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Territories' Predisposition Assessment to "Smart" Companies' Location*

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Abstract. Currently, one of the urgent issues for the Russian economy is to create conditions for the expansion of "smart" companies in the regions on which depend the society transition to a new type of technological structure, innovative development and the country's competitiveness. The hypothesis of the study is that some regions are more predisposed to the appearance of "smart" companies on their territories, while others do not have the appropriate conditions for developing innovative and digital technologies. To prove this hypothesis, the article reveals the concept of a regional 3D model of a "smart" company and offers a methodology for assessing regions' predisposition to the emergence of such organizations. A special feature of the author's methodology is an integrated indicator which is the result of the synthesis of graphical and analytical evaluation methods. The methodology allows identifying territories with favorable conditions for expansion of organizational ambidextrity, innovative development and companies' digitalization. It was tested in Russia's regions in 2010–2017. As a result, the paper has identified the typology of regions according to five criteria reflecting the predisposition to the emergence of "smart" companies, and has built their rating. The approbation of the author's methodological developments allowed establishing that industrially developed regions can be considered digitalization poles. The work shows that the Ural Federal District acts as a stable basis for the emergence and successful functioning of "smart" companies, as all its entities, except the Kurgan Oblast, fall into the top twenty territories favorable for their development. This pattern is not typical for other federal districts. In conclusion, the authors have determined principal development trajectories of the main elements of the 3D model of a "smart" company at the meso-economic research level in the following areas: "smart" personnel, "smart" environment, "smart" innovations and solutions.

Key words: "smart" company, organizational ambidextrity, innovative company development, companies' digitalization, 3D model of the company, assessment, region's predisposition.

Introduction

Currently, one of the urgent issues for the Russian economy is to create conditions in the regions for the expansion of "smart" companies on which the transition of society to a new type of technological structure, innovative development, quality of life and competitiveness of the country as a whole depend.

The concept of a "smart" company is mainly found in foreign sources and is understood as an organization functioning as an open system accepting information, material resources and energy from the environment, converting these resources into knowledge, processes and structures that produce goods or services, in turn consumed by the environment [1–4]. The relationship between the environment and "smart" companies is both cyclical and critical, due to the environment interdependence in terms of resources and justification for its continued existence [5].

As the environment becomes increasingly complex and volatile, maintaining viability requires companies to have sufficient knowledge about its current and likely future conditions, as well as timely application of knowledge to change their own behavior and positioning. In this regard, the models of "smart" companies are of absolute scientific interest. They are studied at the corporate level which clarifies the structural elements, characteristics, behavioral attitudes in the dynamic conditions of the external environment and develops recommendations for a particular company on how to increase knowledge level of organization's employees.

The object of the research is the regions of the Russian Federation. The subject of the study is the system of socio-economic relations that arise in the process of the emergence and expansion of "smart" companies. The purpose of the work is to design a 3D model of a "smart" company and assess the predisposition of territories to host organizations of this type on them.

The purpose predetermined the solution of the following tasks: to form the authors' understanding of a "smart" company; to develop a model of a "smart" company at the regional level; to develop a methodology for assessing the region's predisposition to the emergence and expansion of "smart" companies; to identify regions with the maximum predisposition and determine the support areas for successful functioning of such organizations.

Theoretical aspects of the concept of a "smart" company: an overview

Currently, the concept of a "smart" company is revealed meaningfully in general at the corporate or microeconomic level of research. However, there was no unambiguous understanding of this definition. For example, scientists at the University of Stuttgart define it as a production system that, being aware of the context, helps employees and equipment to perform tasks. There is a view that this is any robotic system that uses networks of sensors and computing devices that interact with each other to achieve highly efficient production [6] which, in turn, determines the technical content of a "smart" company as one of the dimensions of multi-scale production, involving the use of the most advanced tools and technologies of ubiquitous computerization. This point of view is based on the idea of a "smart" company as an environment capable of coping with the turbulence of the production process in real time through the use of a decentralized information and communication structure for managing the production process [7].

L. Kapustina and Yu. Kondratenko conclude that a "smart" company uses the results of digital factories (as an input product) and assumes production without human participation based on artificial intelligence and flexible integration (both between divisions within and with external partners). At the same time, digital factories themselves are the forerunners of smart enterprises [8].

E. Filos thinks that "smart" companies have as their goal a wider use of automation tools, improved control and optimization of processes. At the same time, he shares the concepts of "smart", "virtual" and "digital" companies believing that they differ in the purpose of creation, the means of achieving the goal and the emphasis in the work [9].

Despite the lack of a single definition, the main criteria for a "smart" company can already include data collection using sensors and transmitters, the Internet of Things, data storage in cloud services, information processing based on big data algorithms, the presence of human-machine interfaces and a digital platform that includes a common database and production cycle management tools and makes up an ecosystem, formation of a customized business model. In such an organization, the scale effect loses its meaning, due to the possibility of rapid changeover and restructuring of technological processes controlled by decentralized artificial intelligence to meet the orders and needs of specific individual customers [8].

In addition to the technical aspect, the definition of a "smart" company in the scientific literature is considered in two aspects: an organization that has knowledge or creates it. In the first case, we are talking about smart companies that are able to accumulate and multiply knowledge that allows solving problems of competitiveness in a dynamic environment. Moreover, the prefix "smart" is added to the concept of a company or organization when it is assumed that it uses "smart" technologies. Knowledge creation occurs when novelty is generated to solve new problems for which adequate solutions cannot be found in the knowledge base. The context of the intellectual behavior of the organization here is the solution to problems which implies the achievement of goals and objectives. In this case, the mind (intelligence) of the company is manifested not in the amount of accumulated knowledge, but rather in the ability to find original solutions to overcome various difficulties and resolve various life situations, or simply accurately assess them and use it to their advantage. Such companies are called "intelligent organizations", the very concept of a "smart" company is broader than the concept of a "smart company", and the first includes the second [10; 11; 12].

