learning object instructional sequence. A learning object can be created to be used in different courses, and its content can be created on many ways (e.g. using text editor, slide presentation creator, HTML editors, graphical tool, domain applications, etc.). Once created a learning object with its ontology-based content can be included in different courses [3]. We use LOs when a new instructional design is being constructed.

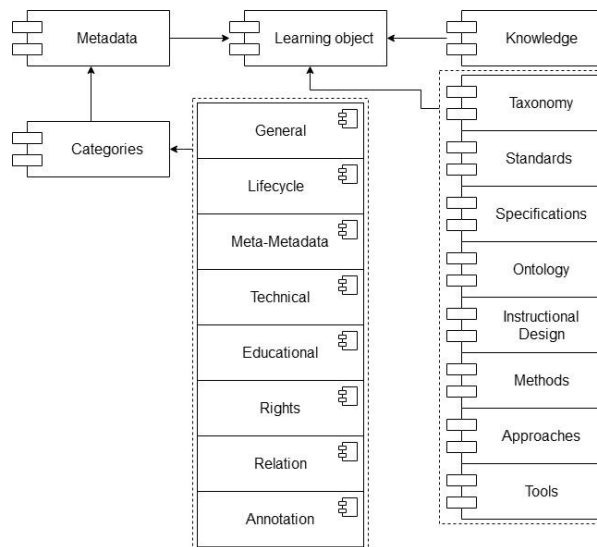


Fig. 1 A model for describing, structuring, and organizing the ontological representation of learning objects

2.2. Standards in Learning Object Ontology

In conformity with the IMS specification the environment content package includes two components – an XML file describing the course structure, called imsmanifest.xml and the physical files forming the course structure.

The XML manifest file consists of the following components: meta-data, organizations, resources, and a sub-manifest of each separate environment course. The meta-data are used for describing the content package and its characteristics in particular. The characteristics suggested by the Learning Object Metadata Standard are used in the environment grouped in the following order: general, lifecycle, meta-metadata, technical, educational, rights, relation, annotation, and classification categories. The learning objects stored in the Learning Repository can be found using the metadata. The organizations component shows the systematization of the course content. It includes several subcomponents describing the separate elements of the course. It does not include a description of the physical files but ensures an information work frame guiding the user in the consecutive implementation of particular actions.

The resources component describes the physical files used in the learning course and the relations between them. It shows features different from the organizations component.

The physical files include the following content: a course information, a theoretical material, tests, simulations, games, an interactive editor, and a glossary.

The IMS specification [8] allows placing the content package in the Package Interchange File. It is a single compressed file which can be used in different learning systems. By packaging the separate courses of the learning support environment presented in the

research they can be used independently in learning management systems.

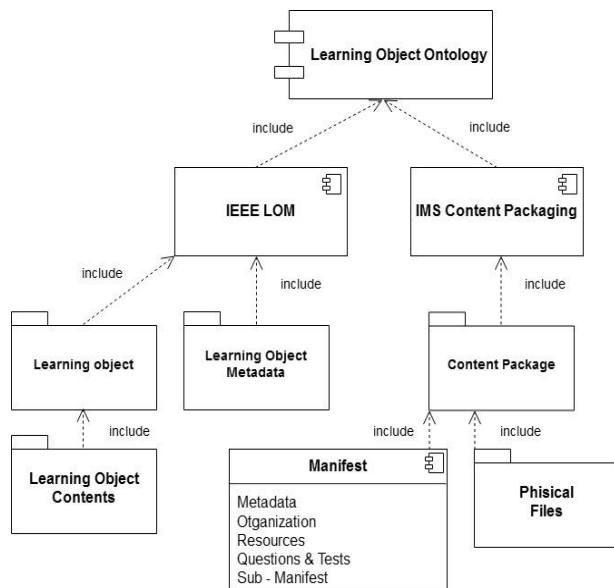


Fig. 2 Standards in Learning Object Ontology

We have designed and implemented a LOM ontology that establishes an intermediate layer offering a shared vocabulary that allows specifying restrictions and gives a common semantics for any application which uses Learning Objects Metadata. LOM aims at the abstract description of learning objects by providing an interoperable form and vocabulary for semantic learning objects description and discovery in repositories. Some of the technical aspects in the domain and instruction model provide input for the transformation to LOM. An ontology of a specific domain for a learning objects repository serves as a map and suggests paths for retrieving candidate learning objects to reach a certain objective of learning or teaching [1].

2.3. Application of Instructional Design for ontological organization of e-learning

The IMS Learning Design specification (IMS-LD) provides a model of semantic notation to describe both the content and processes of units of study. This specification is based on: a well-founded conceptual model that defines the vocabulary and the functional relations between the concepts of the LD; an information model that describes in an informal (natural language) way the semantics of every concept and relation introduced in the conceptual model; a behavioral model that specifies the constraints imposed to the software system when a given LD is executed in runtime [8].

The Learning Design has a number of components used to describe the learning process: the execution entities to be carried out, which can be *Activity* or *Activity Structure* (groups of activities that will be executed in sequence); the *Role* that participate in the execution of those activities as instances of the *Learner* and *Staff* concepts; and the *Environment* that describe the educational resources to be used in the activities (Fig. 3). These concepts constitute an exhaustive and disjoint partition, because an instance of a component must necessarily be an instance of one of its subclasses.

