

ASYNCHRONY FORMATION 4.0 INDUSTRY IN THE RUSSIAN REGIONS

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Abstract:

Subject. In the conditions of high variability of the external environment and dynamic development of new technologies in all spheres of social and economic life, modern society and Russia, in particular, face the need to develop adequate and flexible mechanisms for responding to external challenges. **Goals.** The author attempts to analyze the trends and limitations of the development of the fourth industrial revolution in the regions of Russia in a multifaceted way (by the example of the regions of the Southern Federal District). **Methods.** The methodological base of the study is a complex-comparative analysis and synthesis of the experience of the regions of the southern federal district in the field of strategic development of territories in conditions of the transition of the Russian economy to digital format, as well as the method of included monitoring of institutional changes in strategic territorial development. In addition, within the framework of this study, a sociological survey was conducted, in the form of a questionnaire of three target groups - representatives of government authorities, regional business and the scientific community (together with students) of the city of Volgograd. **Results.** The article analyzes the readiness of Russian regions to move to a digital economy (Industry 4.0) from the positions of regional authorities and the education system as the main drivers of realizing the technological potential of the territories. The study analyzed the strategic documents of regional development regions of the Southern Federal District and the data Index Russian regions' readiness to information society. The conducted sociological surveys showed that the overwhelming majority of respondents are completely ignorant of the trends in the development of the fourth industrial revolution and even of its existence.

Conclusions. Based on the analysis, trends are revealed in the development of Russian regions in the context of the transition of the economy to digital format and practical recommendations are being made.

Keywords: the fourth industrial revolution, Industry 4.0, regional development, information and communication technologies, place marketing

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1. Introduction

Experts from around the world are confident that we are on the threshold of "radical changes in all sectors of industry, marked by the introduction of new business models, the disruption of more traditional established companies, as well as a core transformation of systems of production, consumption, transportation and supply" [1]. The development of information and production technologies is transforming not only the economic, financial and institutional sectors, but has also borne a significant impact on the social foundations of modern society.

The spatial development of Russia's regional systems occurs is molded and influenced by this new global model of technological development; the so called "Fourth industrial revolution" or "industry 4.0". A distinctive feature of this model of technological development is the transition to "smart systems", which are based on digital technology and artificial intelligence. The need to modernize local industries coupled with the transition to a new model of economic development has forced the majority of Russia's regions to seek new ways to transform their industrial potential in the context of its post-industrial innovative development. These transformations are important not only from the point of view of sustainable development of economic, social, and political regional systems; but also can heighten the competitiveness of regional producers in foreign markets.

The main goals of this research is to provide a multifaceted and insightful analysis of the trends and developmental constraints of the Fourth Industrial Revolution in Russia's regions (using as an example the regions of the Southern Federal district) and to propose a way forward to the regions faced with adapting to this technological shift.

2. Methodology

The methodological basis of the study is a comprehensive comparative analysis and synthesis of the Southern Federal District's experience concerning the strategic development of its regions in response to the Russian economy's digital transformation as well as monitoring the institutional changes of this strategic territorial development. In addition, we conducted a sociological survey, in the form of a questionnaire, on the trends of the fourth industrial revolution. The sample-size of 547 was drawn from three groups of respondents: representatives of the local government and public administration, of local businesses and from members of the scientific community (together with students) of the city of Volgograd. Such sociological surveys have made it possible to assess the scale, nature and stage of development of the Fourth Industrial Revolution in the Volgograd region, as well as emerging trends that cannot be assessed exclusively by quantitative indicators.

This research is based on the analysis of two factors considered by the author to be essential for a successful transition to a new model of technological development: the effectiveness of existing state institutions and the systems of higher education.

Perspective of economic development in the Russian regions

The development of the Southern Federal District (SFD) is complex. The exception is some of its territory such as Krasnodar and Rostov region, where the main

financial, human and innovative resources are accumulated. However, it should be noted that in the recent years many regional projects have been implemented in all areas of the southern Federal district. The timing of the most projects is determined by the year 2025. All regional projects support national projects and development strategies of each individual subject of the Russian Federation. For example, the General goal of the Strategy of socio-economic development of the Volgograd region till 2030 (decision of the Volgograd Duma on 25.01.2017 No. 53/1539) determined the increase in the quality of life of the population of Volgograd through the development of human capital, innovative economy, local governments, and improve the quality of the urban environment.

At the same time, economic factors have a significant impact on the quality of life of the population: real incomes are falling, business is leaving the region. These trends affect the revenue side of the budget, and, accordingly, the implementation of the powers of local governments.