The company's "mind" can also be understood as a quality of behavior that is adaptive in the sense that it represents effective ways to meet the requirements of the environment as they change [13]. Thus, smart behavior is both purposeful and adaptive [14; 15], and it is the ability of organizations to possess knowledge, create and apply it that will be crucial in the future.

In a series of the works, G. Vilenskii considered a "smart" company from the point of view of collecting, processing, interpreting and transmitting technical and political information necessary in the decision-making process [16]. In his opinion, only a "smart" company is able to protect itself from information pathology which is largely due to the attitude of managers to the process of obtaining knowledge and the ability of information technology specialists to influence strategic discourse.

According to J. Mark and J. Olsen, the intelligence of a "smart" company is due to "rational calculation and learning based on experience". Rational calculation is the choice of alternatives based on an assessment of their expected consequences in accordance with preferences. This is a look into the future to anticipate the results. Experience-based learning is a choice of alternatives that takes into account the rules developed on the basis of the accumulation of past experience. This is a view into the past to find guidance for future actions. The researchers noticed that, as the limitations of rational calculation are realized, interest in the potential of organizational learning as the basis of organizational intelligence increases. Organizations and their people learn through their interaction with the environment – "they act,

observe the consequences of their actions, draw conclusions about these consequences and draw conclusions for future actions. This process is adaptively rational" [17].

J.B. Quinn described a "smart" company as "an organization that primarily manages and coordinates information to meet customer needs" [18]. The "mind" of an organization depends more on the development and use of intellectual resources than on the management of physical and financial assets. Its functions are divided into managed intelligent clusters, the so-called service activities. At one time, information technologies made it possible to delegate and outsource many of these activities to other organizations which strengthened the competitive position in the market. Instead of focusing narrowly on products, a smart company succeeds in several key knowledge-based activities that are critical to its customers, and surrounds them with other activities necessary to protect the core. Then, it uses advanced information, management and intelligent systems to coordinate many other diverse and often dispersed centers of activity needed to meet customer needs. As an example, we can cite the Russian company "Dodo Pizza". Openness and the Internet helped the Syktyvkar Company to become a market leader without a big history. Its own information system which it started using from the first day of work allows the company to permanently observe online what is happening in the business. Everything that has the Internet access can be integrated into this system. This is an example of creating value through the use of several critical types of knowledge-based services and the effective use of organizational intelligence.

Later, in 1996, Quinn co-authored with Anderson and Finkelstein described the intelligence of a "smart" company as having: 1) cognitive knowledge, 2) advanced skills, 3) systematic understanding and trained intuition, as well as 4) self-motivated creativity [19].

S. Haeckel and R. Nolan define a "smart" company as an organization that has "the ability and possibility to cope with complex situations in dynamic realities, that is, to capture, perceive, share and extract meaning from market signals" [20].

The complexity of managing a "smart" organization, in turn, is due to the volume and quality of information sources that are necessary for this, the number of business elements that should be coordinated within its organizational structure, as well as the number and type of connections of these elements. According to the analysis, the "intelligence level" (IQ) of an organization is determined by three important attributes: the ability to access knowledge and information (connecting); the ability to integrate and share information (sharing) and the ability to extract meaning from data (structuring). Connecting means that information sources, media, locations and users are connected in such a way that accurate information can be obtained and accessed by the right users at the right time and in the right place. Sharing means that people in an organization can share data, interpretations of data, as well as understanding of the main organization's processes. Structuring means that understanding, or meaning, is achieved by comparing and correlating information from several sources in such a way that some form of pattern or trend arises. Structuring is achieved by creating information about information, for example, how data is organized, connected and used. S. Haeckel and R. Nolan believe that structuring has the greatest potential for the strategic application of information to create a "smart" company.

According to T. Liang, the intelligence of a "smart" company begins with the intelligence of the divisions and members of organization; therefore, the scientist's research is related to the analysis of the mental abilities of individuals, as well as the influence of individual intellectual characteristics of a person involved in the formation of collective intelligence [21; 22].

M. McMaster noted in his works that in order to compete effectively, companies must be adaptive entities that directly welcome changes, constantly collecting information, generating new knowledge and introducing innovations based on these changes. He defined organizational intelligence as a function of the number of connections, their complexity and system design, as the main resource of a "smart" company [23].

M.A. Glynn gives a "smart" company information processing competencies that allow adapting to environmental requirements that initiate the development and implementation of innovations [24]. W.E. Halal gives the following definition: organizational intelligence is a function of five cognitive subsystems: organizational structure, culture, relationships with stakeholders, knowledge management and strategic processes [25]. According to J. Leibowitz, a "smart" company integrates the collective totality of all intelligences that contribute to building a common vision, the process of renewal and the direction of organization's activities [26].

A. Bollinger and R. Smith prove that the intelligence of a "smart" company is not just the sum of individuals' knowledge, but the synergy of employees' interpretations of information based on personal experience, skills, abilities and observations, as well as experience gained over time. Such characteristics allow understanding it as a strategic asset [27]. For a smart organization, knowledge is defined as what the staff knows about their suppliers, customers, products, processes, mistakes and successes. Knowledge can be placed in databases or distributed in experience and information about practice.

In addition, one of the characteristic features of a "smart" company is the ability to quickly respond to changes and complexities. It is obvious that the IQ of such an organization will be the higher, the stronger this ability is. From this point of view, the model of ambidextrous organizations is of interest, whose organizational design allows extracting profit from current economic activities (operational activities) successfully in the same way and exploring opportunities for creating new types of activities through the production of consistent and radical innovations (research activities). These companies use various strategies for producing innovations both internally and with the help of external developments [28].

