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Original Paper

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The role of biological and economic factors in urban population growth

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ABSTRACT
This paper explores the influence of biological mechanisms in overpopulated territories on urban growth and addresses the question how biological factors correlate with economic factors, such as GDP growth, in this process. The article provides an overview of the approaches in regional economics, ethology and demography to this problem. To analyze the influence of biological and economic factors on urbanization, four hypotheses are formulated. To test these hypothesis, methods of regression analysis are applied to the statistical data of the United Nations and the World Bank for 132 countries for 1995, 2005, 2015. The analysis shows that the biological mechanisms of population reduction play a significant role in the least and less developed countries. Per capita GDP growth leads to an increase in the concentration of population in big cities (with the population of 1 million inhabitants or more). The total fertility rate varies significantly in these countries, but as the population starts to grow, fertility begins to fall gradually. In more developed countries with a high per capita GDP level, the share of urban population tends to shrink, while the total fertility rate stabilizes there at the level of ca. 1.0–2.0 births per woman.

KEYWORDS
urbanization, overpopulation, fertility rate, birth rate, population density, level of economic development

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Рост численности городского населения: биологический фактор

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АННОТАЦИЯ
В статье исследуется, оказывают ли биологические механизмы, вызванные перенаселением территории, существенное влияние на рост городов, и является ли уровень экономического развития страны значимым при влиянии биологических механизмов. С целью анализа влияния биологических и экономических факторов на процессы урбанизации сформулированы четыре гипотезы, основанные на теоретических утверждениях и эмпирических выводах региональной экономики, этологии и демографии. Результаты регрессионного анализа статистических данных на национальном уровне, примененные для проверки этих гипотез, показывают, что биологические факторы городского развития следует рассматривать наравне с экономическими, но необходим комплексный анализ. Биологические механизмы сокращения численности населения играют важную роль в наименее развитых и развивающихся странах. С ростом ВВП на душу населения в этих странах увеличивается концентрация населения в крупных городах (с населением 1 млн человек и более). Общий коэффициент рождаемости в этих странах значительно различается, но с ростом населения он постепенно снижается. В развитых странах с высоким уровнем ВВП на душу населения доля жителей крупных городах в общей численности населения страны имеет тенденцию к снижению, и общий уровень рождаемости стабилизируется на уровне около 1,0–2,0 родов на одну женщину.

КЛЮЧЕВЫЕ СЛОВА
урбанизация, перенаселение, коэффициент рождаемости, рождаемость, плотность населения, уровень экономического развития

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Introduction

Urban economics explains the formation of cities and their growth in terms of endogenous and exogenous factors, which include access to public good, scale and localization economies, product differentiation, multiplicative effect of industrial development, and location advantages (e.g. proximity to transport nodes). At the same time, the biological factors affecting urban development largely remain underexplored in modern research literature.

However, the interdisciplinary approach to the problem of urban growth, in particular the one that combines the perspective of human ethology and demography, is also interesting and holds much promise. Human ethology studies the behaviour of humans as social animals and, therefore, it looks the growth of urban population in the light of such problems as the scarcity of natural resources and the overpopulation of our planet. The permanently deteriorating conditions of rural life make people move to cities and towns. The biological mechanisms of population decline lead to urbanization, which in a natural way reduces fertility. In their turn, demographers observe lower fertility rates in cities in comparison with less densely populated areas.

Biological mechanisms often induce people to act against their economic interests and in ways that seem to be contradictory to the common sense. In economic literature, however, biological mechanisms are considered of minor importance, whereas economic incentives, such as the cost-benefit principle, are expected to prevail. Thus, the theoretical premises of urban economics can be expanded by adding the biological factor to the analysis of urban development. The overpopulation of a certain territory leads to urban growth, while in cities the fertility rate of population reduces.

The aim of this research is to investigate how big is the influence of the biological factor on cities' growth by using the statistical data for different countries. The key question this study addresses is whether overpopulation of a territory really leads to urbanization, and whether in urban areas the fertility rate decreases. Another important question of this research is how biological factors correlate with economic factors, such as GDP growth, in this process.

The paper is organized as follows. The second section provides an overview of the main approaches of regional and urban economics, ethology, and demography, which explain urban growth by taking into account biological factors. This section also contains the main hypotheses of this study. The third section describes the statistical data and the main indicators used in the analysis. In the fourth section, the hypotheses are tested by applying methods of regression analysis. The final section contains the conclusions.

Theoretical framework

Emergence and growth of cities is explained in regional and urban economics by applying approaches developed within conventional urban economics, the theory of industrial organization, the New Economic Geography, the theory of endogenous economic growth, and so on (for more detail see, for example, [1]).

However, in the context of this research it is worth pointing out that in economic literature, biological factors are mentioned only briefly. Natural limitations are sometimes discussed, for example, when considering urban-rural linkages. Due to shortages of working places, famines caused by natural crop failure in rural areas and so on, many people have to move to the city in search of better opportunities [2; 3]. This kind of urban growth is especially typical of developing countries.

At the same time, the emergence and development of cities was impossible without the rise in agriculture surplus generated by the technological progress [4; 5] Nowadays technological and scientific development has made it possible to produce enough food for cities with the help of labour-saving technologies. In the USA, where incomes are especially high in agriculture, farmers with their families make up 1% of the country's population, but they supply the rest 99% of population with foodstuffs [6].

Therefore, it is possible to conclude that redundancies in rural areas contribute to urban development. This idea was mentioned by many theorists of regional economics [4], but, unfortunately, it has not received enough attention in research literature.

In ethology, cities, especially big ones, are considered as collapsing gatherings and as a relatively harmless way of decreasing the population size [7]. When the population size reaches its critical level and the territory becomes too densely populated, this activates the biological mechanisms that lead to a decrease in the population density such as epidemics, a rise in interpersonal aggression and violence. Other mechanisms, including collapsing

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gatherings, have a more gentle effect. It is important to emphasize that the second group of biological mechanisms come into force before the essential resources, in particular food, are exhausted [8–10].

Studies on the influence of high population density on animals' behaviour were carried out on many species, such as the rats [11], insects (for example, the Mediterranean fruit fly [12]), and birds [9]. One of the first studies of this kind was John B. Calhoun's experiment on rats. Its results were published in 1962 [11]. He discovered that overcrowding among rats lead to pathological behaviours, such as increased aggression, violation of sexual relations (same-sex relations, rapes of female individuals, simplification or total disappearance of marriage rituals), and decrease in care for posterity. The essential consequences of high density were the declining birth rates and rising death rates. At the same time, those males with their females who managed to claim up to the top of the hierarchical ladder had a normal way of life, which means in some sense that hierarchy is able to soften the pressure of overcrowding and to increase environment capacity [9; 13].

Calhoun's work aroused a large resonance in scientific world and inspired many scientists to research the problem of overcrowding from different aspects, including the challenges of living in large, densely populated cities and ways of dealing with these pressures [14]. Following Calhoun's research, Jonathan Freedman began the first laboratory studies of crowding among human beings at Stanford University in the late 1960s [15]. He sought the correlation between density and a variety of pathologies similar to those found in Calhoun's laboratory. His concluded that crowding per se did not automatically lead to pathological behaviour. We cannot solve modern urban and environmental problems by merely reducing the density in the areas we inhabit, but we cannot ignore the fact that the population density does contribute to these problems [16].

One of the central questions in these studies is how relevant are the results of animal experiments for humans [10]. There are two opposite views on this problem: one point of view is that these results cannot be applied to human beings, because humans are a social species and, therefore, a high concentration of individuals within one area might not have a negative effect on their behaviour [8]. In other words, unlike rates in Calhoun's experiment, people are able to cope with overpopulation [14].

Other scholars, including the author of this paper, consider these results to be applicable to humans, pointing out that biological mechanisms are shared by animals and humans alike since they do not require rational decision-making [7]. Each physical contact of individuals of the same species, including human beings, is a stimulus for the release of a small amount of adrenaline, which means that there should be a limit to the load a person can endure [5]. Humans did not use to live in huge conglomerations, numbering thousands of individuals. Our behaviour is adapted for living in small tribal groups of little less than one hundred individuals [17]. Behaviour aimed at avoiding excessive contacts allows us to limit the number of people we interact within the necessary limit.

In big cities, where life is stressful, it is problematic to pursue only healthy forms of human behaviour, which causes aggression, isolation and indifference to others, alienation and a loss of individuality [18]. No wonder that the "prevalence of hypertension rose with urbanization" [19]. Despite all our technical achievements, we are still an elementary phenomenon in a biological sense [20]. The iron wall of anthropocentrism prevents us from realizing our natural inclinations [10]. No matter how sophisticated we consider ourselves to be, if the population density rises above a certain limit, when the number of people exceeds the number of the available social roles, it might cause violence and destruction of social structures.

Nevertheless, urban life also holds a number of advantages: interactions within close urban communities enhance people's mental abilities. Another important advantage of the supertribal conditions is that people enjoy relative freedom in their choice of activities [17].

There are also many demographic facts that confirm the arguments that the results of animal experiments indeed are applicable to humans. A lot has been said about the sharp fall in the fertility rates for urban population, accompanied by alienation and indifference to children [10]. Two competing hypotheses are elaborated to explain this fact: compositional and contextual [21]. The compositional hypothesis suggests that fertility levels vary between places simply because different people live in different settlements (e.g., more educated people, students, married people live in cities), whereas the contextual hypothesis suggests that factors related to the immediate living environment are of critical importance. The immediate living environment in cities is deter-

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mined by such factors as high costs of raising children, the lack of opportunities to improve their housing conditions, more individual autonomy and self-actualisation, leading to more rational individual choices, which usually results in people having fewer children.

There are studies that explore the regional difference in terms of fertility rates and associated factors for specific countries: Great Britain [22], Nigeria [23], Finland and other European countries [21], the USA [24], Switzerland [25], etc. All these studies indicate that the fertility rate is influenced by a set of factors (female education and employment, age at first marriage, birth control, family structure, housing conditions). These factors (and the population density is among them) also determine the differences between the urban and rural population. The more densely an area is populated, the lower the fertility rate is. All these factors have an objective character and it is hard to control them through state regulation, for example, through birth-control programs [25]. Furthermore, studies show that in many countries the urban-rural fertility variation has decreased over time, but significant differences between various settlements still persist [21; 23].

It is worth mentioning that many developing countries are characterized by high fertility rates even in urban areas, which results in rapid population growth. High fertility rates used to be necessary to compensate for high infant mortality rates but now, thanks to humanitarian aid, these countries are experiencing decline in the infant mortality rates, whereas their fertility rates require more time to decrease accordingly. In sustainable populations, the fertility rate normally conforms with the infant mortality rate [7].

Dolnik states that there is no strict dependence between poverty and fertility, pointing out that "poverty" and "wealth" are vague concepts even in economy and sociology [7]. There cannot be a strict causal relationship between such subjective and short-term notion as poverty and the long-term population response (fertility rate).

Our literature review has led us to the following conclusions:

1. Although the influence of biological factors on cities' formation and development is not denied in urban economics, they are considered to be of minor importance while the priority is given to economic factors. However, the behaviour of economic agents can take irrational forms due to the impact of biological factors.

2. The influence of biological mechanisms on the regulation of animals' population size is an established fact. One of such mechanisms – collapsing gatherings – leads to the concentration of individuals within a limited territory. When the population density becomes high, the fertility rate decreases and the population size starts to shrink as well, which usually happens in the second generation.

3. The possibility of applying the results of animal experiments of high-density living to human beings is still a debatable question, although the fact that the fertility rate decreases due to the growth in population density is widely acknowledged in demography.

We have formulated the following hypotheses:

Hypothesis 1: There is a direct relationship between the population density and urban growth.

Hypothesis 2: Urban population growth is accompanied by a fall in the fertility rate.

Hypothesis 3: There is no correlation between poverty and fertility.

Hypothesis 4: Population concentration in big cities and the relationship between the birth rates and the infant mortality rates depend on the level of economic development.

Methods and data

To test the above-described hypotheses, this study uses the method of regression analysis. One factor regression is taken into account. Multiple regression models are not included in this paper because, as statistical analysis has shown, all of the considered multifactor models can be reduced to one factor regression model. Among the types of models under consideration are simple regression models, such as linear, exponential, square root, squared, logarithmic, reciprocal, multiplicative models and polynomial regression models (of the second order).

Most of the statistical calculations within the scope of regression analysis are made with the help of "Statgraphics 18" software. The data of the United Nations and the World Bank for 132 countries for 1995, 2005, 2015 are selected for the analysis because of their availability and relative sufficiency[1]. The coverage of the countries is as

[1] World Bank, World Development Indicators (https://data.worldbank.org); United Nations, Department of Economic and Social Affairs, Population Division. Demographic Yearbook 2016, 2011, 2006, 2001, 1996. Online Editions (https://unstats.un.org); United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: 2018 Revision, Online Edition (https://esa.un.org)

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maximal as possible, but it is limited by the availability of the relevant data. We take the years of 1995, 2005 and 2015 in order to reveal the dynamics in the indicators within a ten-year period. The choice of the years and the interval is determined by the availability of the source data and the aim of this research.

