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Directions and possibilities of predictive analytics in managing the development of single-industry towns

Direcciones y posibilidades de análisis predictivo en la gestión del desarrollo de ciudades con una sola industria

Olga P. IVANOVA 1; Vladimir A. TRIFONOV 2; Dmitriy N. NESTERUK 3

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Contents

ABSTRACT:

The purpose of the article is to analyze the possibilities of using predicative analytics in managing the development of single-industry towns (a) to substantiate the trends in the modernization of single-industry economies, (b) to develop, monitor, and correct projects for diversification, and (c) to form and development of advanced social and economic development (TASED) territories in single-industry towns. To determine the possibility of using predicative (predictive) analytics in the management of single-industry cities, the authors consider the main problems associated with the development and implementation of strategies and programs for the development of mono-profile settlements. In addition, they determine possible directions and possibilities of using predictive analytics (in aggregate, for example, with foresight) in managing the development of single-industry towns: developing and improving state programs to support single-industry towns; forming a strategy for smart specialization; selecting priorities for innovative development; searching for sources of a unique strategy of a single-industry town; foreseeing innovative changes; managing risks of implementing strategies and programs; developing TASED, managing technical risks of enterprises. The authors made a preliminary choice of possible predictors. The results of the research can be helpful

RESUMEN:

El objetivo del artículo es analizar las posibilidades de utilizar el análisis predictivo en la gestión del desarrollo de ciudades de una sola industria (a) para corroborar las tendencias en la modernización de las economías de una sola industria, (b) desarrollar, supervisar y corregir proyectos para la diversificación, y (c) para formar y desarrollar territorios avanzados de desarrollo social y económico (TASED) en ciudades de una sola industria. Para determinar la posibilidad de utilizar análisis predicativos (predictivos) en la gestión de ciudades de una sola industria, los autores consideran los principales problemas asociados con el desarrollo y la implementación de estrategias y programas para el desarrollo de asentamientos de monoliberales. Además, determinan posibles direcciones y posibilidades de usar análisis predictivos (en conjunto, por ejemplo, con previsión) para gestionar el desarrollo de ciudades de una sola industria: desarrollar y mejorar los programas estatales para apoyar a las ciudades de una sola industria; formando una estrategia para la especialización inteligente; seleccionar las prioridades para el desarrollo innovador; buscando fuentes de una estrategia única de una ciudad de industria única; prever cambios innovadores; gestionar los riesgos de implementar estrategias y programas; desarrollando TASED, gestionando los riesgos técnicos de las

in developing the regional economy in terms of tools for long-term planning and forecasting the transformation of economies and societies of single-industry towns.
Keywords: single-industry town, predicative analytics, diversification, modernization, foresight, intelligent specialization, innovations, risks.

empresas. Los autores hicieron una elección preliminar de posibles predictores. Los resultados de la investigación pueden ser útiles para desarrollar la economía regional en términos de herramientas para la planificación a largo plazo y la previsión de la transformación de las economías y las sociedades de las ciudades de una sola industria.
Palabras clave: C

1. Introduction

The urgency of the study presented in this article is determined by the need to modernize the single-industry towns of the Russian Federation and the Kemerovo region, Namely, we focus on the most important condition for their sustainable development and improving the quality of life in the urban environment. The urgency of improving approaches to management of single-industry towns in the Russian Federation is due to the fact that the disposal of Russian single-industry towns from the problems associated with the dependence on frequently unsuccessful activities of city-forming enterprises has been a difficult task in recent years. So, the list of measures to support the 319 single-industry towns in Russia contains more than 90 different measures aimed at solving their problems of single-industry. Projects are being implemented to improve the quality of their urban environment. There is also the program "Integrated development of single-industry towns" being implemented, as well as the "Monocities Development Fund" exists (Ministry of Economic Development of the Russian Federation, 2016; Monogoroda Project, n.d.). We can say that Russian social scientists have accumulated a significant array of research and development aimed at diversifying the monocities economy. However, the number of single-industry towns in the Russian Federation has not declined despite the implemented solutions, particularly the active creation of TASED in single-industry towns (now there are more than 30 of them). Thus, one of the significant indicators of the intensity and success of the TASED development in monotowns (the number of registered residents) is still rather modest: the register of TASED residents established in the territory of single-profile municipalities as of April 25, 2018 includes only 132 organizations (Ministry of Economic Development of the Russian Federation, 2018). Investors do not seek to invest in such territories. Businesses, despite a number of stimulus measures, are in no hurry to become a resident of such territories.

