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SOCIAL DIMENTIONS OF LABOUR ROBOTIZATION IN POST-INDUSTRIAL SOCIETY: ISSUES AND SOLUTIONS

Nelly Petrovna Lukina, Anastasiia Valerievna Slobodskaia and Nadezhda Nikolaevna Zilberman

This article discusses social consequences of labour robotization and the specifics of employment in the post-industrial society in the information age. This topic is of immediate interest, for it leads to a comprehensive analysis of social and technological reality of the last decades. The authors of this paper discuss the following issues: What effect industry robotization will have on employment? What will the robots' place and status be like in the structure of the post-industrial industry? What are possible ways to neutralize negative social consequences related to employment, resulting from robotization of labour? Our approach is interdisciplinary and we propose a comprehensive examination of multiple modes of interaction between humans and technology within metaphysical, anthropological, sociological and natural scientific frameworks. Our study is based on theoretical works by N. Berdyaev, O. Spengler, L. Mumford, A. Giddens, G. Standing, N. Wiener. The present article examines the specifics of the post-industrial society related to nature of work and employment in the context of robotization of industry and of the service sector. The notion of social robotics and limitations in using social robots in emotional labour are the object of analysis. We claim that robotization of industry has significantly altered the established social order. This refers to robots replacing humans in various economic sectors and a rise in unemployment in developed countries. Precarization of work is examined as an example of marginalization of certain social groups having problems with employment as a result of robotization of industry.

Keywords: robotics, post-industrial society, service economy, social philosophy, social robotics

INTRODUCTION

New technological advances accompany the formation of post-industrial society: artificial intelligence, instant global communication, robotization of industry. Innovations in genetics, biotechnology, nanotechnology make progress. The boundary between digital and real worlds is gradually blurred, marking a turning-point in the evolution of technology. Major global changes related to the spread of Internet use have led to the era of "super-diversity" (Giddens, 2015).

Technological progress typical for the post-industrial society that is presently in the formation phase leads to significant changes in human social life. Robotics is already playing an important role in employment in the industrial and service sectors. Robots replacing humans has become one of the most discussed topics in research and business circles. Certainly, the fears that quickly developing technologies would eliminate jobs go back to the beginning of the Industrial Revolution in Great Britain in the 19th century. At the present day, a positive attitude to technologies as means to create new jobs gives place to the supposition that this will not be the case (Rotman D., 2015).

* Tomsk State University, 36, Lenin Prospekt, Tomsk, Russian Federation 634050

Researchers have observed a rise in unemployment especially among youth in all developed countries along with an increase in social inequality. Unemployment among recent university graduates is high in many EU countries. Analysing this situation, A. Giddens (2015) comes to the conclusion that the social model of industrialized states as an all-encompassing and efficient system of social insurance combined with the aspiration to equality and inclusiveness in deteriorating.

Here, we raise the following questions: what effect will robotization of industry have on employment? What will the robots' place and status be like in the structure of the post-industrial production? What are possible ways to neutralize negative social consequences related to employment that resulting from robotization of labour?

The answers to these questions require a thorough context analysis of multiple modes of interaction between humans and technology within metaphysical, anthropological, sociological and natural scientific frameworks. Western and Russian philosophy and sociology have a long tradition of a multi-aspect analysis of technology. I. Kant considered science and technology as inseparable from social and anthropological issues. In the 20th century, philosophers and social theorists, such as O. Spengler, N. Berdyaev, J. Ortega y Gasset, L. Mumford, have also continued this trend.

The philosophical and anthropological focus of their research seeks to solve the following problem of mankind: What are the human nature, essence and origin? What is the meaning of existence? What are the holistic characteristics of a human being as a biological and, at the same time, a supra-biological, conscious entity?

A critical analysis of the complex contemporary sociological and technological reality is necessary in order to determine the robots' place and status in the employment structure of the post-industrial society. This analysis is aimed at understanding the nature of work and the specifics of employment in the post-industrial society in the information age.

Processes of social stratification and mobility that have modified the structure of the contemporary society under the influence of information technologies attract great interest among researchers.

The issues under investigation are of immediate interest, for they contribute to a comprehensive analysis of social and technological reality of the last decades.

THEORETICAL AND PHILOSOPHICAL FOUNDATIONS OF RESEARCH ON INTERACTION BETWEEN HUMANS AND TECHNOLOGY.