The countries are classified according to their level of economic development. The level of GDP per capita in current prices is chosen as the main criteria and, therefore, the countries are divided into three groups: more developed, less developed and the least developed countries. This division of the countries is based on the following relative principles: per capita GDP of more developed countries equals or exceeds the doubled average value of this indicator; per capita GDP of the least developed countries equals or is below the median value of this indicator. These are relative criteria of classification, but they enable us to use the available statistical information.

As GDP was gradually growing in all countries of the world, in 1995, 2005 and 2015 the boundary values were different. In 1995, developed countries had per capita GDP of more than 15,400 US dollars. In less developed regions, per capita GDP varied between 2,101 and 15,400 US dollars. The least developed countries had per capita GDP of or less than 2,100 US dollars. In 2005, more developed countries had per capita GDP more than 25,000 US dollars; less developed countries, more than 3,500 but equal or less than 25,000; and the least developed countries, 3,500 or less. In 2015, more developed countries had per capita GDP more than 30,000 US dollars; less developed countries, more than 5,800 but equal or less than 30,000; and the least developed countries, 5,800 or less.

In the next section we are going to test the four hypotheses by applying regression analysis and the above-described indicators.

Results

To prove our first hypothesis, we need to show that urban growth is a consequence of high population density. Urbanization (urban growth) can be measured as a level of urban population relative to the total population of this area (a static indicator) or as the rate of urban population growth (a dynamic indicator). Both indicators can be expressed in percentage terms. We need to look at the relations between the following indicators: the average annual rate of change of urban population in a country and its population density; the share of urban population in the total population of a country and the population density. Regression analysis showed that there is no statistically significant relationships between these indicators in all the considered years (see Table 1).

To test the second hypothesis, we considered the relationship between the fertility rate and the share of urban population in the total population of a country. Regression analysis showed that there is a moderately strong relationship between the two variables in all the considered years (see Table 2). In 1995 and 2005, the best model fitting

Table 1

Results of regression analysis (first hypothesis test)

Dependent variable (y)	Independent variable (x)	Year	Correlation coefficient	Regression model	R-squared, %	T-statistic (P-value)		F-ratio (P-value)	Durbin-Watson statistic (P-value)
						Intercept	Slope		
Average annual rate of change of the urban population, percent	Population density, inhabitants per square km	1995	–0.14	Square root-X model: $y = 3.06 - 0.02\sqrt{x}$	1.8	15.9 (0.000)	–1.9 (0.061)	3.6 (0.061)	1.5 (0.000)
		2005	–0.10	Square root-X model: $y = 2.13 - 0.01\sqrt{x}$	1.0	13.7 (0.000)	–1.4 (0.160)	2.0 (0.160)	1.6 (0.001)
		2015	–0.06	Reciprocal-X model: $y = 1.79 - \frac{0.04}{x}$	0.4	12.9 (0.000)	–0.8 (0.450)	0.6 (0.450)	1.4 (0.000)
Urban population, percentage of the total population	Population density, inhabitants per square km	1995	–0.08	Square root-X model: $y = 54.34 - 0.35\sqrt{x}$	0.7	11.8 (0.000)	–0.8 (0.450)	0.6 (0.450)	0.9 (0.000)
		2005	0.05	Linear model: $y = 56.35 - 0.01x$	0.2	19.0 (0.000)	0.4 (0.670)	0.2 (0.670)	0.6 (0.000)
		2015	–0.19	Logarithmic-X model: $y = 68.58 - 2.61\ln x$	3.6	9.7 (0.000)	–1.6 (0.110)	2.6 (0.110)	1.1 (0.000)

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this dependence was a linear model in 2015 – a logarithmic-X model (Figure 1)[2]. The moderately strong relationship between the fertility rate and the percentage of urban population means that as more and more people start living in cities and towns, less children are born in the country.

[2] To save space, the graphs are shown for the last considered year.

If we divide countries according to their level of economic development in the way described above, we shall see that this relation is more evident in the least developed countries of the world (see Table 3). In less developed countries, this correlation between the fertility rate and the percentage of urban population is also observed, but this relationship is weaker. In more developed countries, this dependence is almost absent.

Table 2

Results of regression analysis (second and third hypotheses test)

Dependent variable (y)	Independent variable (x)	Year	Correlation coefficient	Regression model	R-squared, %	T-statistic (P-value)		F-ratio (P-value)	Durbin-Watson statistic (P-value)
						Intercept	Slope		
Fertility rate, births per woman	Urban population, percentage of the total population	1995	–0.60	Linear model: $y = 5.9 - 0.05x$	36.2	23.5 (0.000)	–10.4 (0.000)	108.0 (0.000)	2.10 (0.803)
		2005	–0.56	Linear model: $y = 5.2 - 0.04x$	31.7	21.1 (0.000)	–9.5 (0.000)	89.9 (0.000)	2.05 (0.645)
		2015	–0.52	Logarithmic-X model: $y = 83.1 - 27.6 \ln x$	27.5	25.6 (0.000)	–8.5 (0.000)	73.1 (0.000)	2.10 (0.766)
Fertility rate, births per woman	Per capita GDP at current prices, US dollars	1995	0.64	Reciprocal-X model: $y = 2.7 + \frac{594.6}{x}$	41.1	21.4 (0.000)	11.1 (0.000)	122.2 (0.000)	2.0 (0.534)
		2005	0.70	Reciprocal-X model: $y = 2.2 + \frac{925.6}{x}$	49.3	21.5 (0.000)	13.5 (0.000)	181.9 (0.000)	2.0 (0.626)
		2015	0.75	Reciprocal-X model $y = 2.0 + \frac{1643.5}{x}$	56.1	24.6 (0.000)	15.3 (0.000)	233.6 (0.000)	2.1 (0.661)

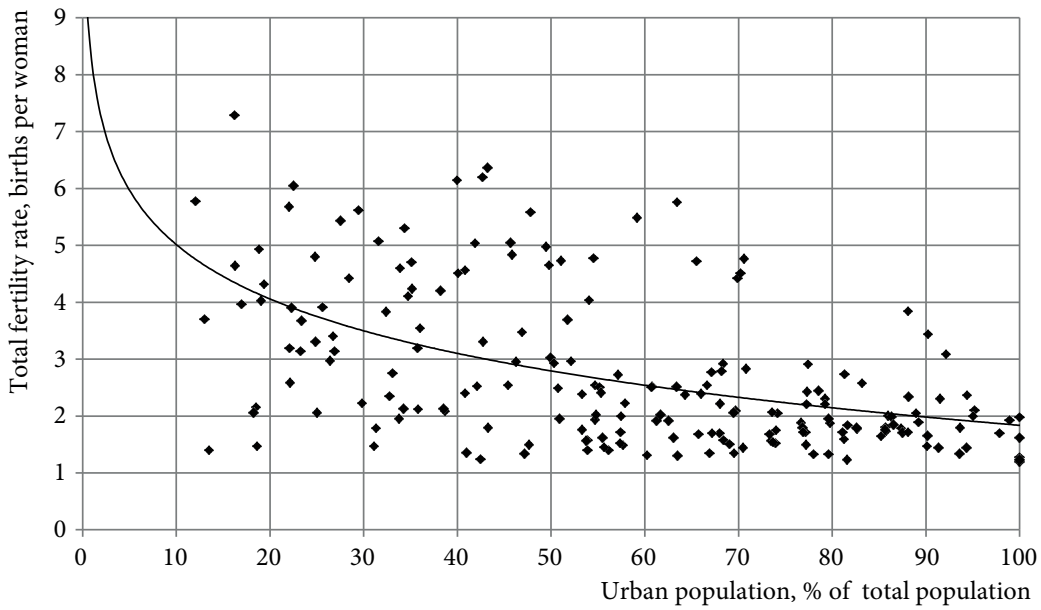

Figure 1. *Dependence between the fertility rate and the share of urban population in the total population of a country in 2015*

Notes: points denote certain values for countries; the thick solid line denotes a trend line of the logarithmic model

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According to our third hypothesis, *poverty and fertility are not correlated*. To check this hypothesis, we built a dependence between the fertility rate and per capita GDP (see Table 2 for the results of regression analysis). We found a moderately strong relationship between these two variables. In all the given years, one of the best-fitted models for this dependence was the reciprocal model (Figure 2). A moderately strong nonlinear relationship between these two indicators means that as per capita GDP grows, the fertility rate tends to fall until the definite level of ca. 1.0 – 2.0 births per woman.

Table 3

Results of regression analysis of the dependence between the fertility rate and the percentage of urban population in the total population of a country, divided by the level of its economic development

Year	Level of economic development	Correlation coefficient	Regression model	R-squared, %	T-statistic (P-value)		F-ratio (P-value)	Durbin-Watson statistic (P-value)
					Intercept	Slope		
1995	Least developed countries	–0.44	Linear model: $y = 6.2 - 0.04x$	19.4	17.4 (0.000)	–5.0 (0.000)	24.8 (0.000)	2.1 (0.707)
	Less developed countries	–0.38	Squared-Y square root-X: $y = \sqrt{(31.2 - 2.7\sqrt{x})}$	47.6	5.0 (0.000)	–3.3 (0.001)	11.2 (0.001)	1.4 (0.007)
	More developed countries	0.05	Reciprocal-Y square root-X: $y = \frac{1}{(0.5 + 0.01\sqrt{x})}$	0.25	1.6 (0.123)	0.2 (0.782)	0.1 (0.782)	2.0 (0.5499)
2005	Least developed countries	–0.48	Square root-Y model: $y = \sqrt{(2.43 - 0.01x)}$	23.3	25.3 (0.000)	–5.6 (0.000)	30.9 (0.000)	1.81 (0.166)
	Less developed countries	–0.21	Square root-X model: $y = 3.36 - 0.14\sqrt{x}$	4.33	4.9 (0.005)	–1.7 (0.102)	2.8 (0.102)	2.1 (0.715)
	More developed countries	0.11	Squared-Y model: $y = \sqrt{(2.59 + 0.01x)}$	1.3	2.2 (0.035)	0.7 (0.513)	0.4 (0.513)	2.0 (0.451)
2015	Least developed countries	–0.40	Exponential model: $y = 4.72e^{0,01x}$	15.9	15.7 (0.000)	–4.4 (0.000)	19.2 (0.000)	1.6 (0.016)
	Less developed countries	0.09	Square root-X model: $y = 1.55 + 0.05\sqrt{x}$	0.90	2.6 (0.011)	0.7 (0.479)	0.51 (0.479)	1.9 (0.348)
	More developed countries	0.05	Square root-X model: $y = 1.63 + 0.02\sqrt{x}$	0.25	3.3 (0.003)	0.3 (0.781)	0.1 (0.781)	1.0 (0.001)

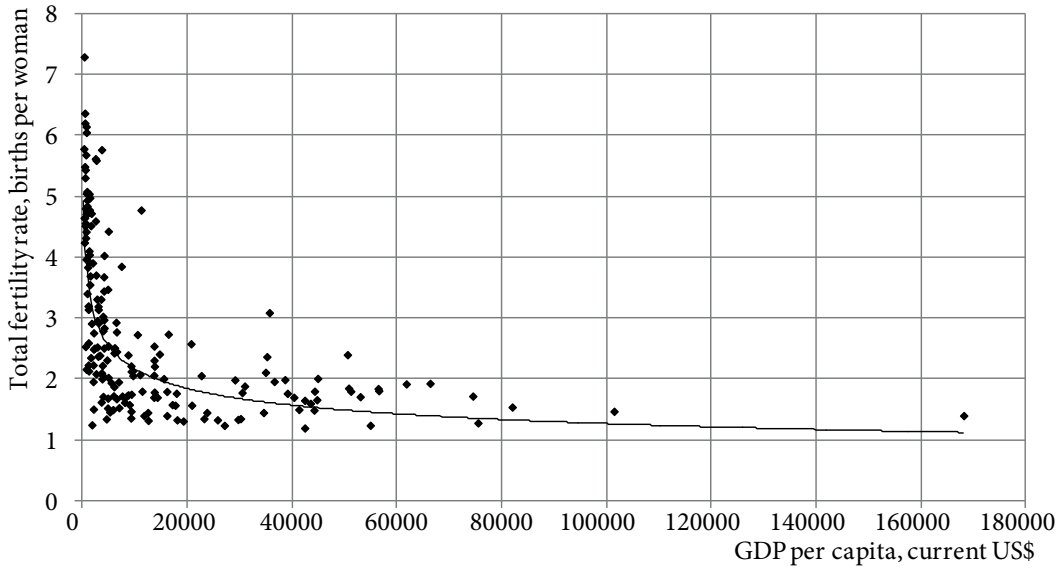

Figure 2. *Dependence between the fertility rate and per capita GDP in 2015*

Notes: points denote certain values for countries; the thick solid line denotes the trend line of the reciprocal-X model

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According to the fourth hypothesis, population concentration in big cities and the relationship between the birth rates and the infant mortality rates depend on the level of economic development.

To check this hypothesis, we considered the relationships between the following variables:

– the share of population of agglomerations with 1 million inhabitants or more in the country's total population and its per capita GDP;

– the ratio of the birth rate to the infant mortality rate and per capita GDP.