The Learning Design is related to the *Method* concept, which describes the dynamics of the learning process (Fig. 3): a method is composed of a number of instances of the *Play* concept that could be interpreted as the *runscript* for the execution of the unit of learning. All the play instances have to be executed in parallel, and each one consists of *Act* instances, which could be understood as a *stage* of a course or module. The *Act* instances must be executed in

sequence (according to the values of the execution order attribute), and they are composed by a number of *Role Part* instances that will be executed concurrently. A *Role Part* associates a *Role(s)* with an execution entity to be carried out in the context of the *act*. Every execution entity requires an *Environment*, which manages Learning Objects as resources. The execution of an act consists on the simultaneous participation of roles in an activity or group of activities, and once the activities are completed, the associated roles could participate in the execution of any other activity through different role part instances. The *Activity* has two subclasses: the *Learning Activity* and the *Support Activity*. A *Learning Activity* includes an educational activity that uses a relation with the *Prerequisite* and the *Learning Objective*. The *Support Activity* is introduced to facilitate a learning activity [6].

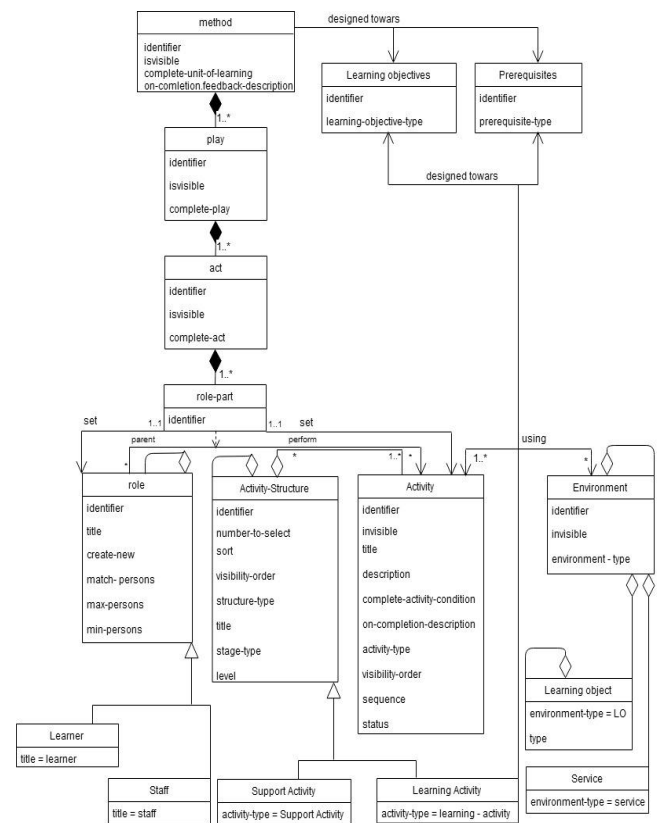


Fig. 3 Application of Instructional Design for ontological organization of e-learning

2.4. Web based learning support framework with scaffolding

The processes of supporting e-learning are presented on the fig.4.

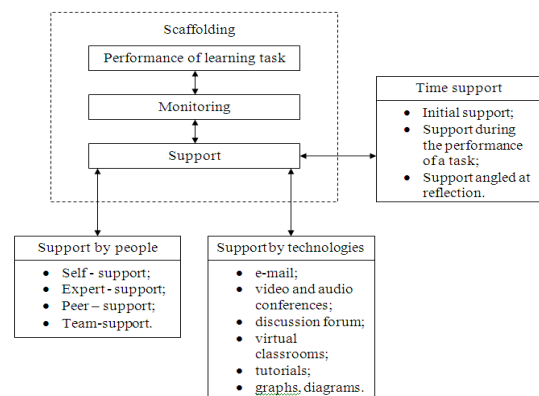


Fig. 4 Web based learning support framework with scaffolding

The support has been an effective and intensive way for individuals on users group to learn about the consequences of his behavior, for users group to improves its effectiveness, and for organization to monitor learner progress. Users receive on-going support from their personal tutor. When problems in task performance are expected and known beforehand, place support for these problems in the learning environment, so that the NTEL instead of the mentor becoming the main source of just-in-time support.

These decision aspects, provide a model for the categorization of learning support used in this research.

2.5. A model for E-Learning Network Technologies

The LMS must be guided by instructional design approach. This model (fig. 5) is theoretically motivated by socio-cultural approach and cognitive apprenticeship model for each element of the learning environment. While each form of scaffolding provides support, each differs in the level of social support, collaboration with peers and type of feedback offered. These forms of scaffolding with technology researchers are now developing more principled and innovative forms of instructional design to guide the process.

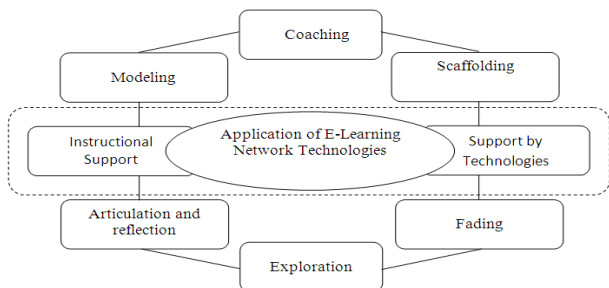


Fig. 5 A model for E-Learning Network Technologies

3. A multi-criteria decision-making approach

In recent years, most educational organization have preferred to use open source LMSs. They have to decide which LMS is suitable for them. Problems have been experienced when determining the features to be considered in selecting the most suitable LMS for their institutions due to the high number of LMSs available with different specifications. This has created a multi-criteria problem, which can be solved using a multi-criteria decision making approach (MCDM) [5].

