Unified digital platform for the transport industry and human factor

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Abstract. Digital technologies, globally introduced in the urban environment and made available to the majority of the population only in recent years, are relatively new phenomenon. This paper discusses the circumstances of the transition of the transport industry to the “digit” as an example of studying the theme of human factor in the digital world. The main professional groups united around the unified digital platform for the transport industry were taken into account, the possible changes due to the transfer to the unified digital platform for the transport industry were studied, and the current state of the transition of the transport industry to Industry 4.0 was assessed. In the process of implementing digital technology, problems are found in the boundary layer of the interaction of the human factor with technical and digital factors, it should be noted that these factors are mutually complementary. Therefore, when transferring the transport complex to the unified digital platform, emphasis should be placed on effective training and retraining of personnel not only in connection with digital technology, but also in programs of emotional competence and intergroup adaptation for managers and employees.

1. Introduction

Around the world, the transport complex is the largest consumer of digital technologies and solutions. Work is underway to create a unified digital platform for the transport complex (online application platform for all modes of transport). Sectoral digital platforms developed on their own, services of some companies transferred to the “digit”, are interconnected with each other and other government systems. At the end of 2018, the Ministry of Transport of the Russian Federation proposed the creation of a digital transport platform (DTP) based on Russian software as part of the Digital Transport and Logistics Association (CTLA), established by “RT-Invest Transport Systems”, Russian Railways, and PJSC “Aeroflot” [1].

The official website of the Ministry of Transport of the Russian Federation lists the components of the unified platform. These are the registers of carriers, an electronic bill of lading, a waybill, registration of transportation permits, and also an electronic queue for crossing the state border [2]. In the last 20 years, the space of life has been transformed in connection with the introduction of smart city technology, among which the “smart” transport network occupies one of the main positions. Since 2000, urban infrastructure has been transferred to a virtual mode of operation on the basis of unified information platforms; urban streets and public institutions are equipped with smart technologies that ensure safety, convenience and comfort, and reduction of resource costs.

Discussions in the scientific literature and the media are worrying about the possible negative impact of smart city technology on the human psyche and on health in general, referring to the
scattered studies of psychologists, medical workers and the forecasts of futurologists [for example, 3]. Unified digital platform is designed to remove the burden from people, but how much is it autonomous and independent of the people themselves, their mood and condition? How safe is life facilitated by technology? How is the unpredictability factor, determined by the irrational human nature, leveled? This is a factor that has been called human in recent decades and is mainly mentioned in the context of life safety. The issue of security of the large-scale use of information technology in urban infrastructure remains open. What happens to the psyche (cognitive processes, emotional-volitional sphere), human health in general? What is the opposite effect of using digital technology? This is just a small list of questions that we ask ourselves in the light of global digital transformations.

The identification and correction of the prevailing psycho-emotional states of representatives of the modern information society, especially urban residents, characterized by the widespread adoption of digital technology, can solve the problems of disease prevention and maintain emotional health. Therefore, there is an opportunity to improve overall health, extend and improve the quality of life for contemporaries and subsequent generations. The appeal to human emotions, as an irrational component of the psyche, is appropriate in connection with their signal and regulatory function, which allows serving as a criterion and as a means of controlling the general condition of a body. Of course, a general improvement in health status is achieved by an integrated balanced approach. This approach includes a wide range of specific manifestations at the physical, psychological and social levels of consideration [4]. In terms of health psychology, it is not the fact of the presence of mental disorders or diseases that matters, but the initial formation of healthy psyche and support for it functioning. Prevention of the negative consequences of the introduction of smart city technology for the human psyche by identifying the causes of possible problems is of strategic important.

We understand the human factor as characteristics, including (and in our case, first of all) psychological, of a person, personal abilities and limitations, determined in the specific conditions of human activity. Life safety directly depends on the human factor, because often it causes emergencies and accidents [5].

In order to study the topic of the human factor in the digital world, we will consider, as an example of such a world, the circumstances of the transition of the transport industry to a "digital". We will consider the psycho-emotional state of a person who acts as the central link in digitalization as the entry point to the topic. After all, a person develops technology, is a supplier and consumer of transport services. And from whom come the dangers associated with hacker attacks, software failures, incompatibility of product protocols from different countries? We are interested in studying the urban residents, because in cities, thanks to urbanization, the bulk of the population is concentrated.

