Resource-Saving in the Digital Economy[1]

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Abstract. The report examines the importance and transformation of the concept of resource-saving in the digital economy, based on the reasons proposed by the authors for the emergence and characteristics of the information society, whose economy is what is now called the digital economy. According to the authors, a rather constructive definition of the information society is proposed, its main features, including, are briefly considered. determining the meaning of the concept of "digital economy," the reasons for the transition from industrial society to information society. The main risks that may appear during the transition to the information society are described. The new content of the concept of "resource-saving" is considered from the point of view of the implementation of resource-saving as one of the main features of the information society in terms of production, production facilities (products) and resource-saving infrastructure. It was emphasized that the target installations of industrial society production in the form of mass content, pre-planned restrictions on the life cycle of manufactured products are in contradiction with the technological capabilities of the information society. In this regard, it is shown how resource-saving should strategically develop in terms of production, production facilities (products) and resource-saving infrastructure.

Keywords: Resource-saving, information society, knowledge society, industry 4.0, fifth and sixth technological ways, digital economy.

1 Introduction

Now the world is in the beginning of the tectonic shifts caused by emergence and development of the information society, which succeeded industrial society.
Definitions of information society it is possible to find much at various authors. Nevertheless the majority of these definitions can be reduced to the definition given in the glossary of information society (2009) [1] of the Institute of Development of Information Society (IDIS) - "Information society is the society which is at a step of development of the modern civilization which is characterized by increase in a role of information and knowledge in life of society; increase of a share of information and communication technologies, information products and services in gross domestic product; creation of the global information infrastructure providing information ex-

[1]The article was prepared with the support of the Russian Foundation for Basic Research (grant No. 18-07-01053)

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Proceedings of the of the XXIII International Conference "Enterprise Engineering and Knowledge Management" (EEKM 2020), Moscow, Russia, December 8-9, 2020.

CEUR-WS.org/Vol-2919/paper27.pdf

change of people, their access to information and satisfaction of their social and personal requirements".
The terms which are synonyms of the concept either information society» or its any part are rather often used. These are the terms "society of knowledge", "digital economy", "industry of knowledge", "industry 4.0", the fifth and sixth technological ways, digital globalization, etc.
Despite wide circulation and use of the concepts given above, there is practically no more or less constructive definition the concept of information society giving reference points in understanding of what it has to be and as it has to develop.
The present work proposes, according to the authors, a rather constructive definition of the information society, briefly considered its main features, including those defining the digital economy and the reasons for the transition from industrial society to information society.
The main features of the information society identify the main risks that may arise in the transition to the information society.
On the basis of the proposed definition of the information society and its peculiarities, the new content of the concept of "resource-saving" from the point of view of the implementation of resource-saving as one of the main features of the information society in terms of production, production facilities (products) and resource-saving infrastructure was considered.

2 Definition of information society, cause and main features

The traditional philosophy can give the answer to a question of the nature of information society. Civilization eras are defined by means of production and determined by them the production and social relations. It means that in information society the information and communication technologies (ICT) become fixed assets of production. Based on the analysis of various sources it is possible to draw a conclusion that concerning ICT as means of production there is already an implicit understanding, the question of the corresponding production and social relations is not put yet, they obviously and accurately keep lines of industrial society. At the same level, there is also an existing regulatory framework of life of society. It is possible to assume that the accruing disproportion of these questions is one of the reasons of the crisis existing now in highly developed countries.
Interesting question is also the question of the transition reasons from industrial to information society. The following – if during all eras can be the answer to this question, including industrial, the main moment in development of means of production was fight for mass character of production and resources (see Thomas Malthus's theory and his theory of the population), then transition to information society is caused, first of all, **by need of targeting of production for the purpose of economy of resources.**

Production lines are increasingly becoming integrated automated production sites, robots. All types of production control, both technological control and administrative control are also automated.

This approach to production lines requires a major transformation of existing production business processes in specific enterprises (business process reengineering).

Since the components of such production lines must communicate with each other in the process of operation, their design takes an approach called the industrial Internet of Things.

Thus, it can be said that ideally nothing should be done without the order of a particular consumer.

Such conclusion can be drawn based on overproduction crises in developed countries last century and unreasonable development of marketing for sale of what is addressless made. Only development of means of production based on ICT, which, in turn, are based on the software, allows creating the flexible reconstructed production structures adapted to the changing address requirements.

The targeting of production (while maintaining the possibility of mass production characteristic of industrial society) is the main target function in the transformation of industrial economy into digital economy. Increasing productivity, increasing gross domestic product, increasing production efficiency, while important, are not the main target function of the digital economy

In addition to the features of the information society discussed above, some other characteristics of the information society that were absent from the industrial society can be distinguished.

The next main feature of the information society is the fact that ICT is increasingly embedded in production facilities and their functionality is increasingly based on them.

This feature of information society, as well as previous, is also connected with need of economy of natural resources.