Table 1 Summary of applications of the DM techniques [4]

Метод	Честота на приложение	Процент
AHP	128	32,57%
ELECTRE	34	8,65%
DEMATEL	7	1,78%
PROMETHEE	26	6,62%
TOPSIS	45	11,40%
ANP	29	7,38%
Aggregation DM methods	46	11,70%
Hybrid MCDM	64	16,28%
VIKOR	14	3,56%

The selection process is based on a literature review and classification of international journal articles from 2000 to 2014 [4]. MCDM provides strong decision making (DM) in domains where selection of the best alternative is highly complex. MCDM method has been applied to many domains to choose the best alternatives. Where many criteria have come into existence, the best one can be obtained by analysing different scopes of the criteria, weights of the

criteria, and the selection of the optimum ones using any MCDM techniques. Table 1 shows frequency of MCDM techniques and approaches. Based on the results presented in this table, a total of 393 studies have employed DM techniques and approaches. Table 1 and fig. 6 shows that AHP method (32.57%), and its applications have been used more than other tools and approaches.

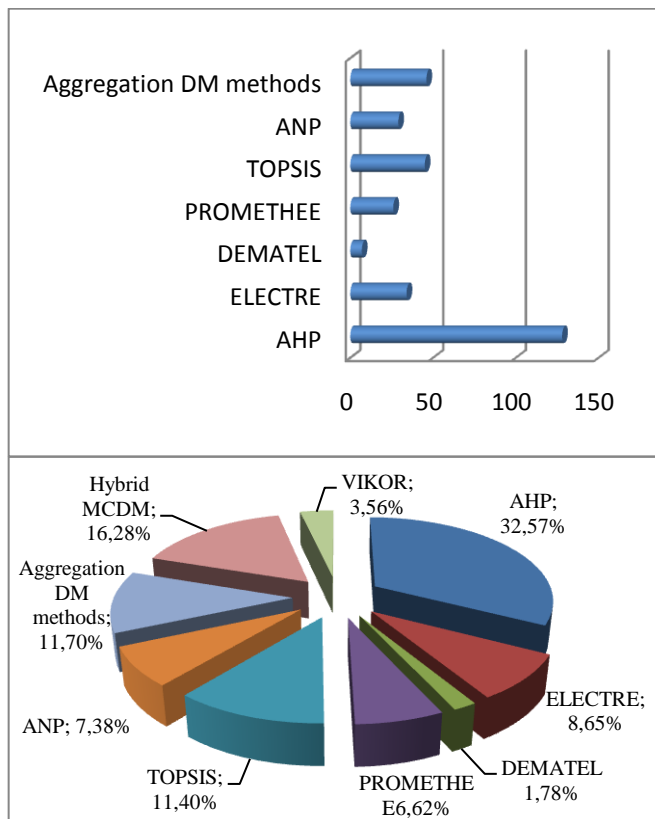


Fig. 6 Frequency of MCDM techniques and approaches

Steps of LMS selection process of effective system are [2]: determination of the affecting criteria, questionnaire collection and statistical analysis, weighting these criteria, evaluation of the entire performance according to these weighted criteria. We compare three LMS (Sakai, Moodle, NTEL) with AHP Process. The evaluation criteria used in this study are: usability, accessibility, compatibility, evaluation tools, portability, reliability, sustainability, and user satisfaction. Reveal that which LMS is best, when altered the weight of evaluation criteria values for main object. According to giving priority to criteria weight, the application allow to find best choice (NTEL) and worst choice (Sakai) from all results shown in fig. 7.

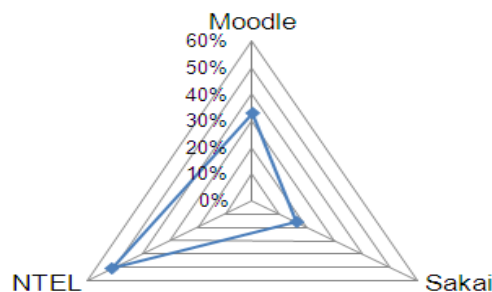


Fig. 7 Comparison of LMSs

NTEL provide instructors with support for activities, such as preparation of learning content, structuring and organization of the content in accordance with the chosen teaching strategy, interactions with coordination of users' activities using online communication tools, that allows

learners to collaboratively create and share knowledge. The information coming from users, for instance, how other users have tagged or commented a piece of learning content is an important factor in increasing learner interest.

4. Conclusion

In this paper, we present a learning design ontology based on the IMS LD specification and the LOM standard for metadata. In ontology, the IMS LD elements are modeled in a concept taxonomy in which the relations between the concepts are explicitly represented. The model suggested for structuring the learning objects can be applied as a whole or in separate parts of the learning assistance media which can be set by the teachers themselves without the intervention of the development teams.

The structures obtained as a result of the model application can be very useful at the development of learning management systems through developing a uniform "frame" of the system and its including in a particular semantics can be done later.