2. Methods
For our study, we explored approaches to understanding the unified digital platform. Digital models are being implemented in all leading sectors of the world economy. The study was previously conducted in the construction industry, where digitalization in the form of BIM (Building Information Model / Modeling) is already being implemented [6]. The transition to digital technology involves a number of stages. To determine the current stage in various companies and organizations, we used the Industry 4.0 model proposed by G. Shu, R. Anderle, Yu. Gaussemayer, M. Ten Hompel, V. Valster (and others) [7]. They identified and described six stages: informatization, connectedness, visualization, permeability, predictability, self-correction. The predictability goal is considered to be achieved when a company can use the data of a digital model to make decisions that will bring the best results in the shortest possible time, and automatically, that is, without human intervention, implement the appropriate measures.

We found out the names of social groups, the determining criteria of which were gender, age, professional affiliation and “boss - subordinate” culture, included in a one-time process of interaction around the unified information model [8].

Previously, one-time (simultaneous) interaction was either absent or mediated due to the linear nature of construction project: designers did not communicate with architects, architects did not
communicate with workers at construction sites, etc. Everyone carried out their part of the project and on this their local work was completed. The virtual model of object at all stages of its life, which, in essence, is the main indicator and the basis of the digital approach, conjoined previously disparate groups and transferred a long linear process into a common space where work, changes, and identification of their consequences occur “here and now”. The features of the interaction of representatives of various departments and companies united by unified model were investigated.

According to the concept of intergroup adaptation (IGA) of the professor, doctor of psychology A.V. Bulgakov, the optimization of intergroup interaction involves taking into account a number of IGA components. The basic definition of intergroup adaptation (IGA) in an organization involves the process / result of optimizing the group interaction in an organization and contains motivational, cognitive, emotional, behavioral and integral components [9, 10]. In this paper, we rely on the emotional component of IGA.

We took into account the main professional groups united around the unified digital platform for the transport industry, which is represented by air, rail, road, sea and river transport, as well as logistics services. In this paper, based on the experience of studying the human factor through the specifics of intergroup adaptation in connection with the introduction of digital technologies in the construction industry, we will study the possible changes due to the transfer of the transport industry to the unified digital platform and assume the current level of transition of the transport industry to Industry 4.0.

3. Results
In construction, BIM technology congruently supplements Industry 4.0 with its levels of company development (informatization, connectedness, visualization, permeability, predictability, self-correction). BIM is all numerically described and properly organized information about an object, used both at the design and construction stages, and during the operation and even demolition of a building. This is the lifecycle management of a building. A similar scheme is now actively used in almost the entire industry of engineering CADS (computer aided design system). But one of the main achievements of BIM is the ability to achieve almost complete compliance with the operational characteristics of a new building with customer requirements. At the same time, BIM is not ideal, it is not a specific computer program, it is a new design technology that benefits not only large facilities. It is important that BIM does not replace a person, it cannot exist without a person and requires more professionalism, a better, more integrated understanding of the creative process of building design and more responsibility in work. BIM makes human work more efficient. The emotional side of BIM is important. BIM is not a threat to already working specialists in the information modeling technology of buildings, they just have to make some efforts to master new tools and switch to a new technology. But practice shows that this is all from real. Modern construction and design technologies allow us to differentiate companies by stages of development using the Company Maturity Index.

Informatization is the basis for digitalization. At this stage, different information technologies are used separately from each other within the company. Informatization is already quite common in most companies and is mainly used to more efficiently perform repetitive tasks. This is mandatory level for effective management in a modern construction organization. Connectedness, as the stage of Industry 4.0, is characterized by the arrival of interconnected elements to replace the separate implementation of information technology.

Widely used business applications are interconnected and reflect the company’s key business processes. Parts of the systems of operational technology provide connectedness and interoperability, but full integration of levels of information and operational technology has not yet been achieved. Visibility is the stage at which it is possible to record the execution of processes from the very beginning to the end with a huge number of data entry points. Today, you can record events and conditions in real time throughout the company and beyond, and not just in some areas, such as production sites, as it was before. Due to this, the current digital model of enterprises has become
available at all stages. This is the digital model of the company, showing what is happening in the company at a certain point in time, so that management decisions are based on real data.