Z. Simsek and his colleagues have developed a model of organizational ambidextrity according to two parameters: temporal (according to which ambidextrity can be sequential and simultaneous) and structural (independent and interdependent ambidextrity). Comparing these parameters, the researchers presented a typology with the identification of four types of organizational ambidextrity: harmonic, cyclic, divided and mutual [29]. So, for example, with the strategy of divided ambidextrity in business, there are two parallel working lines: the group of the present, responsible for current activities, and the group of the future which is looking for an answer to the question of how to transform the company. The team managing the profile business must perform its work effectively. The other team should move away from the current model and fully focus on ways to transform it. For a manager in this case, the main difficulty is to manage the business and at the same time rethink it.

Thus, the analysis of the concepts presented above allows identifying the following distinctive features of "smart" companies:

1. *The ability to "smart" action and "smart" response* (technical efficiency, cost efficiency and benefits are maximized through planning, continuous monitoring of operations and continuous training).

2. *Operational assets of a "smart" company* are an environment in which employees can use any device or mode to perform their work, have direct access to secure reliable information and be completely immersed in the business process.

3. Employees of the *"smart" company have full access to the necessary information* at any time.

4. A necessary feature of a "smart" company is *highly qualified workforce*.

5. Employees of the "smart" company are trained to carry out actions that ensure the *strategic efficiency of an enterprise*.

However, the distinctive features of a "smart" company presented above allow building its model only at the microeconomic level of research, when the object is the company itself, and the subject is the organizational and economic relations that arise in the process of designing its model. We propose a different approach that allows building a 3D model of a "smart" company at the regional, or meso-economic, research level using a three-dimensional space that reflects the regional parameters of "smart" development, i.e. contributing to the emergence and expansion of such companies.

3D model of a "smart" company

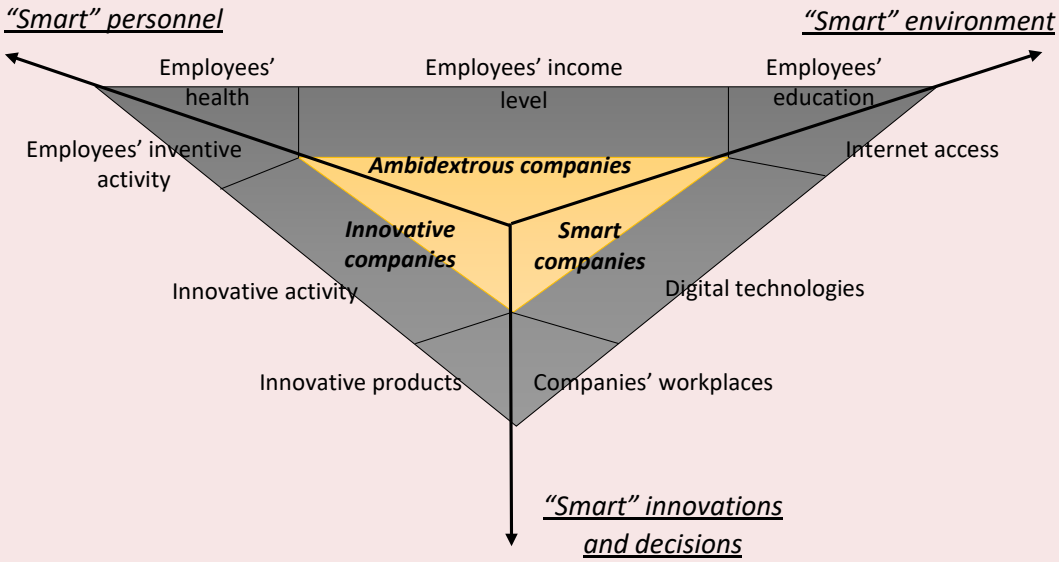
So, let us clarify that by "intelligent" company we will understand a company whose characteristics include the features of innovative organizations, ambidextrous companies and smart companies which determines its economic role as a basic actor of technological transformation and transition to a more innovatively complex sixth way. Based on this understanding, we have developed its model *(Fig. 1)*.

The most significant elements of a "smart" company which can be used in the future not only to identify it in the market, but also to determine the predisposition of regions to the emergence of such organizations, are:

– "smart" staff (IQ_people) whose knowledge, skills and abilities determine productivity level and possibility of simultaneously solving problems of various thematic areas (an element of ambidextrous companies);

– "smart" innovations and solutions (IQ_innovative) which allow producing high-tech products in demand on the market, offering new technical and technological ideas of revolutionary nature, as well as improving production chains, management systems, marketing tools, etc. in order to increase the company's competitiveness and ensure its profitability growth (an element of innovative companies);

Figure 1. 3D model of a "smart" company



Source: own compilations.

– a "smart" environment (IQ_digital), organized using the Internet capabilities that allow working with a large and complex amount of information using various platforms that optimize time and simplify technological value chains (an element of smart companies).

In fact, currently, a "smart" company may not have production funds in their traditional sense at all, as tangible assets are beginning to be replaced by intellectual assets, and current assets – by information [30]. According to experts, currently in the United States, approximately 45 million people use only their own intelligence, backed up by a personal computer, as production means [31].