It is so important to carry out all types of comparisons, presenting the strengths and weaknesses of the different LMS. According to the AHP method the best solution seems to be the NTEL system.

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EDUCATION OF THE DIGITAL GENERATION IN UNIVERSITIES – PROBLEMS AND SOLUTIONS

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Abstract: This article sets out the main essential features of the digital generation that influence the motivation, methods and means for education, the possibilities for education are explored and new forms and means of education are proposed through the use of innovative educational technologies and the transformation of the education system for the purpose of increasing the educational-disciplinary quality.

KEY WORDS: DECISIONS, DIGITAL GENERATION, HIGHER EDUCATION, STRATEGIES DOCUMENTS.

1. Introduction.

The extremely fast development of information and communication technologies and their implementation in practice have set new requirements for the education of students in universities. The generation that grew in the years of dynamically changing computer systems and means of communication has proved to be largely dependent on them and the ways in which they are used in everyday life. Current and future students are typical representatives of the digital generation and have all the features that have a significant impact on their motivation for self-improvement, which directly affects the quality of education.

2. Discussion and results.

The analysis of the education environment shows that a substantial change is needed in the education system and in the traditional approaches that are being applied at the present stage.

Taking into account that the most active and productive work activity of a person, which combines the accumulated theoretical knowledge and practical experience to the maximum extent is 60-65 years then without claims of exhaustiveness and completeness, depending on age and the use of modern technologies the following classification can be made :

- *First group* – born from 1955 to 1965 – about 59 years old. Characteristic for this group is that a relatively small part of them knows and uses modern computer and communication tools. These are primarily people who have participated or are involved in the education of the younger generation, such as teachers, lecturers, and successful managers, representatives of the governmental and local authorities.

- *Second group* – born from 1980 to 1990 – about 35 years old. This group, for the most part, knows and uses the achievements of communication and computer technology and is constantly seeking self-improvement. These are the people who grew up with color TVs, mobile phones, computer systems using Microsoft office packages, digital cameras and others. For them, the TV and the personal computer is a must. Some authors call this generation "generation X" [5].

- *Third group* – born from 1990 to 2000 година – around 25 years old. These are people who are witnesses of the quality leap in computer and communication technology. They mostly know the modern means of communication, the computer industry's achievements, such as 3D images, the creation and use of virtual environments, on-line connections using various applications such as Facebook, Viber, Messenger, Twitter and others. For this group, the availability of a laptop, mobile phone, Internet, intranet, and the ability to communicate with anyone, anywhere, anytime, is a must for existence. According to a group of authors, these are the representatives of "generation Y" [5].

- *Fourth group* – born from 2000 to 2005 – around 18 years old. These young people are our current and future students. These are the people who grew up with digital technologies, they are direct witnesses and users of the rapidly evolving communication systems. For them, the world is a smartphone, tablet, laptop, computer games, web players and PlayStations; on-line communication and conferencing. They are born in the digital world and are unable to be without the digital toys they grew up with. For them, the TV is rather a screen where it is possible to project a video or computer game. This group of society is both a child and a "prisoner" of the digital world because they are emotionally tied to modern computers

and communication systems. Called by modern authors “generation Z”.

- *Fifth group* – children born after 2015 – around 3 years old. These are children from “generation α ”. According to Mark Prensky generations Y, Z and α are “digital natives” – they live entirely surrounded and highly dependent on digital technologies. They are current and future participants in the technological boom of the communication era. These are the children of our time, children who do not know a world without digital technology, no internet and intranet and no mobile communications.

Which are the main characteristics of the digital generation?

Firstly, they gain their knowledge about their surrounding world from their tablet and mobile phone and not from nature. The great dynamics of modern life force them to get the information they need in the fastest way, and modern technologies provide them with the convenient means for such a realization. They can gain information about any part of the world, download existing information about any question they are interested in after a brief “surfing”. They are able to keep track of events from the most distant points on the planet, in real time, if they have an internet connection. Modern computer and communication tools provide the opportunity to receive a huge amount of information and the digital generation as users of its content. The bulk of this generation does not like to read books, even their electronic counterparts and prefer to receive information as quickly as possible but with the use of films and video products.

Secondly, due to the fact that the digital generation was born and raised with digital technologies, it is very well acquainted with their emergence, development and improvement, which creates a prerequisite for extremely quick mastering the novelties in the technical solutions and their application. They are able to easily pass from one device to another, from one application to another and have the knowledge and practical skills to use different types of mobile devices and applications that significantly outperform those qualities of their parents' generation, giving them a sense of superiority and disparagement towards parenting advice.

Thirdly, they want to get knowledge when they decide, regardless of time and place, and not during the regulated school time. They would rather listen to music and watch video films instead of using their resources to receive educational content. They gather knowledge and experience from the results of their own actions. They exhibit a readiness to work in a team but are looking for a place to express themselves by using the capabilities of modern computer and communication systems.

Fourth, they actively participate in social networks, show their identity without worries, openly state their opinions on the issues discussed and like to show the digital content they have created. They greatly appreciate the opportunities for fast communications and Internet access and mobile applications that can be switched according to their wishes and the specific circumstances of the environment.