According to Rosstat of the Volgograd region as of 01.01.2018 the number of registered organizations in the Volgograd region in relation to the previous year decreased by 9.8 percent. The receipt of tax revenues to the Volgograd budget for 9 months of 2018 compared to the same period in 2017 decreased by 728.4 million rubles.

These negative trends indicate that the southern Federal district is developing unevenly and lagging regions should increase the pace of economic development in the short term. To this end, there is a need to mobilize the available resources of the lagging regions in order to increase their own GDP.

The long - term development prospects include the fourth industrial revolution, more commonly referred to as "industry 4.0". The fourth industrial revolution involves the synergy between industry, state and municipal management and digital technologies leading to the creation of digital industries (smart plants and factories), where all machines, equipment, products and people communicate through digital technologies and the Internet.

The industrial revolution boils down to production targeting Internet-dependent consumers, as even household appliances will run through the network. According to many world experts, this will lead to radical changes in the industry and the introduction of new business models. Industry 4.0, smart home or smart city already has its real projects that gradually penetrate into public life. In the near future, the General technological trends will be unmanned vehicles, 3D printing, advanced robotics and new materials.

Ultimately, the development of digital technologies will transform not only the economic, financial and institutional sectors, but will also have a significant impact on the social foundations of modern society.

However, strategic changes in the technological development of the southern Federal district are impossible without quality human capital. Currently, it is necessary to synchronize the training of engineering and scientific personnel with the goals and objectives of the city's economy.

A key factor in the success of the SFD development will be the readiness of municipal (state) institutions to effectively support technological initiatives. Therefore, the model of economic development should be adapted to the scenario of new challenges and threats to the introduction of the Digital economy. In the very near future, it is

necessary to begin preparations for the digital transformation of the economic sector, otherwise some areas of the southern Federal district may lag far behind other regions of Russia.

3. Research results

Our sociological surveys have shown that the vast majority of respondents are completely unaware of the Fourth Industrial Revolution let alone its trends.

Table. 1

Distribution of responses to the question "How do you estimate the trends in the development of the fourth industrial revolution in the Volgograd Region?"

Answer	Total	Including:		
		Authority	Business	Science /students
"The Fourth Industrial Revolution in the Volgograd region is developing at a pace comparable to the global average»	2	6	1	0/1
"The Fourth Industrial Revolution in the Volgograd region is developing at a pace above the global average»	1	0	0	0/1
"The Fourth Industrial Revolution in the Volgograd region is developing at a pace below the global average»	258	12	39	198/17
Difficult to answer	66	14	23	11/12
"I don't know anything about the Fourth Industrial Revolution»	220	70	45	12/85
Total:	547	102	108	221/116

Source: author's

The most uninformed reference group were representatives of government and public administration – 82% of respondents found it difficult to assess the trends of the Fourth Industrial Revolution in the region, or openly stated that they knew nothing about this phenomenon. This is key, because the success of the ongoing initiatives for the strategic innovative development of the region depends on the efficacy of state institutions. The implementation of a model of advanced economic development is impossible without building effective institutions to support technological initiatives from the local to federal level.

The analysis of strategic documents on the socio-economic development of the regions of the SFD¹, as well as the monitoring of the official websites of the Executive authorities of the constituent entities in the section of the structures responsible for innovation development revealed, first of all, that the strategic documents are standardized in nature and highly formalized.

The uniformity of their formats does not reflect the specifics of territorial development, and therefore does not imply adequate tools and mechanisms for individualized development. None of the studied policies for socio-economic development, except for Crimea's, has focused on new technological trends and their potential impact on regional systems. In the Policy for the Socio-Economic Development of the Republic of Crimea (through 2030) there are elements of a more complex approach to the strategic planning of territorial development including a list of factors influencing the development of the region, an analysis of the main risks for development in the Republic of Crimea and potential contingencies, which take into account new forms of technology.

The analysis further revealed the lack of official structures specializing directly in the development of technological innovations and provisions for their support. In general, issues related to the innovative development of territories are addressed by committees (ministries) of economic development or industry, in which the maximum is allocated to specialized departments, which naturally cannot be evaluated as a full-fledged form of institutional support for the technological development of regions.

There is a need for a qualitative review of the place and role of regional institutions in the system of technological development. The transition from a contemplative to an inclusive model of development and the support of technological innovations should be able to rely on the active participation of regional institutions to create an attractive environment within the Russian territories to attract and retain quality human capital that can provide a technological revolution in the regional sectors of the economy.

Russia's low level of readiness for the transition to the digital economy is confirmed by an analysis of socio-economic inequality in the Russian Federation. The readiness index for Russia's regions is a measure of a region's preparedness for large-scale use of ICT for socio-economic development (Table 2).