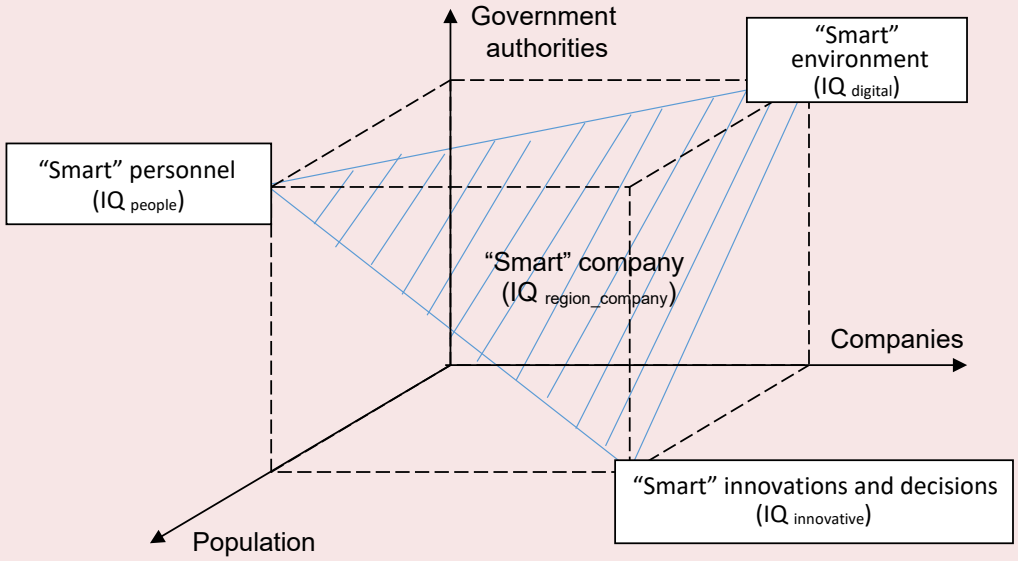
Research methodology

If we graphically present the author's method of assessing the predisposition of regions to the emergence of "smart" companies, we get the following spatial model; its main elements are companies, population and authorities *(Fig. 2)*.

Authorities' interaction with population allows increasing the share of "smart" personnel in total population by implementing measures aimed at supporting healthcare, education and improving the level and quality of life in the regional society. Authorities' interaction with companies contributes to creating conditions for society digitalization through implementation of various strategies and programs for the regional digital development. The quality and quantity of innovative products developed and implemented depend on companies' interaction with population, so it is important to introduce the concept of "talent management" into practice at all enterprises, focused on the goals of intellectual development of personnel and improving their applied effectiveness. There can be many options for interaction, and the active points that serve as the vertices of the triangle are the same. They serve as indicators of regions' predisposition to generate "smart" companies on their territory.

Taking into account the authors' understanding of the 3D model of "smart" companies, we propose a methodological approach which is a synthesis of graphical and analytical calculation methods

Figure 2. Graphical assessment representation of the region's predisposition to the emergence of "smart" companies



Source: own compilations.

of assessment consisting of three main stages of identifying the predisposition of regions to the expansion of "smart" companies in their territories.

Stage 1. Regions' assessment in the context of their predisposition to the emergence of "smart" companies:

1.1. Determination of the regions' predisposition to appearance of organizational ambidextrity.

1.2. Determination of the regions' predisposition to activate innovative development.

1.3. Determination of the regions' predisposition to stimulate the use of digital technologies in business.

Stage 2. Regions' typologization and rating according to the criterion of predisposition to the emergence of "smart" companies.

Stage 3. Regions' identification with maximum focus on the support and expansion of "smart" companies.

The first stage is the main and complex, therefore, for its implementation, we have developed an evaluation tool that allows formalizing a 3D model of a "smart" company in a complex indicator (*Tab. 1*).

Thus, the region's predisposition to organizational ambidextrity is determined by the indicator of public health level, as the dependence of the knowledge level on the presence of chronic diseases is proved: the higher the incidence, the worse the indicators of knowledge among the population. In addition, a healthy person has greater productivity and can be involved in solving more complex and heterogeneous tasks. As a measurable indicator, we propose to use the indicator of life expectancy at birth which reflects population longevity, and therefore public health level.

Public education level characterizes the regional intellectual potential, people's ability to think

Table 1. Estimated indicators of the region's predisposition to the emergence of "smart" companies in the context of a 3D model

Region's predisposition	Basic element	Indicator	Tracer
Toward organizational ambidextrity	"Smart" personnel (IQ_{people})	Public health level ($I_{healthy}$)	Life expectancy at birth
		Public education level (I_{know})	Share of population with higher education in total number of employees
		Population profitability (G)	Gini index
Toward innovative development of companies	"Smart" innovations and decisions ($IQ_{innovative}$)	Population inventive activity ($I_{intellegent}$)	Number of domestic patent applications for inventions, per employed person
		Companies' innovative activity ($I_{innovative\_technology}$)	Share of organizations using innovative technologies, in total number of surveyed organizations
		Innovative products ($I_{innovative\_product}$)	Share of innovative products in total number of shipped products
Toward companies' digitalization	"Smart" environment ($IQ_{digital}$)	Internet access (I_{Inet})	Share of organizations using Internet access with speed of at least 2 Mbit/sec in total number of organizations
		Digital technologies ($I_{digital\_technology}$)	Share of organizations using ERP system in total number of surveyed organizations; Share of organizations that had special software for managing sales of goods in total number of organizations; Share of organization using information and communication technologies in total number of organizations
		Workplaces (I_{work_space})	Share of people employed in ICT sector in total number of employed people

Source: own compilations.

creatively and solve several tasks simultaneously. In this regard, the most informative indicator will be the share of the employed population with higher education in the total number of employed.

Population profitability also affects the conditions for its self-development including obtaining additional and continuing education which positively affects the society labor potential. In our opinion, an important evaluation indicator here is the stratification of population by received income. The higher the stratification, the lower the regional tendency to organizational ambidexterity is. The measured indicator is the Gini index.

Then the indicator that allows identifying the presence of "smart" personnel in the region (IQ_{people}) will be calculated using the Formula 1:

$$IQ_{people} = \sqrt[3]{I_{healthy} * I_{know}/G}, \quad (1)$$

where $I_{healthy}$ – public health level;
I_{know} – public education level;
G – population profitability in the region.