Fifth, they prefer to communicate through SMS and phone calls, the subjects they discuss are more than superficial and are borderline meaningless with a low level of intellectual content. Expressions have a limited number of words, often using jargon and cynical expressions.

According to a survey conducted on teenagers in the USA during 2012 it was established that 93% of young people prefer to communicate using SMS and calls; 90% prefer to socialize on Facebook; 71% of them prefer text messages over conversations. In the Facebook mobile apps 56% are girls and 35% are boys, while in mobile games 35% are boys and 53% girls [3].

Taking into account the characteristics of the digital generation, we will outline the main issues and challenges facing today's educational society and offer solutions in order to overcome them.

1. Obsolete educational facilities, that do not meet the requirements of the students and creates conditions for developing a sense of disinterest, apathy and alienation in them. Traditional wooden boards (black or green) and chalk (white or colored) from the 80s and 90s do not fit into the ideas of today's students for a full educational service. It is necessary to equip the lecture halls with interactive systems, allowing the development of traditional education using the achievements of the modern technology by introducing a new type of knowledge - digital. The use of laptops, presentations, videos and media in the learning process is very close to the students' natural environment and makes teaching new knowledge interesting and effective.

2. A more widespread introduction of forms of electronic education and their combination with the forms of traditional education. It is necessary to create an electronic education platform; publishing lectures on main subjects in the platform; creation of virtual laboratories in engineering disciplines; creation of electronic multimedia teaching aids. [1].

3. Solving the challenges stated above would make it possible to make full use of the students' potential, their ideas and suggestions. This would make them an active part of the learning process and would provide real feedback and adequate management of decisions to change the environment if that is necessary.

Preserving the teacher's position as a leader requires the creation of a new type of teacher model – with a new way of thinking, new opportunities of using modern information technologies and communication tools, with the opportunity to create a new type of knowledge – electronic and digital. It is necessary to organize and conduct discussions, seminars, postgraduate courses and other forms of training in innovative technologies. In these forms, lecturers will have the knowledge to create interactive presentations, lectures; tests and how to use multimedia products during teaching. A broad implementation of the research approach is appropriate. The teacher should become a mentor instead of a bearer of knowledge, as the main motive is to create conditions for maximum development of students' activity, their initiative and creativity. The successful accomplishment of this task would preserve or restore the lost prestige of the teacher and would allow for the full realization of students and a sense of satisfaction from their achievements.

4. It is necessary to apply educational innovations based on digital technologies in order to present the opportunity for every student to study at any time in any place with each teacher using different devices. The use of virtual reality, added reality or distance learning in real time become the basic tools in teaching and learning. An increasing number of student's especially part-time ones are engaged in job performance, which requires increasingly frequent use of a modular learning structure - lecture, exercise, self-study, and exam.

5. Presenting a broad discussion and explanatory work that the time spend on social networks is a time wasted for unrealized opportunities. Elementary communication, rumbling and idle talks

are a waste of time that can be used for more valuable and important things. The current generation knows its legal rights well and is looking for ways of obeying them but often forgets about its own responsibilities and obligations. The development of any democratic society is above all based on the conscious observance of the obligations and rights of its citizens. Students need to create an active civic position, constructive thinking and responsibility.

6. The dynamics of modern day life and the rapid change of circumstances largely demand from the parents to be fully engaged with the working environment. Even so that some parents are in stand-by mode ready at all times and constantly interacting with the employer which in turn causes enormous physical and mental exhaustion and consumes them a lot of time on the phone conducting business. This leads to a lack of real communication with children and to a certain extent causes alienation between the parents and the children. The "child-parent" and "parent-teacher" connection is disturbed which intern disrupts feedback and distorts the actual picture of the pupil's condition - his participation in the educational process, his discipline and his out-of-class forms attendance and performance. It is expedient that in the little time of day when the family is home together to stop using phones and rather have live interactions with children. To get an idea of their physical and mental health, their physical capacity, goals and forthcoming tasks. Such an approach enables the parent to maintain a continuous relationship with his children to know their aspirations and expectations, joys and disappointments, which guarantees timely response and help when necessary.

3. Conclusion

In conclusion, I would like to highlight that lecturing students that are from the digital generation is an added challenge. The need for significant changes in the learning environment such as using on-line technologies, cloud technologies, networking, the Internet of Things, the Internet, etc. require new regulatory documents new materials and inventory a new approach by the teaching staff and real decisive actions to be carried out for a complete change in the educational sphere.

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SECURITY CHALLENGES FOR CYBER-IDENTITY - OUTLINE OF THE PROBLEM

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Abstract: The subject of the considerations contained in the article is the issue of cyber-identity as a subject of protection in the digital area. The considerations concern both the consequences of EU regulations in the field of personal data protection in the context of information placed by the users themselves, as well as the algorithms that are used for analysis.

Keywords: CYBER - IDENTITY, DIGITAL SAFETY AND SECURITY, PERSONAL DATA PROTECTION

1. Introduction

The identity of every human being is not only the constitutive "I" in the psychological aspect, but above all it is the basis of functioning in legal terms as a citizen, representing rights and duties. The achievements of technology have meant that now every citizen – the user has at least two types of identification: state in the "classic, material form" and in the digital form – the so-called trusted profile and a "private digital form – in the form of a profile of any, even fictitious, name" – regulated only by the regulations of the selected website.