There are technical difficulties in creating digital model: usually there is no unified source of reliable data, since they are often stored in decentralized repositories. Permeability allows the company, its management, to understand the cause of the event and use this information to apply the data by analyzing the root causes. New technologies, primarily “Big Data” (analysis of large volumes of data), can be extremely useful for describing large data sets when it is impossible to process and analyze them using traditional analytic techniques.

Predictability is the stage of development based on the permeability. After reaching this stage, the company can model various future scenarios and find the most likely ones. This includes forecasting the future digital model. This is done to present a variety of scenarios, the likelihood of which can subsequently be estimated. As a result, companies can anticipate future events and make timely decisions and appropriate measures. Although actions under such measures still need to be carried out manually, a longer preparation time reduces potential negative consequences. Predictability largely depends on the work done. Self-correction is a fundamental requirement for automated decisions and automated process for their adoption. Continuous adaptation allows the company to shift the responsibility for making certain decisions to IT systems in order to be able to adapt as quickly as possible to changing business environment [7, 8].

According to the official press organ of the Ministry of Transport of the Russian Federation “Transport of Russia” (according to the General Director of PJSC “Aeroflot” V. Savelyev), today Aeroflot takes the fourth place in the world in terms of digitalization (average integral indicator of the ratio of the number of passengers and employees) [11]. It is serious indicator, considering that there are more than 1000 airlines in the world [12]. In the Industry 4.0, this is the Permeability phase. Passenger traffic: in the segment of interregional bus traffic (which is 130-150 million passengers annually), the introduction of the unified digital platform will hit illegal carriers [11]. While the level of digitalization is balancing on Connectedness/Visualization based on optimistic assessment. Digital solutions are generally referred to as “near-future technologies”.

Rail transport: according to the World Economic Forum, the Russian railway network in terms of infrastructure development rose from 24th place in 2015 to 15th in 2018 [13]. Digitalization of the basic level of infrastructure is expensive process [13]. An example of implemented platform is the “Freight Transportation” electronic trading platform, where it is possible to order and organize transit transportation by rail in the digital format as simple as possible while minimizing customer operations [14]. Rail transport has not yet overcome the Connectedness stage. The issue of finding unmanned vehicles on public roads, although for a long time, is only discussed by experts [11].

According to available official sources, the transport industry is still only at the starting positions of Industry 4.0. The transition to the “digit” is discussed, planned, developed. In publications related to the future transformation with an emphasis on digital technologies and their advancement, attention is paid to the human factor. This is, first of all, training, the topic of management, transport safety issues. Some authors write about ways to exclude the human factor, reduce its influence, seeking to create models of the world that are independent of it. Others put the human factor at the forefront, understanding it as a “pillar,” “foundation,” “fundamental,” and “key,” driving force behind digitalization. We have no task to grab words and phrases out of context, but the contradictions in this matter are obvious.

The emotional component of intergroup adaptation, in addition to the general impact of the irrational emotional component of human nature on all spheres of life, is especially important for leaders of organizations that are responsible persons who have a set of qualities and competencies demanded in the light of Industry 4.0. The leaders should be able to make decisions appropriate to current situation, taking into account positive and negative prospects.

It is the level of development of organizations of the transport industry “Permeability” that carries an increased emotional burden. The ambivalence inherent in emotions characterizes this stage as the level of development of digitalization of Industry 4.0 itself [8]. We consider this stage to be a kind of
“point of no return” when the company crossed the line beyond which the company, led by its leader, lives and develops according to new rules that are recognized by everyone. Before this stage, there is an increase in the effectiveness of the personnel management of organization. This is a purely human aspect of technological and digital progress: emotional competence and social sensitivity play the role of the resonator intergroup adaptation. Due to the fact that we have already proved empirically that a change in the emotional component of managers can have a positive impact on the effectiveness of the personnel management in organization and indirect effect on the change in the organizational culture of a company, it makes sense to work with the transport management in the direction of changing organizational culture of a company, which is the basis of social-and-psychological support for the introduction of digital technology in the transport industry. Table 1 presents the current status of the introduction of digital technology, using two industries as an example.