Anthropological and philosophical approaches to research on interaction between humans and technology

One of the founders of existentialism, the Russian philosopher N. A. Berdyaev considered the "Man and Machine" problem as a central problem in philosophical

anthropology. Reflections on the interaction between man and machine are part of N. Berdyaev's worldview and manifest themselves in his philosophical and anthropological works. Berdyaev examines machine and, in a broad sense, technology in its relation to man from metaphysical and sociological perspectives. From a metaphysical point of view, technology is given the status of a new category of existence, and the dialectics of spirit and technology are traced. According to the philosopher, technology is heterogeneous to man, spirit and reason. Technology oppresses the spirit and lacks symbolism. He states that "technology is impersonal. It ignores personality" (Berdyaev, 1989, p. 158). However, technology relates at the same time to the spiritual sphere, to the engineering and other human creative principles. Ambivalent relationship between man and technology makes it possible to examine these relations from inside and from outside. From inside, from metaphysical, philosophical and anthropological perspectives, technology concerns human existence, spirit and destiny. From outside, technology has a social dimension, that is, a machine belongs to the social world, in which the exercise of power is mandatory in order to organize, manage and solve economical and political issues.

Another existential philosopher J. Ortega y Gasset (1991, p. 343) defined power as "technology, mechanism of social order and control», while O. Spengler (1998) notes that "…technology of government, war and diplomacy stem from a common root, and they have always maintained close ties". Considering that technology is an organized life, organization and management issues shift to a social dimension highlighting concerns with irrational consequences of technology for society and for an individual human.

In the second volume of "Decline of Europe", the German philosopher O. Spengler sees the notion of machine as the human aspiration to become equal with God and to subdue nature, the universe, and other people. In Spengler's view, technology is a system of the will to power that materialised to its full extent in Western civilization. The industrial revolution and economy are products of the bourgeois civilization and capitalism. In his article "Man and Technology", Spengler (1995, p. 456) states that an understanding of machine technology should go beyond the temptation to view production of machines and instruments as the sole aim of technology. He writes that "the point is not in production of instruments/object, but in the ways to handle them". Spengler identifies the antihuman nature of machine and provides examples of the negative potential of technology. In particular, he discusses the destruction of human and natural environment by using technology, the alienating nature of human communication mediated by technology and the collapse of social structure.

In "Technics and Human Development", American social philosopher Lewis Mumford (1986) also examines technology from the sociological and anthropological view, perceiving it as the key to organization of Western society.

Similar to Berdyaev, he claims that technology itself cannot be the sole goal of progress (Mumford, 1986, p. 229).

Ancient technologies, used for practical purposes and related to rituals and games, reflected human esthetical conceptions. Mumford wonders what brought about a shift from the utilitarian use of technology in everyday life to a technology used to increase power and wealth. According to him, the causes of this shift lie in social innovations that led to a systematic organization of activity that strictly followed a mechanical model. Man came to be separated from his natural environment and became part of automatic functioning structure which influenced human nature repressed by technology. Complex machinery and the new management system shaped the notion of work as a curse, a burden, a punishment, from which it is necessary to get rid of by transferring the burden to various technological devices.

Cybernetic theory of interaction between man and technology

Not only philosophers and sociologists, but also natural scientists have studied the complex relationship between humans and machine. The well-known mathematician Norbert Wiener has made a considerable contribution to this topic. Ethical, religious and sociological aspects of cybernetics are discussed in his works, "The Human Use of Human Beings. Cybernetics and Society" (1958) and "God and Golem" (1966). Wiener analyses the phenomenon of self-learning machines and self-replicating machines, and reflects upon coordination between machines and humans based on division of functions between them. The theory according to which machines are not to be put on the same level with living beings is the fundamental theoretical and worldview principle underlying his research. Wiener states that comparison between man and machine is not only offensive from an ethical viewpoint, but also erroneous since a human gives top priority to achieving human goals when interacting with machines (1966, p. 81). Here we mention again Berdyaev's claim that "a mechanism is created for a specific goal, it is not born with its particular goal" (1989, p. 150). In Wiener's viewpoint, the magical forces of contemporary automatization working towards destructive goals (nuclear apocalypse, anthropogenic imbalance in ecology) constitute a major drawback of contemporary society. In this regard, the man-creator is responsible for imposing strict limits on his own curiosity and for using his moral sense in regard to the boundary between good and evil.