We propose to assess the region's predisposition to further development of innovative business activity on the basis of measuring such an indicator as inventive activity calculated as the number of domestic patent applications for inventions per employee indicating the effectiveness of knowledge application in production practice. Another indicator that we recommend using concerns the innovative activity of enterprises, manifested in the development and use of organizational, marketing, technological and other types of innovations which reflects the demand for new ideas to maintain competitive positions in the Russian market. The practical result of bringing inventive and innovative solutions to the consumer is the demand for innovative products, so its share in the total volume of shipped products must also be taken into account. We get that the indicator "smart" innovations and solutions ($IQ_{innovative}$) is determined by measuring the effectiveness of innovation activities in the region and the demand for companies' products by "smart" people (Formula 2).

$$IQ_{innovative} = \sqrt[3]{I_{intellegent} * I_{innovative\_technology} * I_{innovative\_product}}, \quad (2)$$

where $I_{intellegent}$ – population inventive activity;
$I_{innovative\_technology}$ – companies' innovative activity;
$I_{innovative\_product}$ – innovative products in the region.

We propose to assess the region's predisposition to creating conditions for the expansion of smart companies on the basis of measuring the Internet access for organizations based on the indicator the share of organizations using Internet access at a speed of at least 2 Mbit/s in the total number of organizations which will indicate the infrastructural features of digitalization of the regional companies. We also propose to take into account the digital business technologies used by organizations, in the context of the shares of organizations that used ERP systems, had special software tools for managing sales of goods and used information and communication technologies, in the total number of surveyed organizations. Another indicator that characterizes the conditions of business digitalization, in our opinion, is the labor market from the position of those employed in the ICT sector in the total number of employed population which indicates, firstly, the demand for IT competencies, and secondly, the presence of appropriate jobs in the region. Then we get that the indicator "smart" environment ($IQ_{digital}$) is determined by measuring the quality of conditions that stimulate business digitalization in the region according to Formula 3.

$$IQ_{digital} = \sqrt[3]{I_{Inet} * I_{digital\_technology} * I_{work\_space}}, \quad (3)$$

where I_{Inet} – Internet access;
$I_{digital\_technology}$ – digital technologies;
I_{work_space} – workplaces in the regional ICT sector.

An important point in the calculation of indicators is their mandatory normalization in the range [0; 1] which allows bringing their values to one measuring scale.

Returning to the 3D model of the "smart" company presented in Figure 2, we get that the desired predisposition indicator can be calculated as the area of a triangle that graphically takes into account three active points – the basic indicators of the expansion parameters of "smart" companies on its territory (Formulas 4–8).

$$a = \sqrt[2]{\mathrm{IQ}_{people}{}^2 + \mathrm{IQ}_{innovative}{}^2}, \quad (4)$$

$$b = \sqrt[2]{\mathrm{IQ}_{people}{}^2 + \mathrm{IQ}_{digital}{}^2}, \quad (5)$$

$$c = \sqrt[2]{\mathrm{IQ}_{innovative}{}^2 + \mathrm{IQ}_{digital}{}^2}, \quad (6)$$

$$p = a + b + c, \quad (7)$$

$$\mathrm{IQ}_{region\_company} = \sqrt[2]{p * (p-a) * (p-b) * (p-c)}, \quad (8)$$

where $\mathrm{IQ}_{region\_company}$ – region's predisposition to expansion of "smart" companies;

IQ_{people} – region's predisposition to organizational ambidextrity,

$\mathrm{IQ}_{innovative}$ – region's predisposition to further innovative development of companies,

$\mathrm{IQ}_{digital}$ – region's predisposition to further digitalization of companies.

After assessing the regions' predisposition to the expansion of "smart" companies on their territory, it is necessary to proceed to the second and third methodological stages of the study which allow identifying the most favorable territories for creating and developing companies that are characteristic of a more complex technological structure of the regional and national economy.

Thus, the peculiarity of the authors' methodology is an integrated indicator which is the result of the synthesis of graphical and analytical methods of assessment. It allows determining the region's predisposition to emerging "smart" companies based on measuring the area of the triangle at the vertices of which the active elements of ambidextrous companies, innovative enterprises and smart organizations are located.

Research results

1. We determine regions' predisposition to the appearance of "smart" companies on their territory.

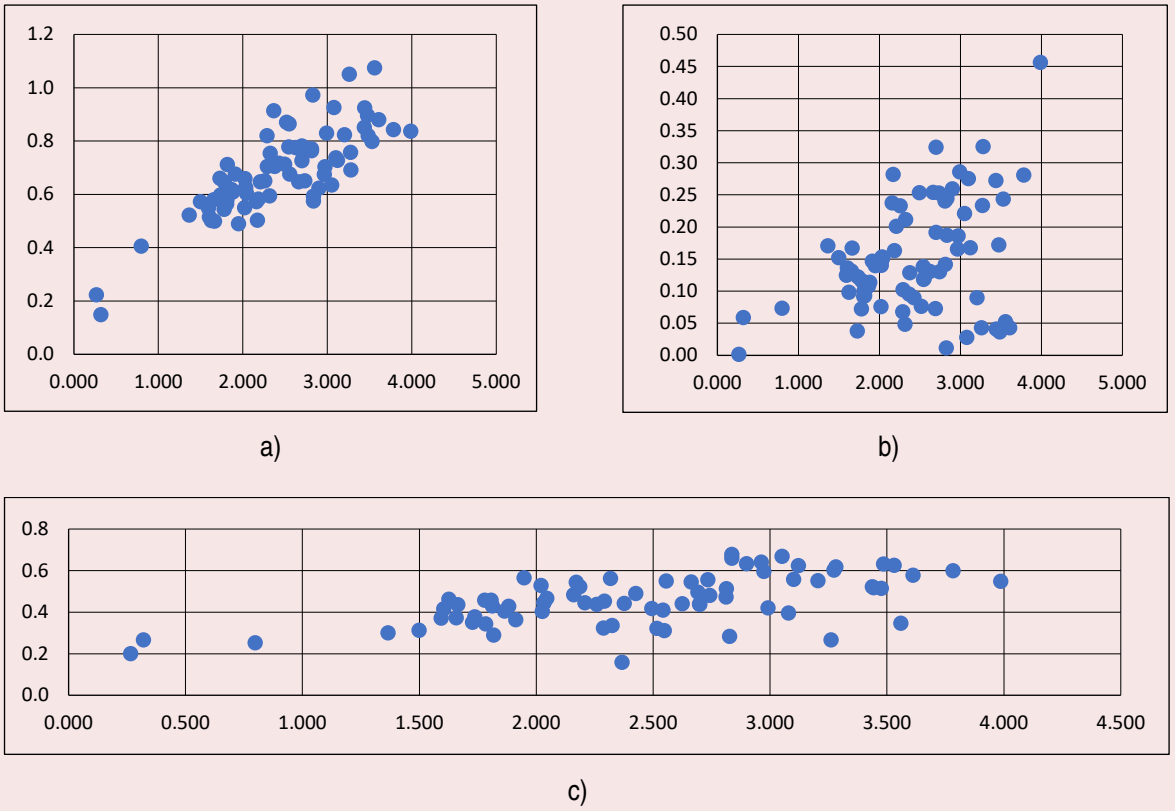
Initially, all regions participated in the study, the analyzed period covered 2010–2017. However, then the authors were forced to weed out some of the territories due to the lack of data on a number of estimated indicators which determined the participation in the final analysis of only 79 out of 85 territories. Further, the study excluded Moscow, the Moscow Oblast and St. Petersburg due to the obvious maximum parameters that were recorded for them when assessing predisposition.