¹ Strategy for socio-economic development of the Republic of Adygea 2025 (<http://docs.cntd.ru/document/459703256>); Strategy for socio-economic development of the Astrakhan region 2020 (<http://docs.cntd.ru/document/424066211>); Strategy for socio-economic development of the Volgograd region 2025 (<http://docs.cntd.ru/document/819076044>); Strategy of socio-economic development of the Republic of Kalmykia for the period up to 2020 (<http://docs.cntd.ru/document/430644731>); Strategy of social and economic development of Krasnodar region until 2020 (<https://krasnodar.ru/content/592/show/49460/>); Strategy of social and economic development of the Republic of Crimea until 2030 (<https://minek.rk.gov.ru/file/File/minek/2017/strategy/strategy-shortvers.pdf>); Strategy of social and economic development of the Rostov region for the period up to 2020 (<http://www.donland.ru/Default.aspx?pageid=85416>); Strategy of social and economic development of the city of Sevastopol until 2030 (<https://sevastopol.gov.ru/docs/250/32152/>)

Table 2

Readiness rating of Russian regions for information society

Place	Region	Index
1	Moscow	0,693
2	Saint-Petersburg	0,643
3	Yamalo-Nenets Autonomous district	0,609
35	Krasnodar region	0,456
46	Rostov region	0,443
47	Astrakhan region	0,439
48	Volgograd region	0,438
71	Republic of Kalmykia	0,399
73	Republic of Adygea (Adygea)	0,399
82	Republic of Dagestan	0,302

Source: based on materials [4]

According to the ranking, the position of the SFD regions, which are in the second part of this list, indicates a low level of development in the information and communication infrastructure.

Among the regions of the southern Federal district the best position in the ranking is the Krasnodar region (35), the outlier is the Republic of Adygea (73 out of 82). Three regions of the Southern Federal District (the Rostov, Astrakhan and Volgograd regions) have almost identical indices and are next to each other in the ranking – 46, 47 and 48, respectively. The inability to respond quickly and flexibly to the technological challenges of the modern world is one of the most significant constraints to regional development.

Public authorities and bodies of local government widely use modern technologies to interact with stakeholders in the territory (population, business, civil society, etc.). However, the level of development of information and communication technologies in the regional context is characterized by asynchrony and asymmetry.

Within the framework of the Readiness index of these regions to information society, the authors identify the sub-index "ICT in state and municipal management", which is based on five groups of indicators characterizing the access of local governments and state authorities of the Russian Federation to ICT.

These indicators characterize the following: the use of electronic document management, the provision of state and municipal services in electronic form, the use of open government mechanisms, and the use of e-government technologies by enterprises in the region. The results of this sub-index are presented in table 3.

Table 3

Rating of regions by the values of sub-index "Information and communication technologies (ICT) in state and municipal management"

Place	Region	Index
1	Moscow	0,556
2	The Republic Of Tatarstan (Tatarstan)	0,539
3	Chuvash Republic – Chuvashia	0,532
13	Astrakhan region	0,489
21	Rostov region	0,476
39	Volgograd region	0,445
57	Republic of Kalmykia	0,413
59	Krasnodar region	0,411
65	Republic of Adygea (Adygea)	0,399
82	Republic of Dagestan	0,329

Source: Based on materials [4]

The performance of the SFD regions in this sub index is much better than their final position in the overall rating. Thus, the Astrakhan region is a leader within the southern Federal district in terms of its implementation and use of ICT in state and municipal management (13th place against 47th in the overall ranking), while the leader in the overall ranking (35th place), Krasnodar region according to the sub-index occupies the very modest, if not abysmal 59th place. The weakest region in the southern Federal district according to the overall rating of readiness of Russian regions for the information society (73rd place), and the values of the sub-index "ICT in state and municipal management" (65th place) is Adygea, where, in our opinion, there is neither the critical level of need nor the interest of regional stakeholders to transition to a new technological way of socio-economic development.

The data presented above indicate the unwillingness of the regional authorities to adequately and flexibly respond to external threats and challenges that are regularly manifested in the external environment. The reasons for this immunity to external changes require further study and cannot be attributed alone to the low qualification of officials and the existing institutional imperfection of regional systems. The low level of readiness of the regional authorities to technological changes and the introduction of innovations in all spheres of life, of course, is a deterrent not only to the effectiveness of socio-economic development of individual territories and the country as a whole, but also a hidden threat to national security.

Strategic changes in the technological development of the country and its regions are not possible without high-quality human capital. The role of human resources in the development of the economy and society as a whole, was described by many scientists and experts such as Korotkov E.[5]; Fursik S. N. [6]; Zaloznaya G. M., Morgunov V. P. [7]; Iatagan, M. [8]; Korobaničová, I. [9]. In this paper, we will focus on a specific segment – the higher education system and its importance for the development of the technological structure of the country and regions Câmpeanu, E.[10] Universities are designed to provide the human resources potential of the fourth industrial revolution. Today's University students both support and promote socio-economic and technological

prosperity. The goal of modern universities, according to the author, should be the training of high-quality interdisciplinary specialists (smart creatives²), able to respond flexibly to the ever-changing environment of the labor market and industrial development.