Thus, the above analysis of various approaches to understanding the relationship between man and technology, as developed in philosophy, sociology and natural science, leads to the following preliminary conclusions.

First, technology has anthropological origins, since it emerged as an essential element of economic processes.

Second, technological advances in the era of industrial revolutions brought about alienating tendencies in the interaction between man and technology. Among

these tendencies are an anthropological regression, a destructive potential of technology in regard to nature, militaristic uses of technology, technologization of politicals, social inequality, unemployment, the need to satisfy the wants of consumers that are imposed by the media and defined by culture, but have no vital significance.

Third, limiting irrational consequences of technology can stem from moral and ethical farsightedness of humans as rational beings that have a social vocation to organize and manage the society.

Fourth, there is hope that negative social consequences of technology can be overcome by using another, more advanced technology as long as they remain under human control and are managed in a rational way.

Fifth, the research tradition of investigating the "man and machine" problem using metaphysical and sociological methods continues to be of current interest. However, an extremely complex framework of the present post-industrial society, unprecedented social and technological shifts and hazards of the last decades highlight the necessity to carry out detailed sociological analysis of this topic, primarily from a sociological viewpoint.

ROBOTS IN SOCIAL LIFE.

Social robots

In his presentation in 2003, Steve Holland, General Motors chief researcher, said that robots had been intended primarily for the "3 D" jobs: dirty, difficult, and dangerous. They could undertake dangerous or routine work, replacing humans (Henderson, H, 2006, p. 25). According to J. Engelberger, this largely improved working conditions for human workers (Henderson, H., 2006, p. 28). Robotics continued to develop and, in the 80s, robots were used for everyday tasks, such as cleaning windows and floors, mowing lawns, etc, going beyond industrial production.

In the 90s, service robotics brought autonomous robots into human environment (Breazeal, C., 2004). Robots gradually came to be considered as potential higher-level employees in the service sector: waiters, babysitters, teachers, secretaries, etc. New tasks for robots requiring active interaction with humans necessitated a new kind of interface and a revision of the existing human-robot interaction (HRT) as possible paradigm. The new interface had to be as intuitive, familiar and natural to humans as possible. Standard semiotic systems of social interaction (language, non-verbal elements, paralinguistic means, etc.) met these requirements. Prior to this time, human beings were regarded, in the research field of human-robot interaction, more as obstacles to robots' navigation system, rather than social beings.

Later, researchers started developing social-interfaced robots able to interact and communicate with humans. A new research direction, called social robotics,

appeared in early 2000s. Cynthia Breazeal (2004), the leading researcher at MIT, defines the new role of a robot interacting with humans as "sociable partner". Terrence Fong (2003) lists requirements for social interface of a robot and, in particular, "human social" characteristics a robot should exhibit. They include:

express and/or perceive emotions
communicate with high-level dialogue
learn/recognize models of other agents
establish/maintain social relationships
use natural cues (gaze, gestures, etc.)
exhibit distinctive personality and character
may learn/develop social competencies

Thus, social interface is a metaphor describing a natural communicative interaction between humans and robots (Hegel, F. *et al.*, 2008).

Large-scale implementation of robots in everyday life will likely take place upon the complete establishment of the post-industrial society. The latter being a service society (Bell D., 1986), there will be an urgent need for service labour, most probably done by social robots. Social robots are already being employed in the service sector. For instance, a hotel run by robots (including social ones) has recently opened in Japan (Pierce, A., 2015). In Japan, South Korea, Thailand (Qing-Xiao, Y., *et al.* 2010) there are new restaurants staffed by robots: cooks, administrators and waiters. Social robots are perceived as the future of the tourism industry (Nieto, D et al., 2014). They are tried out as teachers (Kanda, T., Shimada, M., & Koizumi, S., 2012), babysitters, caregivers (Broekens, J., Heerink, M., & Rosendal, H.,2009), doctors, sex-toys (Levy, D., 2009) and so forth (Pieskä, S., Luimula, M., Jauhiainen, J., & Spiz, V., 2012). Social robots can also be used in military operations. For example, a social robot can act as a mediator preventing war crimes (Lin, P., Bekey, G. A., & Abney, K., 2009).