Table 1. The introduction of digital technology on the example of the construction and transport industries.

| Industry 4.0 stage | Construction industry | Transport industry | General conclusions by industry and points of attention |
|-------------------|-----------------------|--------------------|-------------------------------------------------------|
| 1.informatization  | Implementation of BIM technology (first half of 2018) | With the introduction of unified digital platform for the transport complex, the industry will be at the forefront of visualization – permeability | Achieving the stages of Industry 4.0 allows leaders of companies to maximize their competencies. Attention to the psycho-emotional state of a leader |
| 2.connectedness    | | | Professional groups previously involved linearly in the overall manufacturing process, did not interact with each other. Now they are included in the common space of industry infrastructure and social contacts. Attention to the intergroup adaptation. |
| 3.visualization    | | | |
| 4.permeability     | | | |
| 5.predictability   | | | |
| 6.self-correction  | | | |

The most promising digital technology for the industry:
- BIM
- Big Data
- unmanned aerial vehicles
- cloud collaboration solutions
- Internet of things

The relevance of the existing nonlinear dependence of the effectiveness of personnel management of organization depends on its development level according to the criteria of the Industry 4.0 Maturity Index in connection with the impact on this relationship of the factor of the emotional component of intergroup adaptation is supported by the variety of identified social groups involved in the modern transforming transport industry. These groups are united around the unified digital platform for transport complex and the effects of intergroup adaptation begin to appear between them. Such groups include groups corresponding to types of transport (aviation, rail, sea and river), functions (freight and passenger transportation). The wide understanding of the transport industry, depending on the criteria for identifying groups, also corresponds the specialists in natural and climatic factors (environment, ecology), customer service for vehicles, IT specialists, transport infrastructure workers (fixed objects), logistics sector employees and etc.
4. Discussion

Due to the fact that problems are found in the boundary layer of the interaction of the human factor with the technical and digital ones, it should be noted that these factors are complement each other. What will happen if for one day the information systems that provide transportation are disconnected? Dependence on technology makes us continue to rely on human resources. Or at least not dump them completely in their bold predictions about a self-sufficient information future.

Townspeople are in dynamic, the pace of life in modern cities is very high, but the transition to the category of a smart city with smart transportation systems for comfort is characterized, among other things, by a number of negative consequences for a person: the transfer of activity from muscle to technical, mechanical, electronic. Communication, overcoming distances, labor, education are transferred to a virtual space, which is projection of physical reality. Security is provided by video surveillance systems. Live emotions are packed into a set of limited symbolic parodies (for example, emoticons). Conditions are created for the attenuation and even the loss of mechanisms of physical and mental plasticity, self-preservation, emotional response, mental activity and social skills.

Stress was a partner of industrial society, and emotional-and-cognitive coarsening can become a partner in smart, digital society. Because we touched on the topic of emotions, we can mention that there are ways to maintain or restore health through managing your own psycho-emotional state. For example, through the increase in the number of positive emotions (interest, joy, etc.) and decrease in the level of negative emotional experiences (anxiety, fear, etc.), the prevalence of genuine emotions, which have pronounced physiological correlates, over ordinary ones, proceeding at a greater degrees at the level of psychological experiences. These are breathing exercises, short-term and effective. These are effective psychological techniques that have been practiced for many decades to maintain an adequate state in stressful situations. They are trained by the military, pilots, controllers. Modern diagnostic methods allow you to operate with both subjective (for example, psychological testing, self-diagnosis) and objective (instruments that measure psycho-physiological parameters: stress level, heart rate, pulse) indicators of the emotional state, and these are alternatives depending on the circumstances.

Concerns about the reduction of office services due to the introduction of the unified platform are already being realized (for example, at Aeroflot), which was predicted quite a long time ago [3]. In an economic sense, this is certainly a plus, but in relation to the human factor, it is alarming sign, especially for the older generation, less flexible and adaptive compared to young people. However, experts consider a somewhat exaggerated assessment of the complete departure in the shortest possible time of a number of professions against the background of digital transformations [15].