2. State identity

On the basis of the Polish law Art. 4. 1. the Act of August 6, 2010 on *identity cards* defines personal ID as a document stating the identity and Polish citizenship of a person on the territory of the Republic of Poland and other European Union Member States, European Economic Area countries not belonging to the European Union and countries that do not constitute parties to the agreement on the European Economic Area [1]. The right to have an ID card is available to every citizen, but after the age of 18 it is obligatory to have it. Evasion of an adult citizen from the obligation to possess or exchange an ID card (if its validity expires) is subject to a penalty of restriction of freedom or a fine. The identity card contains data about the person: a) surname, b) name (names), c) family name, d) names of parents, e) date and place of birth, f) gender, g) face image, h) PESEL number, i) citizenship and data concerning the document itself, i.e.: series and number of the ID, date of issuance, expiration date and designation of the authority issuing the ID card [Art. 12.]. Having an identity document is the basis of the citizen's functioning in the state space – from acquiring and confirming property rights, by concluding agreements, submitting official applications, to protecting the rights and interests of every citizen in the area of public safety and order.

3. Trusted profile

The *state trusted profile* is a confirmed set of data that uniquely identifies its holder in the services of public entities on the Internet. Compared to the material form of the ID card, the data set contains only: name (names), surname, date of birth and PESEL number. A person using such a profile, therefore, has the so-called trusted signature for submitting applications and handling official matters of selected public institutions via the Internet. The trusted profile is secured in such a way that nobody – apart from its legitimate owner – can use it, which allows for credibility and authentication of a given person in a given public Internet service (identity confirmation). Thanks to the digital version of the "ID card", the user can, among others, sign an official application, which is

necessary to settle a specific administrative case (e.g. submit an application for an ID card, obtain copies of civil status documents, or submit an appeal against an administrative decision). Apart from purely official matters, a citizen may also use the option of appeal against a social networking decision – in the case of account blocking or deletion of a user's entry, but subject to certain conditions: 1.) submitting a complaint, which has not been considered (or a response has not been provided within 72 hours), 2.) entries were not illegal and the user did not violate the regulations of the website itself, 3.) the applicant is 18 years of age 4.) has an account on a given website and is the author of the removed entry. Currently, this procedure applies only to Facebook [2].

It is worth noting here as well the existence of the official governmental mobile application (dedicated to smartphones) called *mObywatel (mCitizen)*, which allows quick access to the so-called *mDocuments*. Identified as *mIdentity*, it currently has the ability to display its identity on the phone in an electronic version on the phone display, however only in places where it is not required to show an identity card, because it does not replace it (i.e. in the area of services such as loyalty cards, hotel services, etc.). There are also options for two types of *mCard* (school and student). In contrast to the trusted profile, *mIdentity* is only the electronic *quasi identity card* for displaying on the phone's display. In order to check the authenticity of the electronic identity card – the entrepreneur must have an application called *mWeryfikator (mVerifier)*. Regarding the security of the indicated solution, attention should be paid to two aspects: 1.) prerequisites of the application itself, which can be installed on the device in which modifications of the operating system were not made, *in particular modifications consisting in breaking the device manufacturer's security or the manufacturer of the operating system (so-called jailbreaking or rooting)* [3]; 2.) requirements of a given user's behaviour in the form of: securing login data, setting a password, PIN number and optionally (optionally – a fingerprint); 3.) the application itself by: a watermark, hologram, dynamic element (a flag) and update dates. In addition, a user using the application is assigned a cryptographic certificate confirming the authenticity of the downloaded data. With regard to the protection of data stored in a mobile device, the selected service is also encrypted (access is only possible after entering the access password). Other security measures belong to the user himself, e.g. in the form of not installing other applications of unknown origin or downloading files from an unknown source that could expose him/her to the data loss. In this respect, the limitations related to governmental applications are a positive aspect (no data about the place of residence, no possibilities to conclude an agreement, etc.).

4. User profile

The *user profile* has different meanings and the same functionality – depending on both the type of system and the service. In general, it can be assumed that a digital user profile consists mainly of its user ID necessary for logging in, allowing authorized access to a given system, network, computer or the service itself (e.g. account). The ID can be both in the form of a sequence of numbers and the so-called login (username or e-mail address). Depending on the type of services, the user may be given the option of interchangeably entering the form of the ID, but for the system it will always be a series of digits (assigned automatically). The profile is always associated with a specific service and is usually associated with the user’s account (e-mail account, website account, etc.). In the case of social networking sites, the *user profile* is all information contained and shared by him. These include: photos, descriptions, posts and comments. Therefore, it is a digital characteristic, which is shaped by the user himself. The scope of using the websites and services is defined in individual regulations. In the case of electronic banking services, the provisions of the Act in *electronic payment instruments* are applicable in this respect, in particular with regard to the obligation of ensuring the owner with the **security of performing operations**, with due diligence and using appropriate technical solutions [4]. When it comes to statutory obligations on the part of the user – the owner, most of all he **should not disclose information about the operation of an electronic payment instrument** made available under a contract for electronic banking services, the disclosure of which may result in ineffectiveness of mechanisms ensuring the security of outsources transactions [5]. In the case of revealing the indicated information to other persons and performing operations by using the account holder – he is responsible for the operations performed by these persons, which charges the account (individual bank account).