Figure 3 presents the obtained estimated values of the regions where the values of the $\mathrm{IQ}_{region\_company}$ indicator are located on the X axis, and the corresponding predispositions are located on the Y axis: to organizational ambidextrity, to further innovative development and further digitalization of companies.

The largest lag was shown by the Republic of Tyva, Zabaykalsky Krai, the Jewish Autonomous Okrug, Chukotka Autonomous Okrug. Subsequently, these regions were recognized as the most high-risk for creating "smart" companies. We should also note that the majority of the remaining entities of the Russian Federation (72%) have a value of the potential for organizational ambidextrity above the average in the considered range of estimates [0.5; 0.8] with the maximum possible value of 1.2; see Fig. 3 (a)). Compared to other indicators, the predisposition to organizational ambidextrity is of the greatest importance indicating the need for further measures aimed at supporting health, education and increasing the population income level as a whole.

According to the indicator characterizing regions' predisposition to the formation of innovative companies, about 78% of the studied regions have average values in the range [0.05; 0.25] and difficult conditions for activation of innovative

Figure 3. Predisposition of the regions of RF to: a) organizational ambidextrity; b) companies' innovative development; c) companies' digitalization



Source: own compilations.

business activity; see Fig. 3(b)). This indicates the importance of implementing the strategy of scientific and technological development of the regions and strengthening appropriate support measures.

According to the indicator of predisposition to the formation of smart companies, about 35% of the studied regions have a tendency to digital transformation of society, the values of the indicator lie in the middle range [0.4; 0.5], while they are fixed above the mark characterizing the innovativeness of companies; see Fig. 3 (c)). Consequently, there are the first results of implementation of the State Program "Digital Economy of the Russian Federation" and the strengthening of appropriate support measures.

2. We define the typology and rank the regions according to the criterion "predisposition to the emergence of "smart" companies"

According to the $IQ_{region\_company}$ indicator, the authors have constructed a typology of the regions *(Tab. 2)*. Out of 76 subjects, 14.47% are regions with the most favorable conditions, as well as experience in supporting the emergence of "smart" companies; 34.21% are regions with favorable conditions for emerging "smart" companies in which such organizations are emerging; 42.1% are regions that can be considered as stable platforms for emerging "smart" companies, but in which innovative, digital and social forces are only consolidating; 3.95% – regions with a high risk of success in creation and functioning of "smart" companies; 5.26% – regions

Table 2. Typology of regions by predisposition to merging "smart" companies on their territory

	Typology criterion	Regions
5	Regions that have the most favorable conditions for emerging "smart" companies which already have similar organizations: $IQ_{region\_company} \in [3.21; 4]$	Kaliningrad Oblast, Stavropol Krai, Republic of Tatarstan, Nizhny Novgorod Oblast, Samara Oblast, Tyumen Oblast, Khanty-Mansiysk Autonomous Okrug – Yugra, Yamalo-Nenets Autonomous Okrug, Novosibirsk Oblast, Tomsk Oblast, Khabarovsk Krai
4	Regions with favorable conditions for emerging "smart" companies in which such companies are born: $IQ_{region\_company} \in [2.41; 3.2]$	Belgorod Oblast, Vladimir Oblast, Voronezh Oblast, Kaluga Oblast, Orel Oblast, Ryazan Oblast, Tula Oblast, Yaroslavl Oblast, Leningrad Oblast, Murmansk Oblast, Republic of Adygea, Republic of Kalmykia, Astrakhan Oblast, Volgograd Oblast, Rostov Oblast, Republic of Ingushetia, Kabardino-Balkar Republic, Republic of Mordovia, Udmurt Republic, Chuvash Republic, Penza Oblast, Saratov Oblast, Ulyanovsk Oblast, Sverdlovsk Oblast, Chelyabinsk Oblast, Primorsky Krai
3	Regions that can be considered as stable platforms for emerging "smart" companies, but in which innovative, digital and social forces are only consolidating so far: $IQ_{region\_company} \in [1.61; 2.4]$	Bryansk Oblast, Ivanovo Oblast, Kostroma Oblast, Kursk Oblast, Lipetsk Oblast, Smolensk Oblast, Tambov Oblast, Tver Oblast, Republic of Karelia, Komi Republic, Arkhangelsk Oblast, Nenets Autonomous Okrug, Vologda Oblast, Novgorod Oblast, Pskov Oblast, Krasnodar Krai, Republic of Dagestan, Republic of Bashkortostan, Republic of Mari El, Perm Krai, Kurgan Oblast, Republic of Altai, Krasnoyarsk Kai, Irkutsk Oblast, Kemerovo Oblast, Omsk Oblast, Republic of Buryatia, Republic of Sakha (Yakutia), Kamchatka Krai, Amur Oblast, Magadan Oblast, Sakhalin Oblast
2	Regions where it is not recommended to create "smart" companies, as there are no conditions for their functioning, there is a high risk of running a similarly organized business: $IQ_{region\_company} \in [0.81; 1.6]$	Kirov Oblast, Orenburg Oblast, Altai Krai
1	Regions where it is not recommended to create "smart" companies, but it is proposed to develop economic diversification and support small businesses: $IQ_{region\_company} \in [0; 0.8]$	Republic of Tyva, Trans-Baikal Territory, Jewish Autonomous Okrug, Chukotka Autonomous Okrug
Source: own compilations.		

in which it is not recommended to create "smart" companies, but it is proposed to develop economic diversification and support small businesses.