A single-industry town is a settlement of a special kind, which is reflected both in the concept itself and in its inherent problems. The specificity of this concept consists in the terminological apparatus, criteria for singling out single-industry towns, ans the social-production complex of such settlements, as well as the interconnection and interdependence of problems characterizing the economy of a single-industry towns (Ivanova, Antonova, and Antonov, 2016).

Despite the desire to implement strategic planning for single-industry towns, the use of a project approach to diversifying the economy of such settlements and the creation of TASED in single-industry towns, as well as the effectiveness of many strategic documents and programs being developed are not high enough. Often, as practice shows, the use of available statistical data (in particular, accumulated by the Rosstat) by authorities of different levels does not ensure having high-quality strategic documents. It seems that in order to ensure the validity in the selection of projects aimed at modernizing single-industry towns, the use of modern and effective prognostic tools is required, which makes it possible to formulate real scenarios of territorial development with a high degree of reliability. Therefore, it seems relevant to analyze possibilities and directions of using such methods of prediction and forecasting that are already successfully used by businesses with the purpose to determine certain prospects for its development, i. e. predicative analytics.

We believe that the following problem is to be solved: is it possible to combine modern approaches to the management of single-industry towns and methods of predicative analytics within the single-industry town management theory of sustainable development in order to justify the selection of the best scenarios for the development of such towns? In this regard, the study of the possibility of using predicative analytics to solve the problems

of such settlements in the management system of economic modernization of single-industry towns can significantly increase the prognostic potential of Economic Sciences, creating new knowledge that would allow to determine predictors (parameters) affecting the efficiency of economic modernization, sustainable development, successful implementation of projects for creating and developing TASED programs and forming predictive models of their development, in particular, to counteract the sources of danger for the economy and society in general.

2. Materials and Methods

The objects of the study presented in this article are the problems of single-industry towns, characteristics of the TASED programs in single-industry cities, investors' interests and concerns, potential and existing residents of TASED in single-industry towns, as wellas the possibility of predicative analytics in combination with other tools for ensuring effective management decisions in the area of territorial management.

The information base of our study includes the research of foreign and domestic authors on the use of predictive analytics, as well as officially published data on the functioning, support, creation, activities of TASED in Russia, the functioning of single-industry towns, including the implementation of various instruments for diversifying their economies. As an information base, the research of Russian and foreign researchers (in particular, Bruskin, Kryukova, Senchagova, Ivanova, Utkina, Denisova; Glazyev, Lokosov, Chichkanova, Belyaevskaya-Plotnik, Kleiner, Kachalova, Sigel, Calof, Richards, Smith (2015); Gokhberg, Kuznetsova, Tödtling, Trippl (2005); Kutsenko, Islankina, Kindras (2018); Foray, van Ark (2007); Barca, McCann, Rodríguez-Pose (2012); Kroll, Muller, Schnabl, Zenker (2014); Thissen, Oort, Diodato (2013); Milovidov (2018); Carvalho, Freitas, Ebecken (2003); Bazerman (2014), etc.), a review of the Russian single-industry towns (Analitical Report of ICSI, 2017), as well as the register of the TASED residents established on the territory of single-profile municipalities (Ministry of Economic Development of the Russian Federation, 2018).

We will study the possibility of using predictive analytics in improving management tools for single-industry towns: (a) describing and analysing management problems of monotowns – (b) assessing the possibility of applying predictive analytics in solving these problems of single-industry town management – (c) determining the direction of using predictive analytics tools in synergy with other single-industry management tools – (d) preliminary choice possible predictors.