According to our sociological survey (table. 1) the field of science is characterized by the polarity of awareness of the trends of the fourth industrial revolution at the regional level. On the one hand, we see a high percentage of awareness among the teaching staff of universities about the trends of the technological revolution-89.5% of respondents.

At the same time, only 16% of students were able to assess this phenomenon. Under conditions where "the life cycle of technologies becomes comparable to the time it takes to train people, and the professions for which the people are being trained are increasingly under threat of disappearance" [11], universities should, now more than ever be able to quickly and flexibly respond to the needs of the labor market and the economy with professional personnel capable of providing a stable trajectory of development for the economic, social and political systems.

Everyone, from members of the scientific community to top government officials, is talking about the need to synthesize the system of training specialists with the demands of the economy. Regional economic growth largely depends on the availability of qualified engineers in promising industries and science. According to expert opinion, the general technological trends are:

- unmanned vehicles;
- 3D printing;
- advanced robotics;
- new materials [1].

For the purpose of this study, we conducted a content analysis of the sites of the leading universities of the southern Federal district, mainly technical, in order to introduce training in the areas identified as promising based on our predictions of future technological developments.

² The term is taken from the book "how Google works" (authors: Eric Schmidt and Jonathan Rosenberg) and by authors we understand a person who combines deep technical competence in his field with intelligence, business savvy and creative qualities."

Table 4

Educational programs of Southern Federal District (SFD) universities oriented toward a new technological structure

University	Number of educational programs focused on the new technological way		
	Bachelor's Degree	Specialist	Master's Degree
Astrakhan state technical University	4	1	3
Maikop state technological University	2	1	0
Volgograd state technical University	4	0	4
Kalmyk state University	1	0	0
Don state technical University	11	0	13
Crimean Federal University named after V. I. Vernadsky	1	1	1
Southern federal University	8	0	5
Sevastopol state University	3	0	3

Source: author's

In the analysis of educational programs focused on the new technological structure of the SFD universities, we investigated not only the Enlarged Groups of Specialties (EGS), but also the profiles (master's programs) within these EGS. A significant limitation of this analysis is its quantitative rather than qualitative approach to the study, which could give a more comprehensive view of the training system for engineers in priority areas.

The undisputed leader among the universities of the Southern Federal District in the number of educational programs focused on the new technological structure is Don State Technical University (Rostov-on-don), which has a total of 24 fields related in some manner to technological changes and focused on increasing the competency of future graduates in engineering.

The data presented in Table 4 indicate that the regional higher education system is not ready to respond in a flexible and timely manner to the new demands of industrial production on the basis of the emerging technological structure. Conservatism and bureaucratization of regional, and in fact the majority of Russian educational institutions is a strong deterrent in the formation of effective educational routes focused on the specific needs of territorial socio-economic systems.

4. Conclusions and recommendations

Based on the analysis, the following trends in the digitization of Russian regional economies can be identified:

- the unpreparedness of regional authorities to adapt the structures of existing economic, social and political systems to account for the transition of the economy to a new technological structure;
- higher education systems in the regions do not keep pace with the transitioning demands of industrial production on the basis of the emerging new technological structure;
- the asynchronous development of advanced "breakthrough" technologies at the level of Russian regions when compared to global norms;
- the failure of industrial enterprises, higher education institutions and regional authorities to properly develop;
- an imbalance in the structure of engineering training required for the implementation of technological initiatives of a new type.

To overcome the current situation of chronic backwardness in the field of technological development, we propose:

- to revise the model of regional economic development. It is necessary to adapt the methodology of territorial development to the new challenges and threats of "Industry 4.0" (the digital economy);
- to modernize the information technology and innovation infrastructure, to introduce advanced digital telecommunication equipment, high-speed data networks, and next-generation communication networks in regional management systems;- to form mechanisms of collaboration between all those who hold stake in the technological development of their regions. Special attention should be paid to such phenomenon as competitive cooperation [12-13];
- to synchronize the goals and objectives of regional development with the scientific and technical capabilities and resources of leading educational institutions, through the involvement of University scientists in the development of strategic documents of territorial development;
- to develop real practice-oriented education through integration with industrial enterprises of the territories in the implementation of educational programs;
- to form a relevant, flexible and comprehensive portfolio of educational programs aimed at training and retraining of personnel for the new model of the economy (digital economy).

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