Figure 4 shows twenty entities of the Russian Federation characterized by the greatest predisposition to emerging "smart" companies.

3. *We identify regions with the maximum focus on the support and expansion of "smart" companies.*

So, within the framework of the received typology, the predisposition of industrially developed regions is of interest. For instance, 65% of industrial regional leaders have a high propensity to generate "smart" companies *(Tab. 3)*. We get that these territories are the leaders not only in their share in the all-Russian value of industrial product shipments, but also in the digital trend of economic and social development. They can be considered the main digitalization poles.

We can note one more remarkable fact: almost all the territories of the Ural Federal District took the leading positions except the Kurgan Oblast. This, in turn, can serve as a basis for state support for the formation of a cluster of "smart" companies in the region.

As we have denoted the regions of the Ural Federal District as territories with favorable conditions for emerging "smart" companies, it is interesting to see their separation from Moscow, St. Petersburg and the Moscow Oblast which were excluded from the analysis due to the unconditional leadership in the desired indicator. The lag of the subjects of the Ural Federal District is 1 –19% for the entire period under study. At the same time, the positions in the typology are stable which allows considering them a stable basis for "smart" companies, but actualizes the priority of measures to support them due to asymmetric digital development. Such support should be implemented primarily through the "smart" interaction of state authorities with civil society institutions, science, and business community when implementing innovative, scientific, technological and digital development programs in which it is necessary to take into account geographical, economic, socio-cultural, environmental and other features of municipalities as much as possible and focus on meeting the interests of the local population and business. The development of interregional and

Figure 4. Regions' rating with the greatest predisposition to emerging "smart" companies

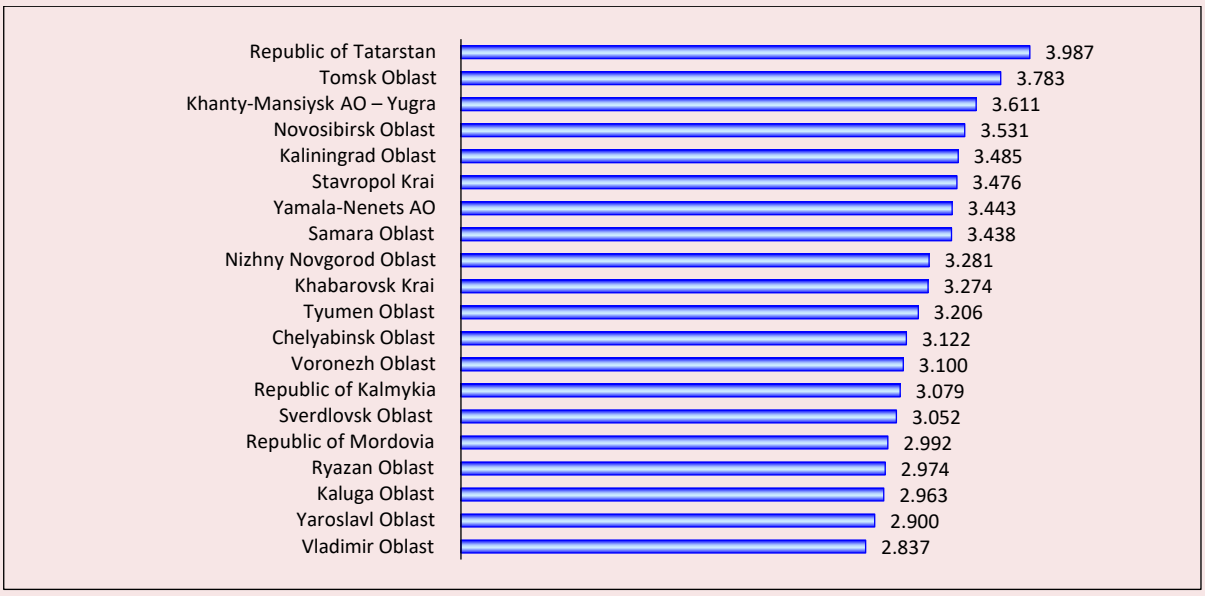


Table 3. Regions' predisposition – industrial leaders to emerging "smart" companies