According to the results of regression analysis (see Table 4), for the given years, a polynomial

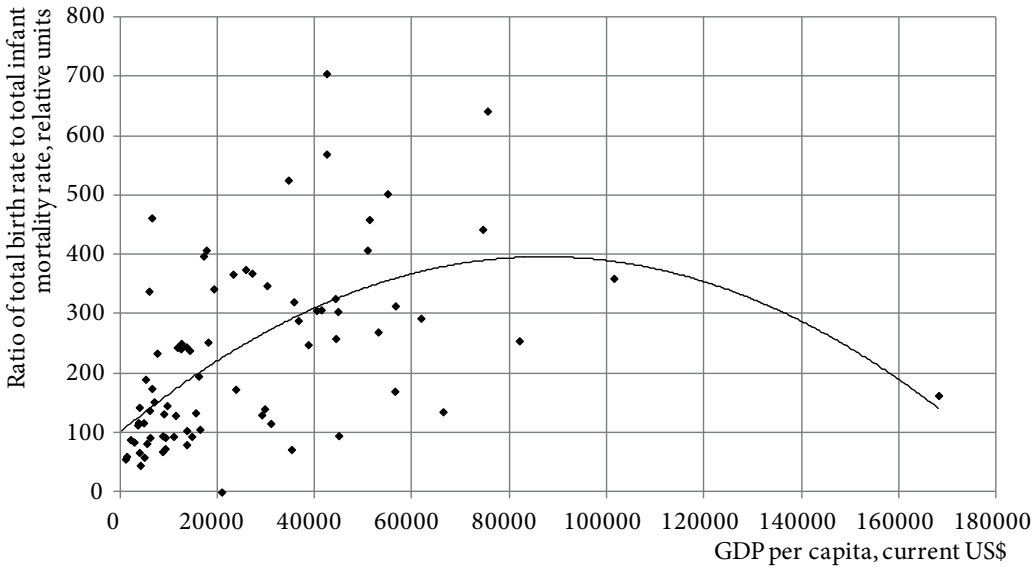

Figure 3. *Dependence between the share of population of agglomerations with 1 million inhabitants or more in the total population of a country and its per capita GDP in 2015*

Notes: points denote certain values for countries; the thick solid line denotes the trend line of the polynomial model of the second order

Table 4

Results of regression analysis (fourth hypothesis test)

Dependent variable (y)	Independent variable (x)	Year	Regression model	R-squared, %	T-statistic (P-value)			F-ratio (P-value)	Durbin-Watson statistic (P-value)
					Constant	Parameter x	Parameter x^2		
Population of agglomerations with 1 million inhabitants or more, percentage of the total population	Per capita GDP at current prices, US dollars	1995	Polynomial model of the second order: $y = 14.8 + 0.002x - 5.22 \cdot 10^{-8} x^2$	30.1	7.7 (0.000)	6.0 (0.000)	–4.6 (0.000)	22.6 (0,.000)	2.0 (0.415)
		2005	Polynomial model of the second order: $y = 14.53 + 0.003x - 4.91 \cdot 10^{-8} x^2$	33.9	7.5 (0.000)	6.7 (0.000)	–5.7 (0.000)	27.4 (0.000)	1.9 (0.224)
		2015	Polynomial model of the second order: $y = 15.21 + 0.001x - 1.63 \cdot 10^{-8} x^2$	28.1	7.1 (0.000)	5.3 (0.000)	–3.8 (0.000)	21.0 (0.000)	1.8 (0.156)
Ratio of the birth rate to the infant mortality rate, relative units	Per capita GDP at current prices, US dollars	1995	Polynomial model of the second order: $y = 33.73 + 0.01x - 1.92 \cdot 10^{-7} x^2$	90.5	4.6 (0.000)	8.4 (0.000)	–5.9 (0.008)	86.2 (0.000)	2.4 (0.844)
		2005	Polynomial model of the second order: $y = 72.27 + 0.006x - 3.00 \cdot 10^{-8} x^2$	53.5	6.1 (0.000)	6.4 (0.000)	–2.5 (0.016)	56.9 (0.000)	2.0 (0.553)
		2015	Polynomial model of the second order: $y = 100.33 + 0.007x - 3.89 \cdot 10^{-8} x^2$	34.1	4.1 (0.000)	5.9 (0.000)	–4.4 (0.000)	19.4 (0.000)	1.7 (0.131)

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model of the second order fits the first dependence best of all (Figure 3). The polynomial dependence between the considered variables means that the highest concentration of population in big cities is more typical of less developed countries. In the least developed and more developed countries, the share of the population living in urban agglomerations with 1 million inhabitants or more is not as high as in less developed countries. In other words, at first, the concentration of urban population grows together with the economic growth of the country, but after reaching a certain level of per capita GDP (ca. 23000 US dollars in 1995, ca. 25000 US dollars in 2005, and ca. 40000 US dollars in 2015), this concentration gradually declines.

The best trend line fitting the dependence between the ratio of the birth rate to the infant mortality rate and per capita GDP is also described by a polynomial model of the second order (Figure 4). The polynomial model shows us that at first with per capita GDP growth the ratio of the birth rate to the infant mortality rate also increases, but after a certain value of per capita GDP (ca. 34000 US dollars in 1995, ca. 80000 US dollars in 2005, and ca. 95000 US dollars in 2015), it begins to decrease. In less developed countries, this ratio is higher in comparison with the least and more developed countries. In the least developed countries, this ratio is low because of the high infant mortality rate, and in more developed countries this ratio is comparatively low because of the low birth rate.

Conclusion

The aim of this research was to investigate how strongly the biological factor (acting alongside economic factors) affects urban growth. Therefore, we have formulated the following hypotheses:

Hypothesis 1: There is a direct relationship between the population density and urban growth.

Hypothesis 2: Urban population growth is accompanied by a fall in the fertility rate.

Hypothesis 3: There is no correlation between poverty and fertility.

Hypothesis 4: Population concentration in big cities and the relationship between the birth rates and the infant mortality rates depend on the level of economic development.

To test these hypotheses, we applied methods of regression analysis and found that the second and the fourth hypotheses were partially confirmed. The first and the third hypotheses were refuted.

The first hypothesis is refuted, because in the given years no statistically significant relationship between urban growth (urbanization) and population density was discovered. It is worth mentioning one more time that we used the national statistical data and, therefore, population density was considered for a country rather than a region

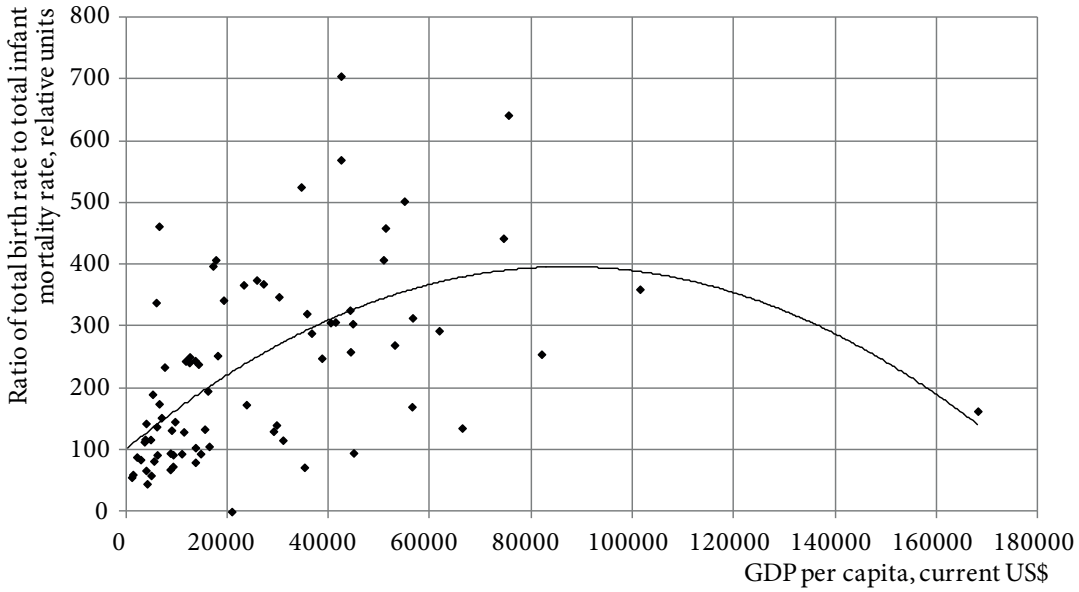

Figure 4. *Dependence between the ratio of the birth rate to the infant mortality rate of a country and its per capita GDP in 2015*

Notes: points denote certain values for countries; the thick solid line denotes the trend line of the polynomial model of the second order

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or a city. Therefore, there is a need for further analysis using the data on population density on the level of individual cities. Even on a national level, when city states, such as Macao or Hong Kong, are taken into consideration, the existence of these relationships is proved. For example, in the regions with extremely high population density (Monaco, Singapore and Chinese special administrative regions – Macao and Hong Kong), the fertility rate is low – it does not exceed the level of 2.0 births per woman.

The second hypothesis is confirmed. We found a moderately strong relationship between the fertility rate and the share of urban population in the total population of a country in the given years. As more and more people start living in cities and towns, less children are born in the country. This relation is more evident in the least developed countries of the world. In more developed countries, this dependence is almost absent. For better understanding of this relationship, analysis of the data on the level of individual cities is needed.

The results of regression analysis did not confirm *the third hypothesis*. We found a moderately strong nonlinear relationship between the fertility rate and per capita GDP. The growth in per capita GDP is accompanied by a decline in the fertility rate until the definite level of ca. 1.0–2.0 births per woman. This observation contradicts the opinion of Dolnik [7] cited above. In other words, the level of a country's economic development directly influences its fertility rate. Our analysis has shown that economic growth is not the sole factor affecting fertility but it is among the most important ones.

Finally, *the fourth hypothesis* was confirmed. The regression analysis revealed the polynomial form (of the second order) of the dependence between the share of population of agglomerations with 1 million inhabitants or more in the total population of a country and its per capita GDP. It means that in the least developed and more developed countries, the share of population living in urban agglomerations with 1 million inhabitants or more is not as high as in less developed countries. The peak of concentration of the population in big cities is observed at the mean level of economic development of a country.

Is there an equilibrium between the birth rates and infant mortality rates in more developed countries, which can thus be described as sustainable populations? To answer these questions, we considered the dependence between the ratio of the birth rate to the infant mortality rate and per capita GDP. We found that this relationship is also better described by a polynomial model of the second order. In less developed countries, this ratio is higher in comparison with the least and more developed countries. In the least developed countries, high infant mortality rates compensate for high birth rates. A rapid decline in the infant mortality rate due to humanitarian aid led to the unrestrained population growth in developing countries. Only more developed countries have managed to find a new balance between the birth rates and infant mortality rates. Therefore, we can conclude that the population of developed countries can be described as sustainable in this sense.

The results of this research show that the biological factors of urban development should be considered on a par with economic ones. Therefore, a comprehensive analysis of different factors of urban development is needed. Biological mechanisms affecting urban population play a significant role in the least and less developed countries, where the fertility rates vary significantly. Nevertheless, they start to decrease gradually along with the population growth. In more developed countries with high levels of per capita GDP, less than 60–70% of people live in cities with the population of 1 million inhabitants or more and the fertility rate does not exceed the simple reproduction level of 2.1 births per woman[3].

As we have pointed out above, this research used the national-level data, so the next step in this direction would be to look at the city-level data. Further analysis may also expand the range of socio-economic factors by considering per capita incomes, social security, the level of education, life expectancy, etc. This could be an important contribution to this research, taking into account the current approach to GDP estimation and the fact that service industries, which usually concentrate in urban areas, bring the biggest added value and make a considerable contribution to GDP formation.

[3] The level of simple reproduction is an average number of children who should be born in order to numerically substitute active generations who are giving births. The total fertility rate of 2,1 is widely used as a simple reproduction level.

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Implementation mechanisms of strategies of socio-economic territorial development: methodological approach

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ABSTRACT
The article analyzes strategic planning and management in Russia. At present the latter can be characterized as lacking a unified methodological approach to devising strategies of territorial socio-economic development, including mechanisms of strategy implementation. Conceptually this study relies on the theory of strategic management, regional and spatial economics, on dialectical, cause-and-effect, and other methods. An overview of approaches to strategies in Russian and international studies is provided. The article also describes the long-term challenges faced by Russian economy at the turn of the millennium and the goals of national development. The main stages of strategic planning are outlined as well as the current state of strategic planning and management. It is shown that strategic planning and management are crucial for the development of territories on all levels (municipal, regional and national). A special emphasis is placed on the case of Ekaterinburg and other large Russian cities and the possibilities of using their experience in other territories. Some recommendations are formulated as to the ways and means of creating mechanisms for implementation of socio-development strategies. The resulting algorithm is shown to be optimal for building strategy implementation mechanisms, which makes this study both theoretically and practically relevant.