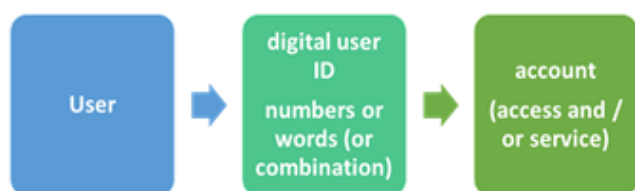


Fig.1. User account creation process

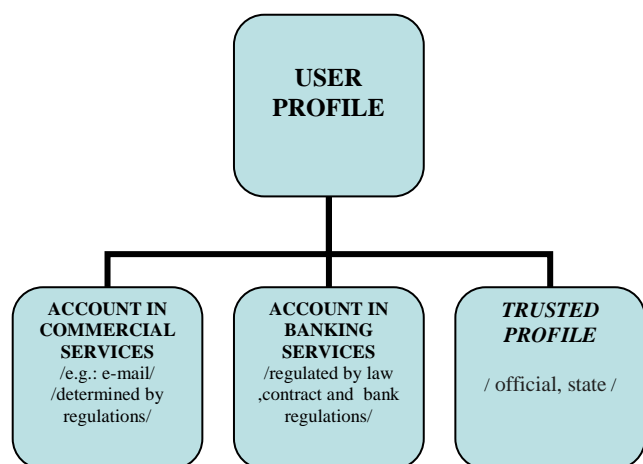


Fig. 2. Types of profiles

5. Threats to profiles and accounts

From the wide range of digital threats, the most dangerous ones for commercial websites users include: gaining access to the account, and then: taking over the profile and account demanding the cyber-ransom for handing it back to the owner, taking over and using the account/profile to commit other crimes (e.g. persuading to violence on social networks, ransom demand, sending offensive content, discrediting).

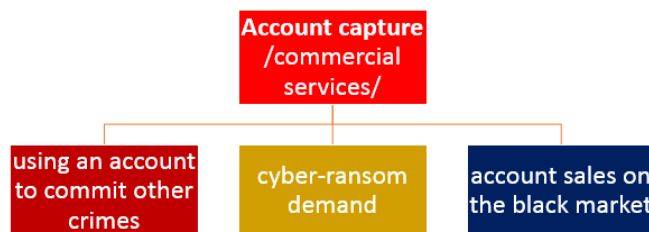


Fig. 3. Account capture effects

In turn, the Internet banking accounts’ users will also include – in addition to the risk of data interception and ransom demand – also the option of making purchases at the expense of the user of the intercepted account. For a trusted profile, these will be, in addition: the possibility of submitting official applications (e.g. issuing a duplicate ID card to a different address than the address of the rightful owner).

6. Personal data

The user account and his profile will not always fully meet the definition of personal data within the meaning of the regulations in force in the European Union, because pursuant to Art. 4 (point 1) of the Regulation of the European Parliament and the Council (EU) 2016/679 of April 27, 2016 *on the protection of individuals with regard to the processing of personal data and on the free flow of such data and the repeal of the 95/46/EC directive* (general data protection regulation) Official Journal of the European Union L 119/1 – “personal data” means information on the identification or identifiable individual, (...) to whom the data relates”. An identifiable person is a person who can be directly or indirectly identified (...) based on information that will identify it, in particular on the basis of an ID, such as the name and surname, ID number, location data, Internet ID or one or several specific IDs determining the physical, physiological, genetic, mental, economic, cultural or social identity of an individual” [6]. Considering the possibilities of commercial services in the scope of having an account, which does not have to be marked with real user data, indicated, indirect markers (e.g. location) may be of key importance. The ability to use an account with fictitious data created an exception: identifying a specific individual in this case will be misleading – unless other factors indicate it. It is worth considering a situation in which the user, wanting to deliberately obscure the real identity – uses fictitious data, which, however, identify a specific individual by, e.g., making purchases using a payment card or an electronic wallet. In accordance with the aforementioned regulation and Polish regulations regarding the protection of personal data: *Information is not considered to enable identifying a person if it would require excessive costs, time or actions* [7]. Such a provision allows for a fairly wide interpretation depending on “the justified probability, but ignorance of the algorithms used to filter user information should not prejudice the lack of qualifications for protection.

7. Profiling users

The so-called user profiling by algorithms created for this purpose differs from the previously indicated profile creation by users themselves. They are most often used to create contextual ads, prepared for specific user preferences.