Machines allowed mankind to transform his physical habitat, and changes in man's natural environment inevitably led to changes in the organization of his social life (Weizenbaum, J., 1976). We regard the implementation of robots into society as a crucial factor triggering major transformations in society and relationships within it. The above-mentioned reasons also call for an explanation of ethical and sociocultural aspects of large-scale implementation of social robots and problems related to the transformation of the social class structure.

Peculiarities and limitations on the uses of robots in social life

At present, it is possible to foresee complications that will inevitably arise in this area. According to A. R. Hochschild (1983), emotional attitude is an inherent part of the service labour, and robots will be considerably limited in this domain. Emotional labour is a complex phenomenon consisting of a superficial (imitation of emotions) and deep (real feelings) performance. The exterior (cultural) interface

of a robot and its technical features will make it possible to imitate to the maximum the expression of feelings when interacting with humans (or to accomplish a superficial emotional labour). However, no matter how faithful their imitation of emotions may be, no robot could ever replicate the deep performance of human emotions. The question is whether this limitation in performing service function will become a real obstacle for robots to be implemented. Although the deep emotional component is of extreme importance, the latest research demonstrates that humans do not feel the lack thereof when interacting with robots. This is due to the fact that people perceive autonomous robots as individual subjects having individuality, capacity for self-control and the ability to feel emotions (Baudrillard J., 1995). In other words, the absent emotional component is imagined by human user's mind.

At present, limitations on professional functions of robots are already being discussed (Lin, P., Abney, K., & Bekey, G. A., 2011). These limitations can be related to technical capabilities. Thus, C. B. Frey (Frey, C. B., & Osborne, M. A., 2013) maintains that, despite obvious advances made in robotics, robots still lack "social intelligence", which is an important part of many professional tasks involving communication, care, etc. Social robots can reproduce some aspects of human social interaction in real time, but recognizing and reacting to human emotions remains a serious challenge for robots. As of now, robotization is more developed in areas in which social intellect is not a key requirement for staff. Other researchers argue that robots should be kept away from some types of professional occupations altogether. J. Weizenbaum (1976) puts forward the idea of "foreignness of artificial intelligence" to humans. According to him, in every culture, there exist kinds of problems for which nobody coming from a different culture can suggest feasible solutions. This does not mean that an "outsider" is totally incapable of taking decisions: he can simply flip a coin. What is important to Weizenbaum is this: the basis on which one made a decision will inevitably prove to be incompatible with the context of the solution to be found. In a similar way, computers are capable of pronouncing judicial sentences or taking decision related to the future of a mentally disturbed person: for example, machines can flip coins in more sophisticated ways than the most obstinate person. In some cases, they could even make "right" decisions, but inevitably based on such conditions that no human being will be willing to accept. Weizenbaum affirms that some types of thinking processes should be done only by humans. In his opinion, it has nothing to do with what we can and cannot achieve in artificial intelligence. Respect, consideration and love are not technical tasks. Robert and Linda Sparrow (2006) also argue that using robots to take care of senior or handicapped people is unethical, since robots are incapable of care, compassion, warmth, etc. Moreover, the question remains whether, during such interactions, social robots should maintain or limit the emotional bond that a client may develop (Riek, L. D., & Howard, D.,2014). Many other ethical issues

related to social interactions between humans and robots are also mentioned, for example desocialization and trust (Royakkers, L., & van Est, R.,2015).

Therefore, multiple issues concerning uses of social robots overviewed above destroy the idealized perceptions of robots as liberators of mankind from heavy and routine work.

PROSPECTS OF A NEW EMERGING CLASS OF THE PRECARIAT IN THE CONTEXT OF ROBOTIZATION OF LABOUR

The precariat and robotization of labout

Robotization, or the gradual implementation of robots in the production sphere, similar to many innovative technological advances, brings about significant changes in the current social order, irrespective of the pace of implementation. This process can be observed in the formation of the precariat class speeded up by an active implementation of technical innovations in the process of the establishment of the post-industrial society. The precariat is a new emerging social class formed by people without permanent employment, professional self-identification and social protection (Standing G., 2011). Large-scale precarization processes contribute to the transformation of social structure. The emergence of precariat as a new marginalized class has led to a new understanding of social stratification, based on the new criterion: stability/instability of employment. This does not mean, however, that previous criteria of social stratification are fully discarded. Since the precariat members have different levels of income, education and professionalism, these criteria of social stratification become less important than stability of employment.