KEYWORDS
territory, strategic planning, strategic management, strategy of socio-economic development, strategy implementation mechanism

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Исследование механизмов реализации стратегии социально-экономического развития территории: методический подход

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АННОТАЦИЯ
Статья посвящена исследованию процессов стратегического планирования и управления в Российской Федерации, одной из особенностей которых является отсутствие единых методических подходов к формированию стратегий социально-экономического развития территорий, в том числе к определению механизмов их реализации. Методологическая база исследования основывается на теоретических положениях стратегического менеджмента, региональной и пространственной экономики. Подходы российских и зарубежных ученых к стратегиям, этапы эволюции стратегического планирования в России, а также особенности разработки (актуализации) стратегий социально экономического развития, в том числе механизмов их реализации, территорий различных иерархических уровней раскрыты путем использования совокупности методов: диалектического, причинно-следственного и т.д. Представлены долговременные системные вызовы для российской экономики, сформировавшиеся в начале XXI в., а также стратегические цели современного развития Российской Федерации. Представлены основные характеристики этапов стратегического планирования, а также современное состояние процессов стратегического планирования и стратегического управления в Российской Федерации. Акцентировано внимание на необходимости применения механизмов стратегического планирования и стратегического управления развитием территорий. Проанализированы особенности механизма реализации стратегий Екатеринбурга и иных крупнейших городов Российской Федерации, а также возможности их применимости (тиражируемости) в стратегическом управлении другими регионами Российской Федерации. Сформулированы рекомендации по формированию механизма реализации стратегии социально-экономического развития. Теоретическая и практическая значимость исследования заключается в том, что оптимальное выстраивание алгоритма механизма реализации стратегии обуславливают прогрессивность социально-экономического развития территорий различных иерархических уровней.

КЛЮЧЕВЫЕ СЛОВА
территория, стратегическое планирование, стратегическое управление, стратегия социально-экономического развития, механизм реализации стратегии

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Introduction

At the turn of the millennium, Russian economy faced the following long-term systemic challenges, stemming from international trends but also from the country's internal issues: "firstly, increased global competition, covering not only the traditional commodity markets of capital, technology and labour, but also the national control system, support for innovation, human potential development; secondly, the expected new wave of technological changes, reinforcing the role of innovation in economic and social development and reducing the impact of many traditional growth factors; thirdly, the increasing importance of the role of human capital as a key factor in economic development; and, finally, the exhaustion of the potential of the raw materials export model of economic development based on forced export of fuel and raw materials, production of goods for domestic consumption due to the pre-loading of capacities in the conditions of low exchange rate, low cost factors of production – labour, fuel and electricity"[1].

To achieve a breakthrough in the technological and socio-economic development of Russia, to improve the living standards and conditions and create for Russian people an environment and opportunities to fulfil their potential, the Russian government approved the goals of national development for the period until 2024[2]. These goals include the following: "enhance technological development of the Russian Federation, increase the number of organizations that implement technological innovation; stimulate digitalization in economy and the public sphere; ensure that the rates of economic growth should exceed the world level while maintaining macro-economic stability and that Russia should become one of the top five largest world economies; support high-productivity export-oriented businesses in the basic sectors of economy, primarily, in manufacturing and agriculture, based on modern technology and staffed with highly qualified employees"[3].

To address the above-described systemic challenges and achieve the desired breakthrough, it is necessary to have a clear vision of what needs to be done, which is impossible without comprehensive strategic planning and management. The latter includes adequate mechanisms of strategy implementation, a plan of action, sufficient resources and so on, depending on specific needs of territories on different hierarchical levels (national, regional and municipal).

This article aims to investigate the mechanisms of implementation of strategies of socio-economic territorial development and to offer recommendations for devising such mechanisms within the general strategy framework.

Methodology

This study is based on the analysis of the key documents used in strategic planning such as officially approved strategies of cities, regions and so on and similar documents. The analysis relies on a set of methods (dialectical, cause-and-effect, etc.) to investigate specific stages in the cycle of strategic planning and management.

We also consider external and internal environment, methods of strategic analysis, missions, aims, objective and problem tree, strategy structure, priorities, key areas, programs, projects, methods of implementation, system of monitoring and management.

In this article we are dealing only with the implementation mechanisms for strategies adopted by territories of different hierarchical levels.

There is a vast body of research literature on strategic planning and management. In Russian and international practice of strategic planning, a strategic plan (or a strategy) is usually a document describing priority (strategically important) areas of development for a certain territory which different local community groups have chosen and agreed upon [1]. Undoubtedly, it is crucial to take into consideration opinions and interests of different stakeholders when setting the priorities of a public policy and devising strategic planning documents.

There is no universally accepted single definition of a strategy. A significant contribution to the research in this field was made by G. B. Kleiner [3], M. Porter [4], I. Ansoff [5; 6], A. A. Thompson, A. J. Strickland [7], H. Mintzberg, J. Quinn, S. Ghoshal [8] and others.

In our opinion, the following definition is the most adequate: strategy is a complex of clearly de-

[1] For more on the Concept of Long-Term Socio-Economic Development of the Russian Federation until 2020, see: Resolution of the Government of the Russian Federation of 17.11.2008. No. 1662-p.

[2] For more on the national and strategic goals of development of the Russian Federation until 2024, see: Decree of the President of the Russian Federation of 07.05.2018 No. 204.

[3] For more on the national and strategic goals of development of the Russian Federation until 2024, see: Decree of the President of the Russian Federation of 07.05.2018 No. 204.

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fined goals; policy, that is, the art of implementing the key goals and coordinated actions (ways of implementation) necessary to reach the desired goals [9].

The main stages in the evolution of strategic planning in Russia are described in Table 1.

Table 1

Main stages in the evolution of strategic planning in Russia [10]

Period	Characteristics on the territorial (state) level	Strategic planning instruments
1. Pre-revolutionary (1860–1920s)	Planning of economic development, budget planning, foreign economic plans as a part of strategic planning concerning military and political alliances	Basic statistical analysis, non-formalized expert assessment
2. Soviet (1920s–1990s)	Directive planning of all aspects of national economy, high degree of centralization	Five-year plans, technical, economic and project-based approach, schemes of territorial development and distribution of labour force, extrapolation
3. Contemporary (mid-1990s–present)	National, regional and local strategic documents, comprehensive strategies of territorial development (regional and municipal levels), development of industries, strategies of national socio-economic development, creation of the strategic planning infrastructure	Strategic analysis, statistical analysis, SWOT, PEST-analysis, systems approach, scenario planning and forecasting, expert assessment, foresight, strategic control, strategic assessment of strategic planning documents and so on

If we analyze modern approaches to strategic planning and management, it becomes evident that the majority of such studies treat strategic planning as an effective mechanism of regional planning. Moreover, it is shown that any region's internal resources and potential depend to a certain extent on the external environment.

Strategic planning and strategic management in Russia: contemporary stage

At the modern stage of development in Russia, strategic planning and management start to be seen as crucial on all levels of the territorial hierarchy: national, regional, and municipal.

One of the key features of strategic planning in Russia is that when strategy documents were first designed, there was no legislation to regulate this process. The first strategy document – the Strategic Plan of St.Petersburg – appeared in 1997. Thus, million-plus and large Russian cities became pioneers of strategic planning [11]. Nevertheless, even 22 years later, not all Russian regions and municipalities have adopted and started implementing up-to-date strategies of development. The situation with million-plus Russian cities inspires more optimism: as of 1 January 2019, all million-plus Russian cities (except for Krasnoyarsk) have officially approved strategies of socio-economic development and have started implementing them.

Even though Russia has already accumulated considerable experience in strategizing, strategic planning and management, a number of problems still remain unsolved [12]: the lack of methodological guidelines necessary for designing and implementing strategy documents; gaps in the legislation on strategic planning; insufficient coordination of the processes of strategic territorial planning and management; the lack of clear understanding of what stakeholder groups should participate in strategic planning and how this process should be organized; the lack of generally accepted mechanisms of strategy implementation; and so on.

It is necessary to improve strategic planning and management methods, in particular those of constructing (designing and updating) strategies of socio-economic development, including implementation mechanisms. It should be noted that at the current stage, Russian scholars take a special interest in the questions of forecasting [13]; strategic planning and strategic management [14; 15], including the methodological support of this process [16; 17]; coordination of processes of territorial planning and management [18]; and development of "smart cities" [19– 21]; and innovative development [22; 23].

Mechanisms of implementation of strategies of socio-economic development of Russian territories

For efficient strategic planning and management it is important to identify mechanisms of strategy implementation. This section, however, is not always included in the strategies of socio-economic development. In some cases, different types of implementation mechanisms are declared (eco-

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nomic, financial, legal, organizational, etc.) but not clearly defined – no instructions are provided as to what, when and how the participants of the process should do.

The main mechanisms of implementation of the Strategic Development Plan of Ekaterinburg, which was among the first in Russia to engage in strategic planning, included involvement of different stakeholder groups (business, public, academia, government and mass media) into strategic planning and implementation.

Project management was combined with program management.

Ekaterinburg's Strategic Development Plan consists of strategic projects. Each project, in its turn, comprises a set of measures aimed at tackling specific problems, which facilitates project management and strategy implementation control. For the same purpose, unified methodological approaches are applied to strategic planning.

Last but not least, the processes of strategic and territorial planning and management are coordinated.

From 2003 to 2018, one of the main parts of Ekaterinburg's Strategic Plan was "The General Plan of the City of Ekaterinburg – City for Life". After 2018, it was replaced by the Strategy of Spatial Development, which addresses a number of important spheres of urban development, such as land-use planning and zoning, residential development, harmonization of urban landscape and so on.

Other Russian cities also have their own specific mechanisms of strategy implementation. For example, the City of Kazan used flagship projects[4]. In Samara, the principle of "live strategies"[5] was applied and so on.

Another question worth considering is how applicable the specific strategy implementation mechanisms are in relation to other territories. Let us look, for example, at the implementation mechanisms defined by the Strategy of Ekaterinburg.

As it was said above, *in Ekaterinburg,* the capital of Sverdlovsk region, *different groups of stakeholders were involved in the process of strategic planning and implementation.*

Sverdlovsk region has a unique advanced experience of designing and updating strategies of socio-economic development. Under the auspices of the Plenipotentiary Representative of the Ural Federal District and the Government of Sverdlovsk Region, the Unified Methodological Board of Strategic Planning and Development was established. The Board created general approaches to designing strategic planning documents on all levels by coordinating federal, regional and municipal strategic planning systems[6]. The resulting unified methodological guidelines and strategy requirements were then officially approved[7]. The main methodological principles proposed by the Board are as follows:

1. Top officials should be personally involved into strategic planning and strategy implementation. In other words, strategic planning should fall within the sphere of responsibility of top officials of regional executive government bodies and heads of municipalities. This function cannot be delegated to lower levels of the hierarchy. The frontline government officials should lead the process of strategic planning and implementation. This process should be well-structured, formalized and automated.

2. The strategy should be designed by those who are in charge of their home regions or cities and who are, therefore, interested in the prosperity of this territory although they may decide to employ external consultants.

3. Strategy is a "public agreement document", that is, a strategy should have a scientifically justified framework and it should balance the interests of the public, business and government, ensuring comprehensive and sustainable development of the territory. Therefore, it is crucial to engage all community groups into meaningful dialogue.

4. The efficiency of local government bodies is crucial for achieving the desired goals set by the strategy.

5. It is important to establish an institution of project managers. Specific leadership respon-

[4] For more on the Strategy of Socio-Economic Development of Municipal District Kazan until 2030, see: Resolution of Kazan City Duma of 14.12.2016 No. 2-12. Retrieved from: https://www.kzn.ru/o-kazani/strategiya-kazani-2030/

[5] For more on the Strategy of Comprehensive Development of the City District of Samara until 2025, see: Resolution of Samara City District Duma of 26.09.2013 No. 358. Retrieved from: http://samgd.ru/upload/mirrors/www.gordumasamara.ru/docs/decisions/1380139200/Strategiya_ot_26.09.13.pdf

[6] Minutes of the Meeting of the Deputy of the Plenipotentiary Representative of the President of the Russian Federation in the Ural Federal District and the Working Group on Strategic Planning and Regional Development in the Ural Federal District of 01.07.2016 No. 12.

[7] Minutes of the Meeting of the Unified Methodological Board of Strategic Planning and Development in the Ural Federal District under the Deputy of the Plenipotentiary Representative of the President of the Russian Federation in the Ural Federal District A. P. Moiseev of 14.11.2016 No. 22.

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sibilities need to be assigned for every project or program: responsible parties are designated in the corresponding government bodies.

6. It is necessary to ensure consistency, coordination and continuity of strategic and ongoing planning. Steps and indicators described in strategic documents should be systematically reflected in planning and control; the choice of specific measurable values, deadlines and stages should be justified. Therefore, it is important to establish strategic control points, which will make the whole process more controllable, make analysis of the situation less time-consuming and ensure efficient decision-making.

In Sverdlovsk region, each municipality had their own working groups and think tanks ("Government", "Business", "Academia", "Public", and "Media") and municipal education councils. The Council of Strategic Development of Sverdlovsk Region, a public collegial body, was established to create a system of strategic planning based on a single methodological framework, to examine and select draft strategic planning documents.

The second mechanism of implementation used in Ekaterinburg was the combination of project management with program management.

Project management became a widely discussed topic in Russia since the middle of 2016, when the Presidential Council for Strategic Development and Priority Projects was established (hereinafter referred to as the Council). The Council determined priority areas of national development and also set the aim of promoting project management principles and practices on the national level. Within a few months, the Government of the Russian Federation adopted the Decree No. 1050 of 15.10.2016 "On Organization of Project Activity in the Government of the Russian Federation" and thus put into force the Council's recommendations. By 2017, almost all federal ministries and regional governments had their own project management offices.

In 2018, project management principles started to be applied on the regional level. The regions which proved to be most active in this respect were Belgorod, Leningrad, Arkhangelsk, Primorye regions and Yamalo-Nenetsk and Khanty-Mansiisk autonomous districts. In 2018–2019, this trend spread to the majority of Russian regions. Some of them attempted ensure the compliance of their strategies with regional and federal projects. In some regions, local municipalities put forward their own project initiatives, and, as a result, some municipal projects were selected to be realized within the updated strategies of socio-economic development.