The main consideration to realize this feature is that in order to save natural resources it is necessary to extend the life cycle of the material part of the product as long as possible, and the development of specific products is increasingly focused on the development of software that determines the functionality of the product.

This consideration conflicts with existing practices in product lifecycle management (PLM) to make it as short as possible to offer consumers new material versions of the same product as often as possible.

This approach, as well as for the means of production, is closely related to the development of one of the most predictable breakthrough directions in the development of information technologies - the Internet of Things (IoT).

The Internet of things can be considered a basic concept of approach a concept Software Intensive Systems, SIS. By the definition given in [2], any product or service which functionality significantly depends on the software can be the Software Intensive System or is even defined by it. It is specified in the same work that the methodology according to which the Software Intensive is measured percentage of costs of

researches and development of the corresponding software was developed for economic estimates.
The architecture and the principles of creation of such systems are considered in the document IEEE 1471-2000 Recommended Practice for Architecture Description of Software-Intensive Systems [3]. Now based on the latest version of this standard from which, by the way, the concept SIS, IEEE disappeared develops the standard for architecture of IoT, but the draft of the standard is not published in open access yet.
The following very important feature of modern ICT is their penetration into social life. Moreover, their penetration happens so deeply that some authors predict penetration of information technologies on genetic level.
Modern smartphones, which are actually quite powerful wearable computers, provide an unprecedented level of communication and accessibility in mobile mode to a wide range of information services, information resources, solve many daily tasks.
This feature is a separate large topic, currently devoted to a large number of studies, both the positive aspects of broad social computerization and the risks it carries.
One more feature of information technologies is the so-called "second coming of Gutenberg" - global availability of information and knowledge thanks to their electronic form. This feature is very important for all the lines of information society stated above, especially education and science.
All these features of information society, in our opinion, will cause distinctive features, development and risks of both information society and its economy are digital economy.
Therefore, in quality as basic goal setting of digital economy it is possible to consider the maximum personification of production and other opportunities of economy of resources due to use of ICT. At the same time, the possibility of mass character of production, which is characteristic of industrial society, has to remain.

3 Risks of information society

As for risks. The most global risk can be considered the labor unemployment growing in process of introduction at ICT. So, according to McKinsey Institute by 2055 unemployment will reach about 50 percent of all labor population (plus or minus 20 years depending on progress of artificial intelligence) [4]. Such time spread (actually, it can be significantly more) is connected with discrepancy of prospects of development of artificial intelligence, which is noted by various authors.
In addition, according to McKinsey Global Institute today's potential of automation in the USA already allows to automate the following part of works (in %) presented in table. 1.

Table 1. Potential of automation of 2017

Automation potential	
What part of works can be automated the existing technologies	%
Hotel and restaurant business	75

Production of minerals	63
Technologies, media, telecommunications	51
Construction	49
Art, entertainments	47
Retail, wholesale trade, transportation	42
Service trade	40
Finance and insurance	37
Health care and social service	36
Education	35
Public service	31
Production	30

From here the global risk follows – how to support the people who were left without work and what they will be engaged in. The work for most people almost all the history of humankind was sacral.

At present, as mentioned above, there are no social and production models that support both the transition period (in the sense of transformation of the labor market and the competences required by it [6]) and the future period of broad automation of production processes.

The issues of ensuring the lives of people left unemployed (unconditional basic income), financial aspects of labor transformation, connection of these issues with digital transformation of production have not yet been worked out.

The following global risk is connected with production relations, with their main issue – who will possess the automated means of production? The solution of the matter can define not digital inequality, but inequality in a level of living.

No have the issues of linking population forecasts, life expectancy growth and the active part of it to global digital transformation been addressed.

The development of the information society and the digital economy is closely linked to the development of ICT. At the same time, ICT needs to be understood in two aspects - as an independent industry with its science, engineering, production, economy and as a basis for transformation of almost all areas of human activity.

ICT development itself also carries some technological risks.

In March 2018, the largest Russian provider of digital services and services Rostelecom submitted for expert discussion the list of perspective through technologies of work with data consisting of 25 technologies, which form five groups [5].

Technologies of artificial intelligence, which are correlated with many other technologies, including through are specified as one of basic through technologies in many documents and many experts. For artificial intelligence many experts connect its development with various forecasts and risks, including social. Some of experts predict on this base significant change of labor market – disappearance of many professions, emergence new, first of all, connected with maintenance and service of robotic and automated manufacture. The so-called "point of singularity" in which achievement possibilities of artificial intelligence will surpass natural what many risks are connected with is actively discussed. Some experts believe that the singularity point already came or will come soon, others believe that this point in process of development of artificial intelligence will be removed as the horizon.

Considering all questions concerning development of digital economy it is somehow forgotten that all today's computers realizing information technologies still are based on von Neumann's architecture, i.e., in fact are an electronic arithmometer. Really, on an electronic arithmometer, it is possible to implement difficult programs, but people (directors of tasks, developer of an algorithm, programmers) create these programs. Those programs, which are already able to create computers, use the expert rules, which are also determined by people. In other words, it is possible to tell that modern computers have no own subjectivity (free will), people bring this subjectivity. We do not know on what algorithms the brain works, but we are going to create artificial intelligence.