This is taking into account quite logical assumptions about the release of all professions, often involving routine activities, with the advent of digital technologies such as robotics and artificial intelligence [16]. For example, among the aging professions, one of the leading places is the “driver”, but the demand for this profession in the labor market is not declining, although all the prerequisites for abandoning it are obvious: drones, artificial intelligence in the automotive industry and systems for monitoring and road safety. In addition, it’s more correct to talk about skills that are transformed with the requirements of activity, and not about the profession as a whole.

5. Conclusions

To summarize the study, we consider it necessary to emphasize that digital technology, globally introduced in the urban environment and on unlimited scale, became available to the majority of population only in recent years, as well as the abuse of this technology, is a relatively new phenomenon. While it is not possible to assess the effects and consequences of such phenomena, lengthy studies are required.

In this paper, as a conclusion, we state the following.

1. Dependence on technology acts as a cause for concern. People need to be prepared for situations where digital opportunities fail. For this, no measures are being taken now.
2. Emotions and stress accompany urban life and this affects people involved in the transforming transport industry. There is an opportunity to master effective psychological techniques of self-diagnosis and self-management with your own psycho-emotional state.

3. Not professions, but skills become obsolete. For the leader in the transport industry, emotional competence and competence in the processes of intergroup adaptation is the key to effective development of the digital industry as a whole and separate companies (departments) in particular.

4. The difficulties of retraining are associated with age-related limitations of human potential (motivation, mental plasticity, negative manifestations of experience).

5. Change is not smooth and gradual, so the principle of studying is lifelong learning (as opposed to the former, learning for life). Continuing education has become a necessity.

Thus, when transferring the transport complex to the unified digital platform, from the point of view of taking into account the human factor, emphasis should be placed on effective training and retraining not only in working with digital technologies, but also in programs of emotional competence and intergroup adaptation for managers and employees. This is "green corridor" for the development of the industry.

References
[1] The digital platform of the transport complex is being created, https://wtcmoscow.ru/services/international-partnership/actual/sozdaetsya-tsifrovaya-platforma-transportnogo-kompleksa
[2] Unified digital platform will unite all services for transport and logistics in Russia (Ministry of Transport of the Russian Federation) https://mintrans.ru/press-center/news/9352
[3] Schwab K, Davis N 2018 Technology of the Fourth Industrial Revolution (Moscow: Eksmo, Top Business Awards)
[4] Nikiforov G S 2006 Health Psychology (SPb: Piter)
[5] Terms of EMERCOM of Russia (Ministry of Emergencies of the Russian Federation) https://www.mchs.gov.ru/ministerstvo/o-ministerstve/terminy-mchs-rossii/term/970
[6] Talapov V 2015 BIM technology: essence and features of the implementation of building information modeling (M.: DMK - Press)
[7] Shu G, Anderle R, Gaussemayer Yu, Ten Hompel M, Valster V 2017 Industry Maturity Index 4.0, Digital Transformation Management of Companies (Munich: Herbert Utz Verlag) https://www.acatech.de/wp-content/uploads/2018/03/acatech_STUDIE_rus_Maturity_Index_WEB.pdf
[8] Magera T 2016 E3S Web of Conference 135 04038
[9] Bulgakov A 2007 Psychology of intergroup adaptation on the ships of the Russian Navy: diss. Dr. psychol. science (Moscow: MU)
[10] Bulgakov A 2014 International Annual Edition of Applied Psychology: Theory, Research, and Practice 1 63
[11] Marusin A, Ablyazov T 2019 Economics: Yesterday, Today and Tomorrow 9(3A) 71
[12] World Airlines, https://www.airlines-inform.ru/world_airlines/
[13] Zhuravleva N 2019 Journal of science, practice, economics 3(82) 19
[14] Electronic trading platform "Freight", The official website of Russian Railways, https://etpgp.rzd.ru/#landing
[15] Labor market and employment. Our experience. Official website of the All-Russian Research Institute of Labor, Ministry of Labor of Russia, https://www.vcot.info/employment-market/our-experience
[16] Balliester Th, Elsheikhi A 2018 The Future of Work: A Literature Review (International Labour Office) https://www.ilo.org/wcmsp5/groups/public/---dgreports/---inst/documents/publication/wcms_625866.pdf