It should be noted that most of the projects, regardless of their officially declared level, are actually realized on the level of municipalities, which is why in many regions efforts are made to provide methodological support and consultancy for municipal authorities. From the methodological and practical point of view, it is particularly interesting to look at the experience of the following Russian regions.

In Perm region, it was decided to create a platform "Municipal Club" to discuss problems, needs and concerns of local communities and municipal authorities. All those interested in the improvement of life in municipalities and enhancement of the efficiency of municipal government could join the club.

As a part of the project "Municipal Home" in Krasnoyarsk region, the leading Russian and international experts conducted seminars on legal aspects of self-government for heads of municipalities, municipal civil servants and candidates for posts in municipal service.

Nizhny Novgorod region realized a number of social projects such as the project "Council of Young Deputies of Nizhny Novgorod region" aimed at enhancing cooperation among young deputies in representative bodies of municipalities and building a talent pool for municipalities. The purpose of the second project "The City to Live in" was to support grassroots initiatives in the sphere of environmental protection, urban beautification and creation of outdoor amenities in streets, neighbourhoods and residential districts. The third project "Social Development – Revival of Traditions" was aimed at encouraging young adults to participate in social development of their local areas and to preserve the cultural heritage of these areas through specialized social projects.

Samara region realized the project "Implementation of New Educational Mechanisms for Career Lift" aimed at organizing short-term training courses (business games) as a platform for exchange of experience and networking among young professionals.

In Bryansk region, project "Mutual Assistance" helps teenagers and young adults to cope with difficult life circumstances.

Sverdlovsk region also actively uses mechanisms of project management. The new management technologies were introduced to the region

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by the Decree of the Governor of Sverdlovsk Region of 14.02.2017 No. 84-УГ "On Organization of Project Activity in the Government of Sverdlovsk Region and Executive Government Bodies of Sverdlovsk Region". Moreover, strategic projects are the key mechanisms of implementation of the Strategy for 2016–2030[8].

The innovative trend in socio-economic development of municipalities as basic spatial units focuses on the local community as the driving force behind project management. At the same time, practice shows that it is necessary to encourage local communities to participate in this process. Municipal strategies also need to be adjusted. One of the ways to involve local communities in strategic planning and management is to introduce a system of proactive budgeting.

Table 2 outlines the main characteristics of proactive budgeting.

Table 2

Proactive budgeting characteristics

Characteristic	Content	Explanation
Financial and budget-related aspects	Proactive budgeting is a way of redistributing from 1 to 10% of the municipal expenditure budget by a special committee	The committee consists of representatives of the local community not involved in municipal government
	This mechanism becomes a part of the budgeting process	State and municipal budgeting
	Principle of project co-funding	Attracting additional funding sources
	Enhancing efficient public spending	Compliance with municipal targeted programs
Organizational aspect	Includes various implementation forms and practices	Crowdsourcing, crowdfunding
	Involves members of local community into project activities	Brainstorming new ideas; designing, realization and control of specific projects; evaluation and selection of such projects
Behavioural aspect	Encourages careful and conscientious treatment of the facilities built as a part of the project	
	Changes the local community's attitude towards budgeting	
Informational aspect	Activates public indicators of development	
	Makes public financial management transparent by ensuring easy access to relevant information	

[8] For more on the Strategy of Socio-Economic Development of Sverdlovsk Region in 2016-2030, see: Law of Sverdlovsk Region of 21.12.2015 No. 151-ОЗ. Retrieved from: http://strategy2030.midural.ru/sites/default/files/files/zakon_no_151-oz.pdf

Our analysis of the data from the Proactive Budgeting Centre of the Financial Research Institute of the Ministry of Finance of the Russian Federation shows that many regions of Russia resort to proactive budgeting methods.

The third implementation mechanism was efficient coordination of strategic and territorial planning and management efforts.

This process is crucial for the strategy's viability. If strategic priorities do not take into account the specific needs and characteristics of this or that territory, they will remain nothing but a piece of highly unrealistic wishful thinking. The methodological guidelines for development (and updating) of municipal strategies in Sverdlovsk region specify the following requirement for the section "Strategy of Spatial Development" in these documents[9]:

1. The aim of spatial development of municipalities should be clearly formulated and aligned with the main aim of municipal socio-economic development.

2. The same refers to the goals of spatial development of municipalities.

3. The key performance indicators should be quantifiable and show the attainment of the aim and the corresponding goals, including those identified for specific stages of strategy implementation.

4. Analysis of municipal development should, among other things, consider the transformations of the municipality, its success or failure to achieve the goals set by the previous documents of territorial planning and description of the main problems that need to be dealt with as well as the positive and negative trends that need to be taken into account.

5. There should be a description of the concept (priority scenario) of spatial development, which sets the main aim and priorities by taking into account the potential and resources of this municipality and its functional zones (they need to correlate with the implementation mechanisms of priority projects included into the strategy).

6. There should be strategic indicators which determine the main criteria and requirements and can be used to assess the results of spatial development in general and the outcomes for specific functional zones.

7. The list of graphic materials should be included into the strategy as appendices.

The section on implementation mechanisms in strategies will help harmonize the pri-

[9] For more on the methodological guidelines for devising strategies of socio-economic development of municipal districts in Sverdlovsk region, see: Decree of the Government of Sverdlovsk region of 30.03.2017 No. 208-ПП.

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orities of socio-economic and territorial development of a certain municipality with its key characteristics.

It is important to conduct further research into the topic of strategic territorial development [24].

Conclusion

Strategic planning and management are important instruments which enable governments to cooperate with other stakeholder groups to achieve the desired goals. Our research findings are as follows:

Strategic planning in Russia went through several stages of development. Our analysis focused on the current trends by looking at strategic planning documents (strategies, strategic plans and so on) and found that such documents were initially designed in the absence of the corresponding legislation. The first to draw strategies of socio-economic development were large Russian cities. Even today, however, not all Russian regions have their own officially approved updated strategies, which makes it a relevant task to promote strategic planning and management and provide adequate methodological support.

We discussed the strategy implementation mechanisms used in Ekaterinburg and other million-plus Russian cities as well as the applicability of this experience in other Russian regions.

Since there are no generally accepted strategy implementation mechanisms, we have formulated a number of recommendations.

First, the section "Mechanisms of Strategy Implementation" should become an integral part of any strategy of socio-economic development since it describes the key principles of strategic management, monitoring and strategy updating.

Second, this section should define the stages, mechanisms and principles of strategy implementation and monitoring as well as the parties responsible for each stage. This section might include a description of new institutions necessary for strategy implementation, their powers, functions, sources of funding, performance indicators and forms of supervision and control.

Finally, it is recommended that this section should include a scheme of organization of strategic management, identifying the specific strategic areas and priorities of spatial development as well as the corresponding government bodies.

Mechanisms of strategy implementation are among the key elements of strategic management, in fact, these mechanisms are what makes a strategy viable. Introduction of universal methodological approaches, including those dealing with implementation mechanisms on all levels (from municipalities to macro-regions and the whole country), will provide a foundation for an efficient integral system of strategic planning and management.

One of the urgent tasks that needs to be addressed by the Russian government is to establish general methodological approaches to strategic planning and management of territories of different levels.

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Analysis of Japanese shrinking cities and policies to tackle this problem (the case of Sammu city and its economic gardening project)

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ABSTRACT
This paper examined the problem of shrinking cities and evaluated the policies used to mitigate the impact of shrinkage. The analytical section of this paper discusses the definition of a shrinking city, Japan's depopulation in the coming decades on the national and municipality level, and the vicious circle of the population loss and the change of economic structure in shrinking Japanese cities. The second section of the paper examines the desired policy goals for shrinking cities, along with strategies and approaches to achieve them. It is shown that the strategies that the Japanese national government has realized since 2014 were inadequate and ineffective. An alternative initiative (for example, the economic gardening model) is necessary to complement governmental programs to empower SMEs in cities, create more jobs and boost the incomes of businesses and city residents. The case study section of this paper analyzed the case of Sammu – a shrinking Japanese city, which has been engaged in an economic gardening project. Even though the outcomes of this project have not been officially confirmed, the available data show that the sales and employment of the local firms that participated in the program either improved or at least remained at the same level. The potential area for future research might be analysis of programs for revitalizing shrinking cities in resource-dependent regions, for instance, of Russia and Australia. Such studies could provide insightful suggestions for adequate policy formulation and implementation.

KEYWORDS
depopulation, regional cities, small- and medium-sized enterprises (SMEs), economic gardening, Japan

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Анализ японских сокращающихся городов и политика для решения этой проблемы (пример города Самму и его проекта экономического садоводства)

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АННОТАЦИЯ
В статье рассматривается проблема сокращения городов и оценивается политика, используемая для смягчения последствий данного сокращения. В аналитическом разделе этой статьи обсуждается определение сокращающегося города, депопуляция Японии в предстоящие десятилетия на национальном и муниципальном уровне, а также связь потерь населения и изменения экономической структуры в сокращающихся японских городах. Во втором разделе рассматриваются желаемые цели политики в отношении сокращения городов, а также стратегии к их достижению. Показано, что стратегии, реализованные японским национальным правительством с 2014 г., были неэффективными. Альтернативная инициатива (например, модель экономического садоводства) необходима в дополнение к государственным программам по расширению возможностей малых и средних предприятий в городах, созданию новых рабочих мест и повышению доходов предприятий и городских жителей. В статье проанализирован случай Самму – сокращающегося японского города, который участвовал в проекте экономического садоводства. Хотя результаты этого проекта официально не подтверждены, имеющиеся данные показывают, что продажи и занятость местных фирм, участвовавших в программе, либо улучшились, либо, по крайней мере, остались на том же уровне. Потенциальной областью будущих исследований может быть анализ программ по оживлению сокращающихся городов в ресурсозависимых регионах, например, России и Австралии. Такие исследования могут дать полезные предложения для адекватной разработки и реализации политики.

КЛЮЧЕВЫЕ СЛОВА
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Introduction

Shrinkage of cities has been both a domestic and international issue and has attracted the attention of economists, economic geographers, sociologists, urban and regional planners. Actors in political, civil, and private sectors are also concerned about the causes, process, and consequences of city shrinkage. Population loss and collapse of communities in big cities such as Detroit attracts academic and public attention, but shrinkage of regional small cities is related to more important and complicated issues. This paper discusses shrinking Japanese cities in the age of sustainable development goals (SDGs).

This paper has three purposes. The first purpose is to analyze the theoretical and practical aspects of the problem of shrinking cities. I will start by discussing the definition of a shrinking city and provide a brief literature review. Then I will focus on the shrinkage of Japanese cities and the background for this phenomenon: Japan is now facing a "slow-burning" nation-wide depopulation crisis and the situation is going to become worse in the coming decades. This alarming trend persists even though Japanese governments, both national and municipal, have been struggling to solve this problem. I will clarify the characteristics of Japanese shrinking cities and discuss the causes of the loss of population and deteriorating economic activities there.

Second, this paper examines the desired policy goals for shrinking cities, along with the strategies and approaches to achieve such goals. I will show that instead of simply increasing the income and employment levels among the residents, it is necessary to enhance the economic resilience in shrinking cities. I will also argue that the strategies that the national government has implemented since 2014 have been inadequate and have therefore failed to solve this problem. I will then propose an alternative approach, which focuses on the areas that the Japanese government has not paid much attention to – economic gardening. This alternative approach was already tested in the US, Australia and Japan and could help tackle the problem of shrinking cities.

Third, this paper proposes a framework for comparative case study analysis on shrinking cities which could be used, for instance, to compare cities in Russia and Japan. There is an urgent need for research on shrinking cities in resource-dependent regions in order to promote sustainable development of these cities. This paper seeks to fill this gap by supplying a framework for comparative analysis. This paper will also present a case study of a Japanese city based on the proposed framework as an example of the above-mentioned alternative approach. I will provide some basic information about this city and the program, then discuss the challenges that had to be addressed and the results of the program implementation.

Issues related to shrinking cities include from public health, loss of young workers, loss of businesses, abandoned houses and farmlands, city planning and management, and maintenance of the infrastructure. While all of these issues are important and need comprehensive solutions, this paper cannot cover all of them, and instead focuses on issues related to income and employment in shrinking cities. Chronologically, this paper discusses the shrinkage of cities after the 1990s, and the information on shrinking cities before the 1990s is used as references.

Analysis

Definition of a shrinking city

One of the difficulties of defining a shrinking city is that understanding of this phenomenon to a great extent depends on the context of each specific country. For example, in Japan, since the mid-1960s, the issue of depopulation and the loss of community sustainability was referred to as "*kaso*", which literally means "being overly-sparsely populated". The Subcommittee of the Economic Council on Regional Issues, a Japanese governmental organization, explained the "*kaso*" issue in the report published on 30 October 1967 the following way: "… we understand "*kaso*" as a state when it becomes difficult to maintain a certain level of living because of depopulation: for example, when it becomes difficult to maintain basic conditions of local community such as disaster prevention, education, and preservation of health; at the same time, when it becomes difficult to use resources rationally; and then the production output in the area reduces significantly. Depopulation leads to lower population density and aging and makes it difficult for the community to maintain a sustainable lifestyle"[1] (English translation was made by the author).