At first sight, the connection between the precarization problem and gradual robotization processes is not evident. Given the continuing establishment of the post-industrial society, however, robotization can be seen as a factor bringing about far-reaching changes in employment labour structure, which will be eventually directly tied to the precarization problem.

Since robot development and implementation practically always results from the necessity to solve a specific problem in a given social situation, this necessity can share common ground with the precarization problem. One of the major causes of the emergence of the precariat is big business's pursuit of additional profit and reduction of expenses. A temporary employee has no health insurance and other benefits guaranteed by the employer. The same necessity may eventually act as a catalyst for robotization. Falling costs of social robots, robots' capacity to work 24/7 and no need for social expenses can lead to replacement of humans by robots in certain areas, due to their low cost and quick cost recovery (Dyer-Witheford, N, 1999).

According to some researchers, robotization will lead, by 2050, to the loss of over 50 million jobs in industry, service and transportation sectors (Brain, M.,

2003). At the same time, the growing need to cut back on social expenses and the ensuing robotization of work will eventually push members of other social classes into the precariat, especially workers, as robotization takes place most actively in this area. Moreover, if the precariat evolves from being a class "in itself" into a class "for itself", and some groups form within it and, subsequently, put forward demands for improving their social conditions, robots can be used to replace precarized workers.

As mentioned above, social robots have limitations when it comes to perform certain socio-economic functions. Thus, their implementation will not affect spheres involving emotional labour. Large-scale use of social robots will create a need for a different kind of workers who will maintain the functioning of robot systems. Some researchers argue that creation of such jobs will inevitably lead to specific economic and social challenges, such as training and re-skilling of employees (Angelo, J. A., 2007). However, taking into account the tendencies of the post-industrial society in which continuous education and acquisition of new specializations become a necessity, expenses on potential employees may provide at least a partial solution to the economic aspect of the problem. The emergence and expansion of the new employment sphere can contribute to partial reduction of social tension caused by increasing competition on the job market, because the precariat can be involved in operating social robots. This will not solve the precarization problem and will only help redirect the precariat into new spheres of activity. However, the reviews of the new occupational area are questionable. Certainly, the spread of social robotics will be accompanied by a high demand for creation, maintenance and sales of robots. The question is whether humans will be engaged or not in these After all, robots can be designed to create, repair and also sell robots. In addition, robot manufacturing can be outsourced to the third world countries to reduce production costs. Therefore, the new sphere of activity will be either artificially assigned to the precariat (in order to address employment problems) or will rely from the very beginning entirely on robot workers.

Challenges and possible solutions

Social robots will be likely implemented in the areas currently occupied by the precariat. The members of the precariat will be unable to compete with social robots for many reasons, the most important of them being reduction of labour costs. Limitations of social robots are only a temporary obstacle to full-scale competition. The unavoidable limitation (for instance, in emotional labour) can be declared insignificant, and their elimination will become superfluous. Service labour can be fully robotized, and self-service systems could make up for the absence of emotional labour. Therefore, human workers will be progressively replaced, as social robots' deficiencies are eliminated. This is why social robots can initially be employed as assistants in some sectors (for example, medical treatment and nursing).

In this case, social robots will perform additional tasks that people interacting with them will be unaware of. Social robots will be able to have informal and covert supervision of human staff; unlike surveillance cameras, they will not only carry out local surveillance for the employer, but will also automatically analyse behavioural patterns of the employees. This will widen the scope of social control, and data obtained may serve as a reason for firing staff.

The distinguishing characteristic of the precariat as a disparate social class comprising a great variety of social groups is the constant internal and external competition for stable employment. In the context of the constant expansion of the precariat class, a systematic lack of positions when necessary measures are not taken to counter this situation and robotization of labour, competition will intensify, leading eventually to a rise in social tension.

Rise in unemployment may cause widespread discontent and aggression towards robots seen as the root of the problem. At the outset of the industrial revolution, workers intentionally destroyed machinery which they viewed as a real threat to their jobs (Hobsbawm, E. J., 1952). A repetition of this scenario – targeting robots, this time – is not inevitable. Robots' social component will act as one of major obstacles to its elimination. A thorough development of cultural interface of a social robot as well as its prospective interactivity will result not only in social robots' close resemblance to humans or animals, but also in their reactions to external stimuli, imitating, for example, a pain reaction when injured. Moreover, if social robots are endowed with minimal rights, injuring them will have serious legal consequences (Darling, K., 2012). Thus, these characteristics of robots will hinder their destruction on a subconscious, emotional level, whereas protection of their social rights will legally block their destruction.