3. Results and Discussion

It is advisable to begin by considering the interpretation of the term "predictive analytics" by various researchers. Thus, Sigel considers predictive analytics as "a new weapon in the arsenal of the world's leading companies and government bodies" (Siegel, 2014), as well as a technology being based on the use of experience, i.e. a variety of data "for predicting the future behavior of people in order to make optimal decisions." Important in this technology is the analysis, testing of a significant amount of forecast factors, which allows to identify even unexpected discoveries (Siegel, 2014). Predictive analytics combines analytical and statistical methods for predicting future actions or behaviors (Calof, Richards and Smith, 2015).

The toolkit of predictive analytics allows answering an important question: how can an increase in the effectiveness of the implementation of diverse and complex functions in public administration, health care, business, law enforcement, and non-commercial activities be possible? Predictably, of course, the use of predictive analytics is reduced to studying the behavior of customers and, on the basis of extracting certain patterns in the behavior of consumers, companies are trying to improve goods, services, assortment or service policy. That is, the toolbox of predictive analytics is more often used in industries that work with end-users. However, predictive analytics has the potential to be applied in almost any field where prospect planning is required. There are several factors of this: a growing rate of processing large amounts of data; an increase in the availability of tools for collecting and

processing all kinds of data; a possibility of obtaining data from different sources; and the development of personalized customer proposals and information technologies.

How can predictive analytics help to solve the problems of single-industry towns, as well as to choice directions for modernization and diversification of their economies?

In order to forecast the development of single-industry towns and to be able to chose the best scenario for developing TASEDs in single-industry towns, it is possible to adapt the principles of predictive analytics to ensure the sustainable development of municipalities based on the identification of predictors of hazards and threats, opportunities and benefits, including in harmonizing the interests of businesses and territories.

It should be noted that the specific nature of the problems of single-industry towns is the complexity of their formation at many levels. Single-industry towns are characterized by problems of municipal government (Ivanova, Antonova and Antonov, 2016), and the first of them is a problem caused by the insufficient elaboration of the mechanism for regulating activities of industrial enterprises by local governments. Otherwise, it can be formulated as follows: the problem of organizating interactions with economic entities and participation of all subjects of economic activity in the development program of a municipal formation. As the analysis of the situation in single-industry towns shows, the current state of the industry often has negative trends, a timely and adequate response to which depends on the justified choice by local governments of the directions for further development of a particular city and industry. Progressive industrial policies face difficulties in the process of implementation if there are discrepancies between the types of regulation being chosen.

Predictive analytics can be used in the formation of industrial policies, various urban development programs, including sectoral programs. It is known that state bodies in many countries actively use analytics primarily through the maintenance of statistics and its monitoring. However, it is also interesting to conduct the so-called “sentiment analysis,” which is based on the study of qualitative information from the Internet (sites and blogs) to determine the attitude of target audiences to the results that are planned to be achieved when implementing various government programs. In addition to forecasting methods (scenarios, road maps, etc.), the analysis of moods makes it possible to identify the dominant views of different groups under analysis (Calof, Richards and Smith, 2015). To predict the effect of implementating state programs, analytical tools for data processing are used (with adequate and properly organized information), providing an opportunity to adapt state initiatives to achieve the expected results (Provost and Fawcett, 2013).

Another problem of municipal management in single-industry towns is the problem of coordinating priorities and targets for development at the oblast and municipal levels. In addition, despite the fact that strategic planning and management of territorial development are mastered by municipalities, there are still issues with the development and implementation of strategic development plans due to the lack of understanding of the essence of strategic planning, which is a systematic approach to development. The analysis of documents characterizing the strategic development of a number of municipal entities shows that often the documents differ significantly from each other, both in their structure and in content.