Ural Federal District and regions-leaders	$IQ_{region\_company}$								Regions' typology							
	2010	2011	2012	2013	2014	2015	2016	2017	2010	2011	2012	2013	2014	2015	2016	2017
Leningrad Oblast	2.938	2.652	2.624	2.859	2.371	1.603	3.108	2.291	(4) 73%	(4) 66%	(4) 66%	(4) 71%	(3) 59%	(3) 40%	(4) 78%	(3) 57%
Krasnodar Krai	2.533	2.612	2.319	2.317	2.120	1.886	2.632	2.591	(4) 63%	(4) 65%	(3) 58%	(3) 58%	(3) 53%	(3) 47%	(4) 66%	(4) 65%
Rostov Oblast	2.857	2.851	2.798	3.126	3.164	2.779	2.571	2.357	(4) 71%	(4) 71%	(4) 70%	(4) 78%	(4) 79%	(4) 69%	(4) 64%	(3) 59%
Republic of Bashkortostan	2.179	2.139	2.145	2.296	2.169	1.808	2.239	2.306	(3) 54%	(3) 53%	(3) 54%	(3) 57%	(3) 54%	(3) 45%	(3) 56%	(3) 58%
Republic of Tatarstan	3.220	3.860	3.797	4.204	3.938	3.748	4.608	4.524	(5) 81%	(5) 96%	(5) 95%	(5) 105%	(5) 98%	(5) 94%	(5) 115%	(5) 113%
Perm Krai	2.179	2.258	1.929	2.681	1,.923	1.994	2.292	2.114	(3) 54%	(3) 56%	(3) 48%	(4) 67%	(3) 48%	(3) 50%	(3) 57%	(3) 53%
Nizhny Novgorod Oblast	3.011	3.095	3.002	3.338	3.359	3.704	3.576	3.165	(4) 75%	(4) 77%	(4) 75%	(5) 83%	(5) 84%	(5) 93%	(5) 89%	(4) 79%
Samara Oblast	3.925	4.003	3.657	3.131	2.943	3.045	3.438	3.365	(5) 98%	(5) 100%	(5) 91%	(4) 78%	(4) 74%	(4) 76%	(5) 86%	(5) 84%
Kurgan Oblast	1.843	2.037	1.824	2.121	1.696	1.540	1.534	1.309	(3) 46%	(3) 51%	(3) 46%	(3) 53%	(3) 42%	(2) 38%	(2) 38%	(2) 33%
Sverdlovsk Oblast	2.634	3.018	2.655	3.106	3.323	3.079	3.386	3.215	(4) 66%	(4) 75%	(4) 66%	(4) 78%	(5) 83%	(4) 77%	(5) 85%	(5) 80%
Tyumen Oblast	3.077	3.186	2.971	3.129	3.418	3.126	3.641	3.097	(4) 77%	(4) 80%	(4) 74%	(4) 78%	(5) 85%	(4) 78%	(5) 91%	(4) 77%
Khanty-Mansiysk Autonomous Okrug – Yugra	3.717	3.701	3.444	3.217	3.928	3.594	3.953	3.335	(5) 93%	(5) 93%	(5) 86%	(5) 80%	(5) 98%	(5) 90%	(5) 99%	(5) 83%
Yamala-Nenets Autonomous Okrug	3.259	3.228	3.344	3.766	3.874	2.945	3.748	3.379	(5) 81%	(5) 81%	(5) 84%	(5) 94%	(5) 97%	(4) 74%	(5) 94%	(5) 84%
Chelyabinsk Oblast	2.970	3.049	3.073	3.141	3.382	2.979	3.501	2.881	(4) 74%	(4) 76%	(4) 77%	(4) 79%	(5) 85%	(4) 74%	(5) 88%	(4) 72%
Krasnoyarsk Krai	1.901	2.052	1.961	2.123	2.236	1.968	2.317	1.712	(3) 48%	(3) 51%	(3) 49%	(3) 53%	(3) 56%	(3) 49%	(3) 58%	(3) 43%
Irkutsk Oblast	1.852	1.837	1.915	1.849	1.956	1.485	1.959	1.605	(3) 46%	(3) 46%	(3) 48%	(3) 46%	(3) 49%	(2) 37%	(3) 49%	(3) 40%
Kemerovo Oblast	1.959	2.104	1.788	2.433	2.268	1.787	1.970	1.852	(3) 49%	(3) 53%	(3) 45%	(4) 61%	(3) 57%	(3) 45%	(3) 49%	(3) 46%
Omsk Oblast	2.481	2.313	2.181	2.239	2.055	1.522	1.905	1.566	(4) 62%	(3) 58%	(3) 55%	(3) 56%	(3) 51%	(2) 38%	(3) 48%	(2) 39%

Source: own compilations.

international cooperation in implementation of the "Smart City" and "Smart Region" projects aimed at supporting new and young IT companies is also an important measure. Within the framework of the federal program "Development of Research and Scientific-Industrial Cooperation", we recommend continuing the creation of research and educational centers that stimulate the development of knowledge economy.

We see a further comprehensive solution to the problem of increasing regions' predisposition to the expansion of "smart" companies in the formation and launch of development trajectories of the main elements of the 3D model of a "smart" company. For example, the priority tasks of the "smart" personnel trajectory should be instilling of healthy lifestyle skills, ensuring the availability of additional education that allows continuously studying the whole life, attracting personnel to the development of advanced technologies. The trajectory of "smart" innovations and solutions should ensure the "smart" management development including implementation of the "talent management" concept at every Russian enterprise, and concentration of innovation space centers in universities, the use of digital technologies that allow balancing the workload of personnel, increasing productivity and improving the quality of offline and online services to colleagues and clients of companies. With the help of the "smart" environment trajectory, there should be solved the tasks of creating a stable and modern digital educational environment, providing support for small and medium-sized businesses and knowledge-intensive businesses in all regions.

The proposed triad of trajectories will not only improve the conditions for the expansion of "smart" companies, but also strengthen their regional 3D model.

Conclusion

Within the framework of the article, the authors propose 3D model meaningfully revealing the main elements of a "smart" company at the regional research level. This understanding allowed the authors to develop a methodological approach and tools for assessing the predisposition of Russian regions to the emergence and expansion of these organizations. The use of the authors' developments contributed to the regions' typologization identifying five groups of territories with different conditions for emerging of "smart" companies emphasizing the specifics of their functioning. Rating of the entities of the Russian Federation according to the desired indicator makes it possible to take timely measures to stimulate digital development of industrially developed territories and identify a stable basis for the expansion of "smart" companies.

The authors' tools are of practical importance for authorities and businesses involved in working out regional strategies and programs for development of advanced production technologies aimed at creating comfortable conditions that determine the emergence and successful existence of ambidextrous companies, innovative enterprises and smart companies in Russia's regions.

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