The following solutions are traditionally put forward to the problem of robots replacing humans in the workplace: use of robots only in low-skilled and, consequently, low-paid jobs and/or creation of highly specialized jobs inaccessible to robots (Henderson H., 2006).

Given the current situation, the first solution is hardly feasible, because social robots are intended for use in various industries, including the high-paying ones. The second solution suggested by researchers, together with the use of robots in low-qualified jobs, can act as a catalyst for the process of human workers being channeled into information production and data processing spheres. This corresponds to tendencies of the post-industrial society to establish information economics, but requires considerable time and economic costs. Both suggested solutions imply the need to restrict the development of robotic technology.

Artificial creation of jobs may serve as a temporary solution to the issue of robots replacing human workers. However, the necessity to distribute jobs among unemployed will only "precariatize" this kind of jobs. And, eventually, this measure will not prevent large-scale unemployment due to high economic costs.

The consequences of massive robotization may prompt sweeping changes not only in economy, but also in employee attitude. The situation of replacement can be used to put into effect Guy Standing's "politics of paradise" (2011). A guaranteed, unconditional basic-income for all along with a shift from job creation to the policy of involving people in socially significant activities could help break the deadlock.

New social and technological system

According to A. Giddens (2015), we are witnessing the emergence of an absolutely new social and technological system consisting of a thought-out set of ideals, strategies and practical measures. Responding the question "Where will the new jobs come from in developed countries?", Giddens promotes the idea of optimal restructuring and reform of state management mechanisms. Economic growth and prosperity in the post-industrial world depend on developing efficient strategies of interaction between government and economics, government and technology. In particular, the point at issue is rebalancing of deindustrialization and reindustrialization in the post-industrial production.

Giddens (2015) maintains that, although production is robotized in developed European countries, it helps create new jobs in auxiliary sectors. The author defines reindustrialization as a strategy to bring back into developed countries manufacturing that was previously outsourced into countries with cheap labour. Auxiliary production and the expansion of the service sector contribute to creation of many new jobs. Giddens states that boundaries between industrial sector and service sector are blurring, and this also helps bring jobs back. Digital technologies transform the very notions of production and services. Giddens cites the example of robotization in the defence industry which produces, for example, unmanned aerial vehicles. The ultimate goal of technological development consists in an unmanned aerial vehicle flying right out of the printer, complete with electronic systems and fully fuelled tanks, he says. While the service sector continues to dominate in the post-industrial economy, handicraft productions, small and medium-sized enterprises and small companies capable of competing with and even replacing large-scale productions have been showing signs of a revival lately. The fusion of nanotechnology, biotechnology and computer technology will have long-term consequences, since it coincides with wider processes that contribute to return of production from abroad.

CONCLUSION

1. Researchers compare the forthcoming mass robotization to an industrial revolution, claiming that it will have no negative consequences for the established employment system. However, their estimates do not take into consideration the ever-increasing pace of technological change. Moreover, during the industrial revolution, implementation of machinery was concentrated

in specific production facilities and threatened only a limited number of workers. Robotization has no precise narrow direction, and it threatens industrial workers along with service employees and even intellectuals.

2. In the first stages, extensive implementation of social robots mostly threatens the precariat, contributing to the growth of this social class and leading to intense competition.
3. Unlimited implementation of social robots will contribute not only to cheapening of unskilled labour, but rather to labour cheapening in general.
4. The consequences of introducing social robots to employment and labour structure will depend on goals of their implementation. Soft implementation, that is, progressive replacement of underpaid human labour with robots without severe limitations on their use in other sectors may prove to be an interim measure for preparing a full-scale shift to information economy. Another measure consists in re-evaluation of jobs with subsequent channelling of human labour to socially useful activities
5. Economic and social factors of social robot implementation should be taken into account to avoid negative consequences of robotization.

The proposed research aims to consider the problem of social dimensions of robotization of labour in post-industrial society and will lead to further research on issues related to conceptualization of social robotics, on the one hand, and analysis aimed at understanding and forecasting changes in social structure in the context of current restructuring of employment system, on the other.

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