[1] Quoted in the collection of official reports published by governmental organizations: "Kaso Taisaku no Keii Enkaku (History and Variation of Kaso Issues)". Retrieved from: http://www.soumu.go.jp/main_sosiki/jichi_gyousei/c-gyousei/2001/kaso/pdf/kasokon19_01_s2.pdf

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The Act on Special Measures Concerning the Promotion of Self-Sustainability in Kaso Areas provides another definition of a "*kaso*" area. The Act, enacted in March 2000 and revised in 2017, follows the preceding laws since 1970 but expands the definition of "*kaso*": a municipality can be recognized as a "*kaso*" area by concerned ministers based on the status of the financial capacity index, average depopulation rate in the past, and seniority rate in the municipality.

Since the notion of "*kaso*" becomes meaningful only in the Japanese context, it is pretty hard to apply this term in the international discussion, for example, to discuss matters related to other countries. Therefore, this paper employs the definition of a shrinking city provided by the Shrinking Cities International Research Network (SCIRN): "a densely populated urban area with a minimum population of 10,000 residents that has faced population losses in large parts for more than two years and is undergoing economic transformations with some symptoms of a structural crisis" [1].

Research questions

The existing literature has already covered various aspects of the phenomenon of shrinking cities on global, supra-national, and national levels, for example, there is a case study of cities in the US, Germany, Italy, and the UK [2]. Richardson and Nam also provide a classification of causes and consequences of urban shrinkage and describe the measures for improvement of the current situation [2].

The analysis of shrinking cities in the eastern part of Germany shows that it is a complex, multi-dimensional problem [3]. First, demographic problems are caused by the decline in population due to low birth rates, migration of the youth, and aging. Second, urban economic problems involve the loss of employment due to de-industrialization, and job losses are linked to de-industrialization and, therefore, cannot be compensated for by the growth within the service sector. Third, urban problems include public infrastructure overcapacity, large brownfield areas, and vacant residential and commercial property. Finally, these demographic and socio-economic processes result in the deterioration of the financial conditions within the struggling municipalities, which limits the local government's choice of policy instruments.

Taking the national and local conditions into account and focusing on the causes of shrinkage, we can point out three types of shrinkage: (1) shrinkage imposed either by natural or external forces (including those external to the local region); (2) shrinkage due to comparative disadvantage; and (3) shrinkage due to societal and global changes [4]. In the first category of "imposed shrinkage", the underlying causes of shrinkage are, for example, political and military conflicts, spatial and administrative reforms (initiated by the national government) or resource depletion. These causes are beyond the control of the local community. The second category of "shrinkage due to comparative disadvantage" reflects the cases when cities become unable to compete with other cities due to inadequate infrastructure, technology, the cost and quality of labor force, changes in the performance of their main industries, business environment, and people's lifestyle. The third category of "societal and global changes" refers to the changes, such as a continuous decline of birth rates and climate change. Since these factors are beyond the control of these communities, the only thing they can do is to cope with the situation by developing strategies that maximize their opportunities.

Yang and Dunford studied the shrinkage of urban and rural areas in Chinese municipalities and compared different types of causes in different regions of China [5]. Their contribution to the discussion is important because they show that there are different reasons for city shrinkage even in the same country.

There is a perceived lack of research literature on the city shrinkage in resource-dependent regions: even though some regions are endowed with fertile land or natural resources, cities in the region may start experiencing shrinkage while their resources are still available. Many municipalities in Russia and Japan fall into this category, and further research on how such municipalities can be revitalized is needed. International joint research on this topic, involving academics in Russia, Japan, and other countries such as Australia and the US, will contribute to the understanding of this problem by making insightful suggestions about the most efficient policies and their implementation.

The issue of depopulation in Japan on the national level

Japan currently experiences and will continue experiencing in the future depopulation and aging on an unprecedented scale. As of 1 October, 2018, the population of Japan is 126.4 million,

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lower than the previous year by 263 thousand people. There are 35.6 million senior citizens aged 65 or older, and the seniority rate has reached its historical maximum of 28.1%. The total fertility rate in 2018 was 1.42, which is well below the level that can maintain the population.

According to the recent estimates based on the National Population Census of 2015, the total population of Japan in 2045 will decline to 106.4 million [6, p. 47]. This means that 16.3% of the population will be lost in 30 years. The loss of population is mainly due to the continuously falling birth rates. The longer lifespan, along with the lower birth rate, leads to an increase in the aging population. The same report also estimates that the seniority rate will become higher in all of the 47 prefectures in Japan [6, pp. 50–52]. The number of prefectures with the seniority rate exceeding 30% was 13 out of 47 in 2015, but it is expected that the seniority rate will exceed 30% in all of the prefectures in 2045. The national average of the seniority rate will be 36.8% in 2045, but the variance is large. The highest seniority rate in 2045 will be found in Akita Prefecture (50.1%), and the lowest – in Tokyo Metropolitan (30.7%). The trends of depopulation and aging will continue and accelerate. The loss of working population combined with the increasing senior citizen population will result in lower consumption and production in domestic markets, raising the welfare payment burden in the public sector, and causing difficulties in maintaining communities.

Japanese public administration system has three levels: national, prefectural, and municipal. Prefectural and municipal governments are responsible for policies in the sphere of education, welfare, safety and security, fire and disaster prevention, area planning and zoning, development and maintenance of local-level infrastructure, and industrial development. The governments use their own budget funds and/or subsidies from the national government. It is necessary to pay attention to demographic changes on the prefectural and municipal level to understand the issues related to city shrinkage in Japan.

The relative loss of population in some prefectures will be higher than others, according to the study of the National Institute of Population and Social Security Research [6, p. 56]. Only Tokyo Metropolitan will gain population (100.7) and a small number of prefectures can maintain their current population levels: Okinawa Prefecture (99.6), Aichi Prefecture (92.2%), and Kanagawa Prefecture (91.1). On the other hand, prefectures which have larger rural areas will experience further depopulation in 2045: Akita Prefecture (58.8%), Aomori Prefecture (63.0), Yamagata Prefecture (68.4), Kochi Prefecture (68.4), and Fukushima Prefecture (68.7).

If we compare the population in 2050 with the population in 2010 per square kilometer, we will see shows that the population will increase only on 2% of the Japanese land [7]. 19% of the land will become deserted in 2050, 44% will lose more than 50% of the population. In smaller municipalities, the rate of population will be falling faster. On average, Japan will lose about 24% of population between 2010 and 2050. Million-plus cities will lose 15% of their population, while municipalities with less than 10 thousand inhabitants will lose as much as 48% of their population. These estimates indicate that Tokyo, Nagoya (the capital city of Aichi Prefecture), and Yokohama (the capital city of Kanagawa Prefecture) will have to attract financial and human capital from other parts of the country.

Municipalities with a small percentage of young women are likely to lose their residents in the future, and 523 municipalities in Japan (29.1% of all the municipalities) will only have the population of less than 10 thousand in 2040, finding it hard to keep up with other, more prosperous municipalities [8]. The number of young women aged 20–39 can be used as a proxy indicator for the reproduction capacity of a municipality since it is women who bear the reproductive responsibility: from giving birth to children to raising them. Municipalities without job opportunities for women and their partners will lose this part of the population, and the reproduction capacity of the municipalities will inevitably decline.

As it was mentioned above, in the 2040s or 2050s, large cities in Japan will become more convenient for living and more prosperous, which will attract more people while smaller cities will lose their population both in absolute and relative terms.

The issue of shrinking municipalities and local SMEs in Japan

Depopulation in rural municipalities due to the exodus of young workers to urban areas is not a new phenomenon. Japan had an experience of massive internal migration of youth labor force during the high economic growth period in the 1960s. The rapid development of manufacturing

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industries led to migration of young people to big cities such as Tokyo, Yokohama, Nagoya, and Osaka after high school, or even after junior high school. Regions without a strong industrial base became suppliers of youth labor, and they started to suffer from the shortage of young people. Figure 1 illustrates the trends of internal migration since the 1950s.

Fluctuations of population in regional cities is closely linked to the economic situation and business activities of local small- and medium-sized enterprises (SMEs). Researchers point out two periods when the economic situation and activities of SMEs in regional cities drastically changed: one is the "bubble economy" period (1985–1992), and the other is the period of the economic structural reforms (2003–2006) [8]. The former period was the time when manufacturing firms left Japan due to the sudden and continuous strengthening of the Japanese yen. Regional cities started losing their manufacturing SMEs. The latter period was the time of privatization, deregulation, and business liberalization in the conditions of the long-lasting recession. Reduced public investment weakened local construction firms, which had relied on public procurement. Large national chain stores were stimulated by the deregulation to come to local markets in regional cities and, as a result, small retailers lost their customers. Regional economies started shrinking and local SMEs became less active because of these changes.

The following discussion shows that struggling SMEs in regional cities and the shrinkage of these regions are closely related. Depopulation, financial losses of local firms, the loss of local amenities, and the shrinkage of cities are interrelated phenomena.

According to the Establishment and Enterprise Census, there were considerable differences between the characteristics of manufacturing SMEs and their business environment –"as though they were in different countries" – before and after the bubble economy [9, p. 197]. Before 1985, manufacturing SMEs were dependent on export to US markets, they also had young and entrepreneurial owners. The Plaza Accord was signed in 1985, when the US dollar was depreciated in relation to the Japanese yen and German mark. Exporters to US markets suffered. The appreciation of the Japanese yen was an indirect cause of the bubble economy, which had collapsed by 1992. After 1992, business characteristics of manufacturing SMEs were different in many aspects: they were more focused on China and Asian countries as production sites and markets and had to meet public demands such as the demand to be more environmentally friendly, engage in recycling, and use new technologies (ICT). They also had to deal with challenges in business succession. The above-described factors together with the loss of jobs accelerated the economic shrinkage in regional cities.

According to the data of the National Population Census, which was conducted every five years, there were two major depopulation cycles in Japanese regional municipalities: one started around 1985, and the other, after 2000 [10, p. 147].

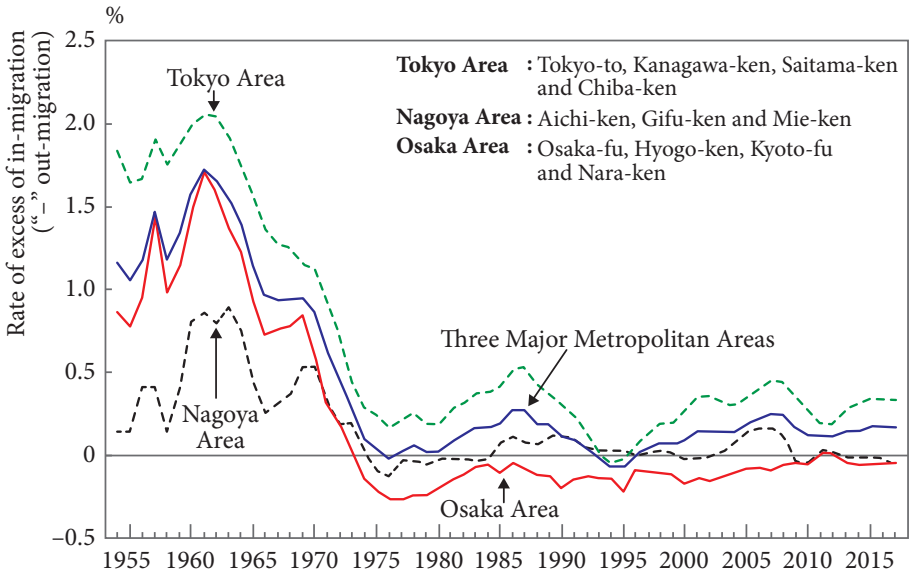

Figure 1. *Historical changes in the rate of net migration for three major metropolitan areas in 1955–2017*
Source: Statistical Bureau of Japan, Summary of the Results of Internal Migration in 2017.
Retrieved from: https://www.stat.go.jp/english/data/idou/2017np/index.html

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Both years marked the turning points of the Japanese economy, which affected regional economies as well. The appearance of shopping malls, DIY stores, large-scale discount stores and home electric appliance stores has had a strong negative impact on regional economies since late 1990s. These large stores do not have headquarters in regional cities, which means that their profits do not stay inside the regions, at the same time local businesses lose their clients. The impact became prominent early in 2000, when local construction business started to shrink because of its diminished participation in public investment projects. Construction business at that time functioned as a quasi-system of income redistribution. Thus, the loss of jobs in construction industry negatively influenced the incomes of local residents [10, pp. 49–50].

This situation occurred during the long-lasting recession and deflation, creating a vicious circle of lower incomes and lower consumption: as the revenues of local businesses dropped and profits flowed out of the region, local inhabitants' incomes fell, which means that they cut their expenses, which led to more losses of local business and, therefore, redundancies. After 2006, new jobs in regional cities were created mainly in nursing care and consumer services. Many jobs in these industries are non-regular and are paid less than in manufacturing industries. Thus, new jobs did not lead to a higher income level in regional economies.

Figure 2 shows the vicious circles that cities were caught in. By "products" we also mean services.