Innovative development is often only declared in the strategic documents of municipalities, as well as in the programs of actions of enterprises located on the territory. A serious obstacle to the development of single-industry cities is the low innovative activity of business, which basically boils down to the acquisition of machines and equipment without R&D ebentually creating a limited demand for innovation (Gokhberg & Kuznetsova, 2011). Weak demand of Russian business for innovation is derived from low competition, high degree of monopolization, and low level of innovative culture of the business community; therefore, various businesses do not see the value for being innovative (Pandia, 2016).

How can we ensure the innovative development of the territories, particularly innovations in single-industry towns, and stimulate the business to innovate? At least, it is necessary to be able to forecast innovations in order to build them, in particular, in the strategy of smart specialization of mono-profile settlements. Each territory has its own way of developing innovations, universal recipes for stimulating innovation can not be effective for all (Todtling

and Trippl, 2005; Kutsenko, Islankina, Kindras, 2018). Intelligent specialization is a set of rules for choosing priorities within the framework of an innovation development strategy. It is well described in the "Guide to Research and Innovation Strategies for Smart Specializations" (European Comission, 2015).

The choice of priorities for innovative development is the identification of a unique niche of the territory on the map of future markets and technologies (Foray, David and Hall, 2011; Hidalgo and Hausmann, 2009).

The development of a qualitative strategy for the development of a single-industry city should begin with the definition of the place in global value-added chains, benchmarking of the structurally similar territories (Hidalgo and Hausmann, 2009; Thissen, Oort, Diodato, 2013).

In (Kutsenko, Islankina and Kindras, 2018), a "smart" strategy of the region is called a "unique" strategy, and uniqueness is understood not as a special support measure for the territory, but as development priorities selected as a result of entrepreneurial search and use of unique territorial resources and available competencies (Hausmann and Rodrik, 2003). The sources of the unique territorial strategy can be: (a) deepening the territorial division of labor (Formaini, 2004), (b) differentiation together with price leadership (Kutsenko, Islankina and Kindras, 2018). The difference between the development of a strategy of intelligent specialization from the traditional approach (representing the study and replication of effective practices better than other developing territories) consists in finding and selecting one's own non-trivial ways of solving the problems of territorial development.

Anticipation of innovative changes is possible taking into account local transformations at the microlevel, combined into a complex of technological, organizational, marketing, legal, cultural, consumer and other changes that accompany the development of the economy and society (Milovidov, 2018). Ignoring the diversity of information does not provide an opportunity to determine the prospects for innovation, the risks of an innovative project and to identify alternatives (Milovidov, 2018). When forecasting innovative transformations, it is important to collect, accumulate, and process data for the accumulation of competencies, including implicit and non-codified (which are located in the theory of knowledge management at the top of the data-information-knowledge-wisdom pyramid), as well as the selection of important information from the mass flow andisolation of essential signals and their analysis (Erickson & Rothberg, 2014). It is in this case that predictive analytics can analyze signals, minimize the risks of erroneous innovative and managerial decisions in the formation of a development strategy for a single-industry town, and choose its "smart" specialization. In studies that deal with the issues of working with information, data mining, algorithmizing the study of texts, interpreting signals and big data, the theories of language vagueness and communication (Russell, 1923) and the concept of fuzzy sets (Zadeh, 1965) are used. They gave rise to the analysis of unstructured information, the identification of patterns and differences in large data sets, as well as contributed to the development in the field of artificial intelligence (Kohl, 1969; Liu et al., 2000; Carvalho et al., 2003; Zong, 2003; Ruiz, et al., 2014).

At the heart of large-scale and unpredictable changes in the environment often lie imperceptible and unpredictable factors (Milovidov, 2018). Innovations leading to significant radical changes have both a cumulative and a sudden nature.

Predictive analytics can help to identify those "innovation at the edge," which, in fact, are alternatives to advanced ones, that is, they are outside the mainstream of technological development promoted by major scientific centers or corporations. Thus, the use of predictive analytics in the process of forecasting innovations can form the basis for building a strategy for the smart specialization of a single-industry town, selecting diversification directions, modernizing the economy, taking into account certain trends in technology, procedures, and management algorithms, as well as interactions between various economic entities, businessmen, and authorities.