It is possible to assume that development of robotics and artificial intelligence will go two ways. The first, actively developing now, will concern robotics and the artificial intelligence, which are based on today's computers, which do not have subjectivity. The second way is a creation of various systems (on the basis of computers which are absent yet and which will work on other algorithms similar to a brain) having artificial intelligence, subjectivity can accelerate emergence of the risks menacing to the existence of mankind about which Stephen Hawking, Elon Musk and many others spoke. The horizons of the second way are still very foggy.

In addition to the above-mentioned IoT and artificial intelligence technologies, a number of other breakthrough or end-to-end technologies are identified - cloud computing [7], distributed registry technologies, big data technologies, quantum computing, virtual and augmented reality technologies, robotics, and a number of other information technologies. All these technologies have their own characteristics, their own risks of their application and are in different degrees of maturity. Analysis of end-to-end technologies of the digital economy is presented in the electronic journal TADVISOR [8].

The dynamics of the emergence and development of information technologies for a number of years is investigated and published by Gartner (Gartner Hype Cycle for Emerging Technologies).

From the review of this schedule for 2019 [9], it can be seen that almost all the technologies depicted have yet reached the maturity stage and are located at the stage of overestimated user expectations or at the stage of disappointment.

4. Resource saving. Production, features of products, resource-saving infrastructure

The concept of resource saving is now quite widely used both in the practical aspect and in the development of methods and means of resource saving. There are many standards and other regulations related to resource conservation.

One of these Russian standards (GOST R 52104-2003. Resource-saving. Terms and Definitions) defines resource conservation as follows.

"Organizational, economic, technical, scientific, practical and information activities, methods, processes, a set of organizational and technical measures and measures that accompany all stages of the life cycle of objects and are aimed at the rational use and economical use of resources".

This definition, as well as other normative documents and existing practice, in our opinion, do not determine the essence of resource saving as the main feature of the transformation of industrial society into information.

Based on the above-mentioned features of the information society and its digital economy, we will consider how the targeting of production will affect on the structure and functionality of enterprises, on the need to maximize the life cycle of the material part of products and on the resource-saving infrastructure.

The main changes in resource-saving in production (enterprise) from the point of view of realization of production targeting can occur in the following directions.

CRM (Custom Relationship Management). Currently, CRM at the enterprise is created mainly to increase sales, optimize marketing and improve customer service by preserving customer information and history of relationships with them, establishing and improving business processes and subsequent analysis of results.

The building of modern CRM is based on a model of interaction based on the theory that the center of the entire business philosophy is the client, and the main areas of the company's activity are measures to ensure effective marketing, sales and customer service. Supporting these business goals includes collecting, storing and analyzing information about consumers, suppliers, partners, as well as about the company's internal processes. Features to support these business goals include sales, marketing, and consumer support.

When moving to production targeting, CRM should provide input for the creation of flexible industries that are tailored to the needs of specific consumers, excluding marketing procedures if possible. Thus, CRM will be a system of orders and logistics of finished products.

Production itself should be based on the ideology of IIoT (Industrial Internet of Things), which, in turn, should be based on the SIS concept discussed above. The purpose of the IIoT is to create flexible integrated production lines.

When creating finished products (production objects), the IoT and SIS approaches should also be used. The main consideration for realizing this feature is that in order to save natural resources, it is necessary to extend the life cycle of the material part of the product (PLM) as long as possible, and the development of specific products is increasingly focused on the development of software that determines the functionality of the product.

Инфраструктура ресурсосбережения должна представлять собой программные системы (может быть в рамках отраслевого управления), учитывающие вопросы демографии, уровни потребления, управления запасами ресурсов и их потребления, вопросы создания и использования возобновляемых ресурсов и др.

4 Conclusion

Based on the global importance of information technologies as a basis for the digital transformation of all spheres of society discussed above, two circumstances seem important.

First, information technology should be considered in two aspects - as an independent industry of production and as the main tool for digital transformation of all other sectors of the digital economy.
Secondly, due to this importance of information technologies, fundamental scientific research of information processes in nature, technology, and society should be significantly strengthened.
The proposed hypothesis about the reason for the transition from industrial society to information society, which consists in the need to save natural resources and, as a result, the targeting of production can be transformed in the future. This transformation can take place as science develops and resources are created through it. In addition, demographic and social trends can influence the transformation of this hypothesis.
The successful development of both the information society as a whole and its economy requires high-level interdisciplinary studies of ongoing transformations, the purpose of which may be to develop formalized ideas of the relationship between resource management, demography, consumption, health, life expectancy growth, life satisfaction and other social processes.
But this is all in the future. It is now clear that most of today's conflicts stem from a struggle for resources. In any case, the transition to global digitalization is inevitable, since only on its basis can flexible production structures be created that ensure the further development of mankind.

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