Initiatives to deal with the shrinkage problems

It will be impossible to stop the shrinkage of regional cities so long as the total population of Japan is becoming smaller. However, it is possible and in fact necessary, to reduce the rate of depopulation in regional cities so that they can "win time" to establish values, norms, and rules that will enable them to create smaller but balanced societies. For this purpose, it is important to create jobs in regional cities and enable people who live there maintain the necessary level of income. By "initiative" we mean a set of consistent ideas which result in clear and coherent policies, projects and programs to solve issues and / or to achieve goals.

Goal for shrinking cities: enhancement of economic resilience

Sustainable planning models for shrinking communities is one of the seven strategic priority areas for local socio-economic development in

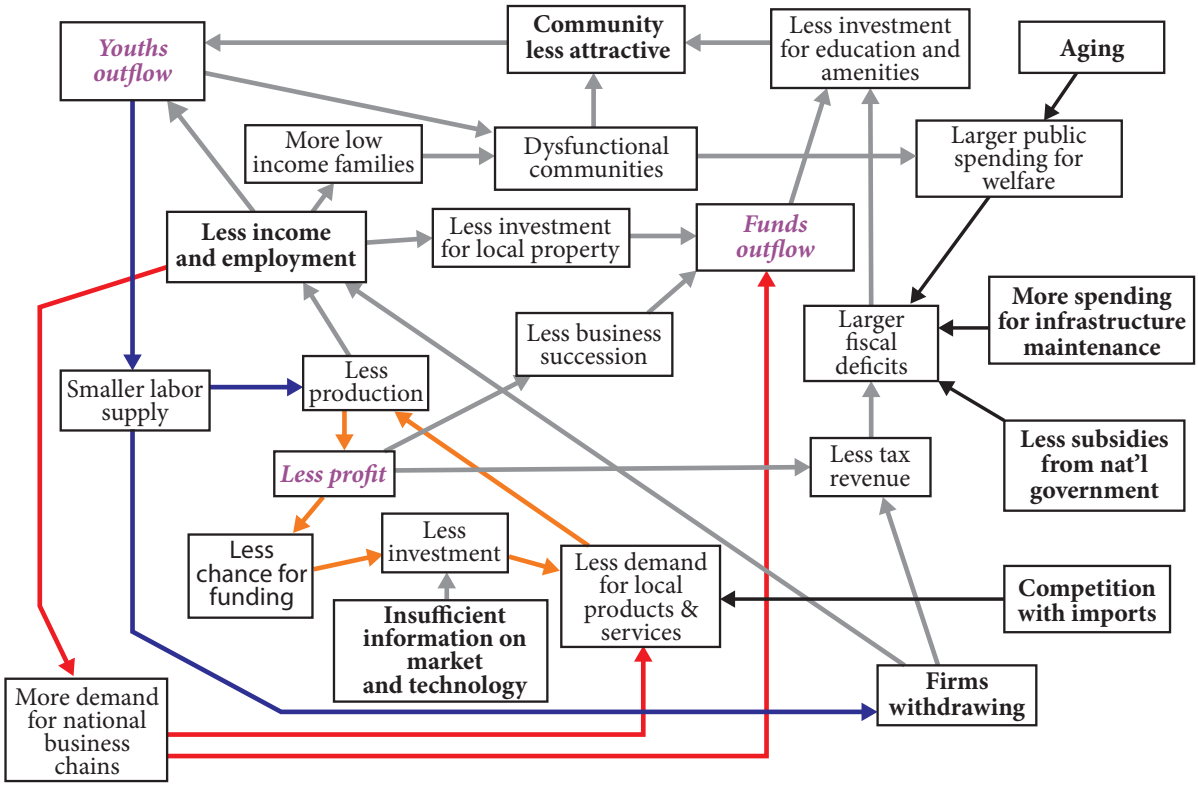

Figure 2. *"Vicious circles" in shrinking cities*
(The scheme was built by the author based on the discussion in Kondo (2010))

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view of demographic change scenarios: "addressing the issue of sustainable development models that move away from the growth paradigm requires different instruments and strategies strongly anchored to the local situation and the manifestations of shrinkage" [11, p. 30].

It is necessary to stimulate local firms to create jobs, to raise the income of local residents, and to promote circulation of funds at the local level to mitigate the impact of the shrinkage and enhance economic resilience. Without attractive jobs and career prospects, young people will migrate to other regions and towns. Local economy cannot be sustained if residents' income is low or funds continue to leak out of the area.

It is usually effective to support basic industries, that is, the industries with output larger than local demand so that the surplus could be exported and bring more funds in return. Basic industries are the key to sustaining and developing local economy. The income brought by basic industries can be used to finance imports and taxation. Basic industries can be manufacturing, agriculture, or even tourism depending on the geographical and historical background of the area. It should be noted, however, that stimulation of basic industries in a city may not directly lead to economic development, especially when their products are not competitive, which can be addressed by lowering the price but in this case residents' incomes will not rise and, therefore, the desired effect will not be achieved.

Import replacement in a city is essential for understanding the rise and decline of the city's wealth and growth. Successful cities have good pro-business "eco-systems": "Economies producing diversely and amply for their own people and producers, as well as for others, are better off than specialized economics like those of supply, clearance, and transplant regions. In a natural ecology, the more diversity there is, the more flexibility, too, because of what ecologists call its greater numbers of "homeostatic feedback loops", meaning that it includes greater numbers of feedback controls for automatic self-correction. It is the same with our economies" [12, p. 224].

It is important that unique strategies should be designed and introduced to ensure economic development in shrinking cities: "Designing skills and employment strategies for these cities requires different approaches from cities that are growing and where skills shortages relate to strong industrial demand. Declining cities need to work much harder at offering lifestyle choices together with a dynamic business environment that can attract and keep knowledge workers and their families." [13; 221]

Governmental initiatives in Japan: long-term vision and comprehensive strategy for regional revitalization

The Japanese government acknowledged that the country would face a structural crisis of nation-wide depopulation and aging and established the Headquarters for Regional Revitalization under the Cabinet in September 2014 to deal with the issue. Mr. Shigeru Ishiba, one of the leaders of the government party at the time, was appointed as the first Minister of State for Regional Revitalization. In December 2014, the Headquarters issued the Long-term Vision for Regional Revitalization (hereinafter referred to as "Vision"), and the Five-Year Comprehensive Strategy for Regional Revitalization (hereinafter "Comprehensive Strategy").

The Comprehensive Strategy described goals, fundamental approaches, and projects of regional revitalization for the period 2015–2019. The Strategy set four main goals: (1) creating jobs in regional cities; (2) attracting investment to regional cities; (3) implementing family policies targeting the young generation; and (4) disaster prevention. The national government passed a new law, the Law for Regional Revitalization, in 2014, which demanded that all the prefectural and municipal governments should do their best to prepare their own population visions and comprehensive strategies for revitalization, so that local governments could start implementing their own projects. The national government provided local governments with information support, human resources and funds[2].

Currently, all the prefectural and municipal governments, except for one municipality, have their own prefectural/municipal revitalization strategies. Almost all of the local governments (100% of prefectural governments and 91.8% of municipal governments) evaluated the effectiveness of their strategies. Their evaluation showed that more than 90% of the local governments prepared their strategies with the assistance of advisors in their regions, while some municipalities

[2] The information in this paragraph is taken from "Machi, Hito, Shigoto Sosei Kihon Hoshin (Basic Approach for Regional Revitalization) 2019". Retrieved from: https://www.kantei.go.jp/jp/singi/sousei/info/pdf/r01-06-21-kihonhousin-2019hontai.pdf

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preferred to employ consulting firms to draw their comprehensive strategies due to time constraints[3].

Alternative initiative – empowerment of local SMEs

The governmental initiative is not the only available approach to solving the problem of shrinking cities. An alternative initiative focusing on the empowerment of SMEs in cities, will complement the government's initiative in terms of job creation and income generation.

It makes sense to support local SMEs in order to revitalize local economies. Three roles of SMEs in regional cities are important for their sustainability: (1) generating income by selling local products to customers living outside the area; (2) creating job opportunities for local residents; and (3) supporting local residents. Seki also claims that these roles are particularly significant if we want to deal with the problems of depopulation and aging [9, p. iv]. SMEs in regional cities should enhance their capacity for product development and proactive marketing. Business development in shrinking cities should focus on creating, expanding, and renewing networks of entrepreneurial business owners, providing them with access to new information and new business connections. Arrangements to make business owners more entrepreneurial will also produce positive results. All of the above-described measures can contribute to business growth and innovation.

Business incentive policies, such as offering tax breaks and/or subsidies to local firms, have been recommended to promote regional economic development. Such policies encourage local firms to increase investment, employ competent workers, and to implement innovation. However, they are not always effective in shrinking cities. Policy-makers assume that local business owners are entrepreneurial and they are in competitive markets but markets in shrinking cities, on the contrary, are often not competitive and business owners tend to have oligopolistic rents. Business incentive policies will not always encourage innovation, but will rather increase the rents of current business owners.

[3] The information in this paragraph is taken from "Dai 1-ki 'Machi, Hito, Shigoto Sosei Sogo Senryaku' ni Kansuru Kenshokai Chukan Seiri (Interim Report from the Review Council on Comprehensive Strategy for Regional Revitalization)". Retrieved from: https://www.kantei.go.jp/jp/singi/sousei/meeting/senryaku_kensyou/r01-05-31_chuukan.pdf

Economic gardening

This paper claims that "economic gardening" can improve the economic resilience of small cities. Economic gardening is an entrepreneurial alternative to traditional economic development strategies. This new approach, created in the City of Littleton, Colorado, US by Christian Gibbons and his supporters in response to massive corporate layoffs, uses high end corporate-level tools and cutting-edge scientific concepts to help entrepreneurial growth companies identify markets, monitor competitors, track industry trends, locate customer clusters on maps, and use search engine optimization (SEO) / Google Adwords / social media for marketing and various customized research.

Economic Gardening was created in 1987 and implemented starting from 1989. Some of the best practices had emerged by the late 1990s. In terms of job creation, Littleton even outperformed when economic gardening was in operation: "Since the introduction of economic gardening principles in 1989, the number of new jobs in Littleton has grown from 14,907 to 35,163, or 136 percent. These numbers include wage-and-salary jobs plus self-employment. This growth is approximately twice the rate of Denver region, three times that of Colorado, and six times that of the United States" [14, pp. 173].

Employment rates continued to be high even during the recession just after the turn of the century in the US: "Littleton's 35 percent job growth between 2000 and 2005 well exceeds that of comparable inner suburban Denver communities of similar size: Englewood (7.3 percent), Northglenn (6.2 percent), and Thornton (21.4 percent)" [14; 174].

Economic gardening model was adopted by a number of communities and states including Wyoming, Oregon, and Florida. There was an urgent need to maintain the authenticity of the model because some economic development consultants might have been tempted to imitate economic gardening and damage its brand image. Gibbons and his team in Littleton had official duties to serve their clients and could not travel much across the country despite the growing interest in economic gardening. The Edward Lowe Foundation established the National Center of Economic Gardening in 2009. The Center now provides training programs for certified economic gardening managers and offers professional services to state centers or regional centers.

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Economic gardening is not an application of specific economic theories. Instead, its creators cooperated with David Birch (jobs and SMEs), Paul Romer (endogenous growth), and researchers at the Santa Fe Institute (complexity science).

Economic gardening is different from traditional economic development strategies in many aspects. First, it is based on an idea that economies are driven by entrepreneurial growth and by innovation rather than the cheapest place to do business. Second, the public has three major roles: information, infrastructure, and connections. Third, the model focuses on companies' growth companies, especially at Stage II (10–99 employees). Fourth, it uses sophisticated corporate tools, such as database searching, geographic information systems, search engine optimization, web marketing, social media research tools, and network mapping. Moreover, it focuses on front-end and strategic issues of business, such as core strategy, market dynamics, marketing, teams, and finance. It depends on a highly skilled economic gardening staff working in an iterative manner with business owners. Finally, the economic gardening organization should be as entrepreneurial as the companies with which it works [15, pp. 6–7].

Economic gardening in Littleton was realized in accordance with the following principles as described by C.Gibbons:

– "Power laws (80/20 rule) that revealed a few companies made a whole lot of difference and a lot of companies made a little bit of difference;

– Network theory that described a critical factor in business success;

– Commodity traps which explained why standards of living weren't rising in agricultural areas and 'business friendly' manufacturing areas;

– Temperament which turned out to be a big factor in company growth; and

– Complexity science which said that economies were not in equilibrium and in fact were far from equilibrium – which in turn nicely explained the turbulent 'gales of creative destruction' identified by Schumpeter a half century before" [15, p. 6].

The primary beneficiary of economic gardening is certainly the entrepreneurs and firms in the community that implements the program. In addition, economic gardening serves the interests of the community making it more economically resilient through diversification of businesses, development of connection among businesses, universities, and other supportive organizations, and through making the businesses more informed and intelligent.

Economic development through business recruitment was popular in the US and Japan, but it did not make the region more resilient because recruited firms or production plants usually moved to other regions in search of better business opportunities. Economic gardening is an effective approach to building regions with economic resilience, and it brought good results in many American municipalities.

Economic gardening was also tested in cities outside the US. The City of Shellharbour in New South Wales, Australia, started their economic gardening project in 2006. Cities of Wollongong and Kiama joined later, and currently the beneficiaries of economic gardening are open to local businesses of the three cities [16]. Local governments in Japan have started their own economic gardening projects in the last decade: Fujieda City in 2011, Naruto City in 2012, Osaka Prefecture in 2014, and Sammu City in 2016.