The problem of managing the development of single-industry towns is the lack of a tool for assessing the implementation effectiveness of the programs for the creation of TASED, industrial parks, the use of various support measures, as well as projects to diversify the

economy of such municipalities. It should be noted that as of today, there is a problem associated with the lack of not only a methodology for assessing the effectiveness of the territories created in cities with a special economic regime (TASED, for example), but also tools and practices for forecasting their development.

To assess the effectiveness of TASED programs in monocities, the researchers propose (a) an analysis of the change in one effective indicator, depending on the change in a number of factors affecting it (Goridko, 2012; Nizhegorostsev, 2011; Vlasov and Shimko, 2005), (b) using tools of economic statistics, primarily correlation-regression modeling (Chichkanov and Belyaevskaya-Plotnik, 2018), (c) determining the economic effect, for example, the index of industrial production as an aggregated result of the synergy of all types of production in the territory of the region (Granberg, Kistanov, Adamescu, 2003; Fujita and Thisse, 2003; Beugelsdijk et al., 2017a), (d) analysis of the dynamics of the indicators specified in Article 27 of the Strategy for Economic Security of the Russian Federation until 2030, i.e. the index of industrial production, taking into account the impact of the size of investment in fixed assets and the real disposable income of the inhabitants of the region (Chichkanov and Belyaevskaya-Plotnik, 2018). However, this tool is not used in full in practice, including due to the lack of necessary and reliable information. Nevertheless, in order to adjust the development programs for TASED in single-industry cities, it is necessary not only to evaluate the results achieved, to identify and assess the reasons for not reaching the planned indicators, but also to forecast possible transformations of the economy and the society of monotowns. The need to predict the effectiveness of management decisions in the development of territories to specify the levers of impact in the future is indicated by a number of researchers, in particular by (Acemoglu and Dell, 2010; Akcomak, Webbink and Wheel, 2016; Beugelsdijk et al., 2017b; Becker, Egger and Ehrlich, 2013). (Chichkanov and Belyaevskaya-Plotnik, 2018) propose to use for this purpose a trend analysis that identifies the tendency of a single indicator to change taking into account external and internal conditions, but it does not allow to trace the fluctuation of this indicator in the context of small time intervals, for example, a month, and to extrapolate these trends into the future.

In this regard, it is important not only to assess the effectiveness of the achieved, but also to predict the risks of not reaching the developed programs and strategies. Mainly strategic and any other development programs (including innovative ones) are characterized by ignoring the possibility of failure, undesirable deviation from the intended course (Kachalov, 2018). This is due, of course, to the fact that strategies or programs emphasize the advantages of the stated goal and the mechanisms for achieving it.

Types of risk factors due to the conditions for the establishment of TASED (Kachalov, 2018; Ivanova, 2017):

– incorrect definition of the aggregate of economic (or socio-economic) agents, the functioning of which will be affected by the implementation of this program;

– the emergence of ways to circumvent or ignore restrictive measures and prohibitions being regulated;

– identification of the possibility of improper use of preferences by the TASED non-residents;

– substitution of real economic policy with imitation processes and activities (Kachalov and Sleptsova, 2017);

– violation of the timetable for the implementation of activities and actions within the framework of the TASED formation program;

– non-compliance of a single-indusry town with the criteria for creating TASED, in particular, attracting residents who have confirmed their readiness to implement investment projects;

– failure of a single-industry town to create a TASED criterion, namely, the provision of land plots and other property to residents for the implementation of investment projects;

– failure of a single-industry town to grant the status of TASED, providing residents with the necessary resources, and developing measures to overcome existing infrastructure and other restrictions;

– excessive interference of authorities in business residents;

– failure to implement projects in the framework of the creation and development of TASED in single-industry towns;

– non-achievement by municipalities of the target criteria established by the program (for the creation of new jobs, for the incomes of resident enterprises, etc.);

– the deterioration of the investment climate in the region and in the country.