The CM/Rec (2010) recommendation 13 of the Committee of Ministers of the Member States on the protection of persons *in relation with automatic processing of personal data during the creation of profiles* in chapter 1 defines: "Profile" – as a data set characterizing the category of persons to be applied to a given person. In turn: "Creating profiles" means automatic data processing technique consisting in assigning a given person a "profile" in order to make decisions about it or analyse or predict its preferences, behaviours and attitudes [8]. Algorithms of most digital services companies (including entertainment) are based on many, seemingly independent indicators, collecting "bits of digital traces" from the actions of each user individually. These include both "likes" of specific content and models based on analysing text information (content). The fact of performing analyses based on face photography should also not be surprising. The Convention no. 108 itself of the Council of Europe *on the protection of individuals with regard to the automatic processing of personal data* [9] does not contain the definitions set out above. It also deals with general issues, such as: collecting personal data for specific and justified purposes, prohibiting the use of such data in a manner inconsistent with these goals, and: appropriate, factual, not exceeding the needs arising from the purposes for which they are collected [10]. However, it would be reasonable to conduct a thorough analysis, or "Advanced analytics" as part of *cookies* used to analyse and identify the behaviour of website users, among others, monitoring the IP address of the device used by the user to be able to identify it, and then combining such data with personal data provided earlier – do not go far beyond the "specified purpose", if the main one is, e.g., to transmit information in the form of newspaper articles. Is it equally legitimate to allow websites to place third-party *cookies* – of advertising partners that are most often used strictly to build interest profiles in order to match advertising types on other websites (sic!) Although they theoretically do not contain personal data, they identify the user's browser and the device itself. Thus, the user's influence and capabilities are limited only to the acceptance of being notified about the use of *cookies* by a given website and possible changes made to the advanced settings that require additional action on the part of the user. Creating such legal "gates" should not take place due to the type and amount of data that is transferred, and then they are used primarily for specific profits for third parties, unrelated to the purpose or content of the website visited by the user.

Profiling vs sharing information by users

Considering the indicated issues, it is impossible not to pay particular attention to the issue of the amount of information placed by the users themselves – in every form. In 2012, it was estimated that each user generated about 500 MB of data a day (sic!), and in 2015 this figure is expected to oscillate around 65 GB. However, most often users do not pay attention to security or privacy – at least when posting their photos.

Algorithms in the security service

The indicated mechanisms do not only serve to predict preferences in the marketing area. They have been used for a long time in areas of public safety and order. The so-called safety gates at airports can

serve as an example, which, taking pictures of all passengers, are able to signal an employee that a particular person is showing nervousness or tension beyond the accepted standard or defined range.

8. Conclusion

There is no doubt that currently the majority of citizens – users operate in two realities: *real* and *virtual* – and in each of them they have their own identity. In the case of official services – both commercial and strictly state-related – these identities constitute *one* [homogenous] in two dimensions and their corresponding forms ("material" proof and digital ID). In the case of strictly private sphere and commercial services, the user can adopt a fictitious, virtual quasi-identity, which he will use, for example, in his activity on forums or social websites – remaining relatively *anonymous* until he goes beyond the limits of the law with his behaviour, which could result in the identification by the law enforcement agencies (IP address, device address, etc.), and then responsibility under the *correct [real]* identity. Undoubtedly, EU regulations in the field of personal data protection constitute a significant step in this area – in particular security principles and procedures, but the remaining issue is the broad meaning of cyber-identity that is owned by every "virtual" user – even if, theoretically, it is anonymous (in the sense: not defined by name and surname). It would be appropriate to prohibit the collection of information in the form of *cookies* and user profiling using mechanisms that categorize their interest, including the selection of information about the location and devices used (including the type of operating systems). Only then would there be a complete regulation regarding the protection of user identification data. Data that is private in the most basic and important issue for everyone. However, it is worth bearing in mind that users themselves are often not aware of the threats and algorithms by which they are analysed and evaluated. Therefore, if legislators want to protect their citizens seriously and comprehensively, the proposed provision should be complementary to the existing gap. Otherwise, the American saying will be binding and unchangeable: "if you do not pay for the service (digital – assumed by the author), it means that you are a product".

Taking into account the current possibilities of algorithms – it is also possible that in the very near future it will be possible to "design" and "code" specific user behaviour, where the strictly *purchasing preferences* will be at the end of the list. From the above-indicated reasons for the protection of cyber-identity, its owner is and will be the most important and critical element.

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 - [3] Source: <http://mc.bip.gov.pl/publiczna-aplikacja-mobilna/informacje-o-publicznej-aplikacji-mobilnej.html>
 - [4,5] Act of September 12, 2002 *on electronic payment instruments* (Journal of Laws of 2002, No. 169, item 1385, as amended).
 - [6] Regulation of the European Parliament and the Council (EU) 2016/679 of April 27, 2018 *on the protection of individuals with regard to the processing of personal data and on the free movement of such data and repealing the 95/46/EC Directive* (general regulation on data protection) Official Journal of the European Union L 119/1.
- Source: <https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=celex%3A32016R0679>

[7] Act of May 10, 2018 *on the protection of personal data* [Journal of Laws of 2018, item 1000, 1669].

Source:<http://prawo.sejm.gov.pl/isap.nsf/download.xsp/WDU20180001000/U/D20181000Lj.pdf>

[8] Recommendation CM/Rec (2010) 13 of the Committee of Ministers of the Member States *on the protection of persons in relation to the automatic processing of personal data when creating profiles*/ Source: <https://uodo.gov.pl/pl/file/1425>

[9-10] Convention No. 108 of the Council of Europe on the protection of persons with regard to the automatic processing of personal data, prepared in Strasbourg on January 28, 1981 [Journal of Laws of 2003, no. 3, item 25. Source: <http://prawo.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20030030025>

[11] European Commission Justice and Consumers, <https://ec.europa.eu/newsroom/article29/news-overview.cfm>

[12] European Data Protection Supervisor *2017 Annual Report - Data Protection and Privacy in 2018: going beyond the GDPR* https://edps.europa.eu/data-protection/our-work/publications/annual-reports/2017-annual-report-data-protection-and-privacy_en