In single-industry towns there is a problem of deterioration of production assets of the city-forming enterprises, which is complicated by the fact that the worn-out capacities are not sufficiently displayed, and new capacities are being put into operation because of the difficulties with attracting investments for updating the equipment. Therefore, it is possible to use predictive analytics in predicting the risks of equipment failure, man-made accidents, and catastrophes. Predictors can be: equipment downtime, the number of accidents, the age of equipment, residual life of components and parts, etc.

The problem of single-industry towns has a special social aspect, due to the specificity of their population. Predictive analytics can also be used in ensuring security, in particular, in the prevention of crime (Ovchinsky, 2007). The use of predictive security analytics provides the ability to track and verify passengers, aircraft, and investigate and prevent crimes (IBM, 2013). In the US, Korea, Japan, and Singapore, analytical tools for risk assessment, intelligent vehicle management systems, and monitoring systems are used and can predict and help to prevent emergencies (epidemics, famines, etc.) (Calof, Richards and Smith, 2015). The following predictors can be used: population migration indicators, the number of registered offenses, real disposable cash income, unemployment rate, absolute poverty, average per capita income, the proportion of households with underage children, etc.

4. Conclusion

The article identifies the main problems that hamper the successful development of single-industry towns: (a) the problem of organizing interaction with economic entities and participation of all subjects of economic activity in the development program of the municipal formation; (b) the problem of coordinating priorities and development targets at the regional and municipal levels; (c) problems of developing and implementing strategic development plans due to a lack of understanding of the essence of strategic planning; (d) lack of tools for assessing the effectiveness of the implemented programs for the establishment of TASED, industrial parks; (e) the problem associated with the lack of not only a methodology for assessing the effectiveness of urban areas with a special economic regime (TASED), but also tools and practices for forecasting their development; (f) the problem of deterioration of the production assets of the city-forming enterprises, which is complicated by the fact that the worn-out capacities are not sufficiently displayed; (g) a social aspect due to the specificity of the population, the outflow of population from disadvantaged mono-profile settlements, contributing to the growth of criminogenic risks.

Possibilities of applying predictive analytics for increasing the efficiency of decisions made related to the development of single-industry cities are determined. It is concluded that predictive analytics can be used in the formation of industrial policies, various urban development programs, including sectoral programs. Predictive analytics can analyze signals, minimize the risks of erroneous innovation and management decisions in the formation of a single-industry town development strategy. The use of predictive analytics in management will provide an opportunity to avoid the symmetry of delusions, and can form the basis for building a strategy for the smart specialization of a single-industry town in the process of forecasting innovations. Predictive analytics will make it possible to forecast possible transformations of the economy and the society of single-industry towns. It also helps to identify risk factors and select such administrative measures that would allow minimizing the likelihood of adverse events or the extent of possible damage. In addition, the use of predictive analytics in predicting the risks of equipment failure, man-made accidents, and catastrophes is extremely important, including for ensuring security, in particular, in the prevention of crime.

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1. Doctor of Economic Sciences, Professor, Institute of Economy and Management, Kemerovo State University, 6 Krasnaya str., 650000, Kemerovo, Russia, and Yurga Institute of Technology, TPU Affiliate, 26 Leningradskaya, 652057, Yurga, Russia, prof-ivanova@rambler.ru. ORCID: 0000-0002-9563-4166.

2. Candidate of Economic Sciences, Associate Professor, Head of the Department of Economics and Automated Control Systems, Yurga Institute of Technology, TPU Affiliate and Acting Director of the Institute of Economics and Management, Novgorod State University named after Yaroslav the Wise, 3 Pskovskaya str., 173015, Great Novgorod, Russia, tva@novsu.ru

3. Assistant, Department of Economics and Automated Control Systems, Yurga Institute of Technology, TPU Affiliate, 26 Leningradskaya, 652057, Yurga, Russia, nesteruk@tpu.ru, ORCID: 0000-0003-0784-3150

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