Case Study

Proposed framework for comparative case study analysis

This paper proposes a framework for comparative case study analysis of shrinking cities in Russia and Japan. The framework comprises the following components:

(1) Profile of the city with the history of city shrinkage;
(2) Characteristics of local SMEs;
(3) Institutional aspect of the programs;
(4) Business support activities;
(5) Evaluation and future development

The case of Sammu City

Sammu City, with the population of about 51,600, has been trying to support local SMEs. Anticipating that they are going to lose more population in the future, the government officially started an economic gardening project in 2016 after two years' preparation. The city's business support program is unique in that the city government and the local economic organization formed an equal partnership. Practical business support measures are provided through working groups involving business owners. They have not implemented post-program surveys yet to identify and confirm the effectiveness of the initiative. However, it is necessary to pay attention to networks

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of businesses and to the rules for planning SME support programs.

(1) City profile: Sammu City is located in the northwestern part of Chiba Prefecture, approximately 70 km away from central Tokyo. The population of the city is about 51,600 as of April in 2019, but it has been losing about 2% of its population every year since 1990s (see Figure 3). Their major industries are manufacturing, services, and construction (see Figure 4). Agriculture is not prominent in terms of output and employment, but people in the city are very proud of their agriculture-based culture and their superior agricultural products such as rice and strawberry. Sammu City is one of the municipalities in Japan where economic gardening principles have been implemented.

(2) Characteristics of local SMEs: Following the recommendation by the Sammu Economic Gardening Preparatory Committee, Sammu City Government conducted a comprehensive survey on SMEs in the city to understand its business environment that affected local businesses. The information for Tables 1–9 was taken from the internal survey report published by Sammu City Government in March 2016: *Shinai Chushokigyo Shokibojigyosha Jittaichosa Hokokusho (Survey Report on Small- and Medium-Sized Enterprises and Sole Proprietors in the City)*. Survey questionnaires were sent to 1,758 businesses (firms and sole proprietors). 841 of them (47.8%) responded.

Table 1

Number of employees

Nr of employees	0–5	6–10	11–50	51 or above
Percentage	55.2%	11.9%	14.9%	4%

Comments: 82.0% of the respondents work in businesses with 50 employees or less.

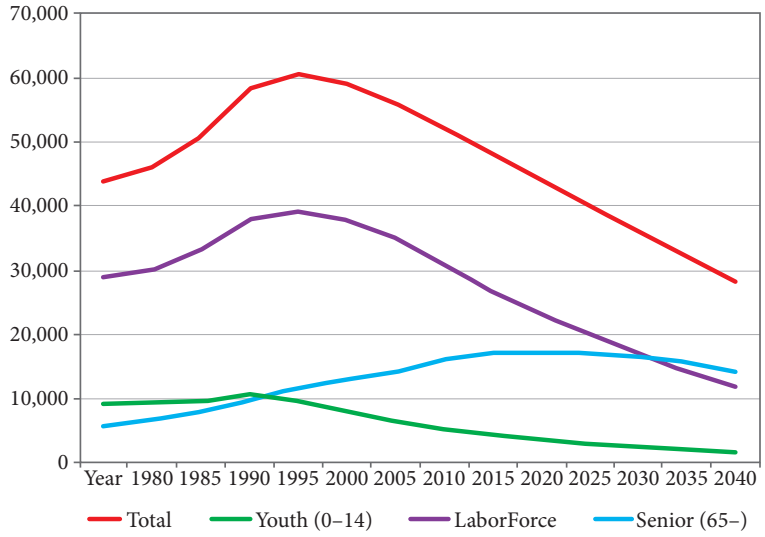

Figure 3. *Population change in Sammu City*

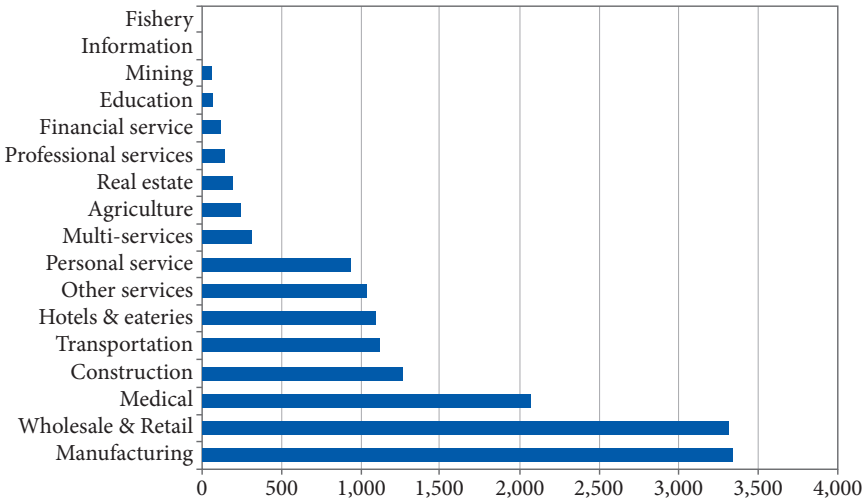

Figure 4. *Employment levels in industries*

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Table 2

Type of organization

Type	Firms	Sole Proprietors
Percentage	54.4%	42.3&

Comments: We can safely assume that most small businesses with employees of 5 or less are owned by sole proprietors.

Table 3

Age of business owners

Age	40 or under	41–50	51–60	61–70	71 or above
Percentage	5.2%	14.3%	20.6%	35.2%	22.1%

Comments: More than a half (57.3%) of business owners are 61 or older. The majority of the respondents are seniors and pre-seniors.

Table 4

Top five industries

Industries	Construction	Personal service	Grocery	Commerce	Medical or nursing care
Percentage	14.1%	11.2%	9.9%	7.8%	7.0%

Comments: Industrial composition in Sammu is diverse, while these top 5 industries account for about a half of their industries.

Table 5

Location of current clients

Location of current clients	Same city (Sammu)	Neighbor cities	Same prefecture (Chiba)	Neighbor prefectures	Other areas in Japan	Overseas
Percentage	25.7%	12.7%	24.5%	6.9%	14.7%	0.1%

Comments: A quarter of the respondents have clients in Sammu City; more than a half of the respondents have clients outside the city.

Table 6

Desired location of clients in the future

Desired location of clients	Same city (Sammu)	Neighboring cities	Same prefecture (Chiba)	Neighboring prefectures	Other areas in Japan	Overseas
Percentage	32.8%	25.1%	23.4%	10.3%	13.3%	3.0%

Comments: More than a half of the respondents want to have clients in the same city or in neighboring cities, which means that they are interested in having clients within their arm's length. A small number of firms seek clients abroad. These firms can lead local economy.

Table 7

Changes in sales revenues compared with 3 years ago

Change	Increased (< 9%)	Increased (2–9%)	No change	Decreased (–2 to –9%)	Decreased (less than –9%)
Percentage	3.3%	13.3%	28.3%	24.9%	24.0%

Comments: Almost a half (48.9%) of the respondents said that their sales revenues decreased in the last 3 years, while a small number of firms increased their sales revenue significantly.

Table 8

Current business issues (it was possible to choose several answers)

Current business issues	Percentage
No new clients	29.8%
No new employees	29.1%
Declining sales	26.6%
High material costs	17.6%
Obsolete machinery / facilities	17.4%
Weak financial base	12.8%

Comments: Six major concerns for respondents are the lack of new clients and new employees, declining sales, high material costs, the need to upgrade machinery facilities, and the weak financial base.

Table 9

Need for information support from the government

Do you need more information support from the government?	Yes	No	No reply
Percentage	34.7%	47.3%	18.0%

Comments: Only a third of the respondents say that they want to receive business development information from the city government. Their replies do not necessary mean that most businesses in the city do not need information services. The respondents may have doubted that the city government would be able to provide useful information.

(3) Institutional aspect: Sammu City Government and the Youth League of the Sammu City Society of Commerce and Industry jointly organized the Sammu Economic Gardening Preparatory Committee in April 2014 so that both organizations could cooperate in providing more effective support for SMEs in the city. The Committee had 23 corporate members. Members of the Committee shared information on demographic changes in the past and in the future, industrial structure, and best practices in other municipalities. They also discussed how public support for local SMEs should be improved.

The Preparatory Committee launched four working groups as an experimental activity in 2015. Operation costs of the working groups were covered by the city budget. The working groups had the right to engage external experts if necessary.

By 2016, Members of the Committee had shared a view that their economy had been shrinking and would shrink further with a smaller and aging population. They also had a common recognition that the services for business development of local firms and solo proprietors needed improvement. In April 2016, the Preparatory Committee was transformed into the Sammu Economic Gardening Promotion Committee,

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which coordinates business development support projects for local businesses.

The Small- and Medium-Sized Enterprise Promotion Basic Ordinance was enacted in April 2018. The Ordinance provides an institutional justification to adopt economic gardening as an official policy.

The purpose of economic gardening in Sammu is to establish a business environment in which local firms and entrepreneurs will live long and prosper[4]. The purpose of the Sammu Economic Gardening Promotion Committee is to enhance the effective partnership of the business, academic, public, civil, and financial sectors to deal with the challenges and needs of local SMEs and businesses[5].

Economic Gardening Sammu ("EG Sammu") is member-based. As of December 2018, there were 73 members of Sammu Economic Gardening Promotion Committee: 36 in commerce, 15 in manufacturing, 13 in finance and public services, and 9 farmers[6]. What is special about Sammu Economic Gardening Promotion Committee is that a private sector organization (Society of Commerce and Industry) has taken the leadership. One of the Society's senior directors serves as the Chairman of the Committee, and the deputy mayor of the city serves as the Vice Chairman. The Committee delegates its decision-making powers to the standing council, which meets twice a month, so that they can flexibly respond to requests from members and beneficiaries of the business support services.

The annual budget for the programs in fiscal year 2019 is approximately US$ 55,800, including subsidies from the city government. Increasing financial independence from the city government is one of the points in the agenda of the Committee. The government budget may vary largely due to the political and administrative situation on the national level. It is important to gain a more stable financial base for the sustainability of the program.

(4) Business support activities: As mentioned above, practical business support measures are provided through working groups, involving business owners. Seven working groups are currently active:

1. *Local resource utilization*. Members of this working group engage in research and development activities to create new commercial products made of Sammu cedar, which was a local specialty for long time.

2. *"Chat Biz"*. In this working group, business owners develop new ideas for marketing and product design through brainstorming sessions held in the local library, which provides them with access to books and on-line databases.

3. *Job fair*. Every year, they organize a "job fair" for business owners who intend to hire new employees in the city and for job-seekers who look for local employers. Members of this working group are now creating short videos that capture characteristics of local firms.

4. *Local tourism*. Members of this working group develop new sightseeing routes for visitors and for those who are interested in moving into the city. They organize an annual tour to examine the effectiveness of their ideas.

5. *Local food promotion*. This working group intends to link local farmers, food manufactures, and restaurants so that they can develop new menus that use local food materials.

6. *Tourism content development*. Members of this working group identify local "valuables," unique and commercially viable, for tourism.

7. *Businesses and banks*. In sessions organized by this working group, local businessowners and those who intend to start a new business can meet representatives of bank and receive suggestions so that they can develop a better business relationship.

(5) Evaluation and future development: Sammu City has not conducted post-program surveys on the current situation of SMEs to confirm the effectiveness of the initiative, and the official statistics are not available yet. Members of the Economic Gardening Committee said, however, that sales and employment in their companies have improved or at least remained at the same level. They also said that this result was achieved because (1) they got new clients through discussion for management improvement among SME presidents; (2) their management skills became more up-to-date; and (3) they jointly developed new products and services.

Business support programs in Sammu City are different in many aspects from those in Littleton although they both use the term "economic gardening" to denote their activities. Both cities have almost the same size of population, but different cultural and institutional backgrounds for

[4] Stated in http://eg-sammu.jp/faq

[5] Stated in http://eg-sammu.jp/council

[6] Response to Mr. Kazunobu Namiki, a City Councilor, by the Director-General of the Department of Economic and Environmental Affairs, Sammu City Government, at the regular session of Sammu City Council, December 2018. Published in Sammu Shigikai Dayori (Sammu City Council Bulletin) No. 51, 1 February 2019, p. 10. Retrieved from: https://www.city.sammu.lg.jp/uploaded/attachment/21914.pdf

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their economies. In Littleton, the city government provided business intelligence information to the second stage growth firms so that they could successfully make good strategic decisions. The team members for the programs in Littleton were public officials, and they were highly skilled and specialized in specific services, such as geographic information systems (GIS) and database analysis.

On the other hand, SMEs support programs in Sammu City are open to all the firms and sole proprietors in the city. This is partly because businesspersons in Sammu are not as entrepreneurial as those in Littleton and that small firms do not grow rapidly. As mentioned above, the role of city officials in working group activities was minimal. SME presidents use working groups to expand their business networks and to improve their performance. It is customary in Japanese regional cities that local firms have a stable business relationship. SMEs support policy can contribute to many firms, if they are successful, through such business networks.

Thus, it is necessary to pay attention to networks of businesses and to rules, whether written or customary, of planning SMEs support programs. This is especially important when a new approach is introduced in the economy, because something new tends to create some resistance and reluctance.

Conclusion

This paper examined the problem of Japanese shrinking cities and evaluated the policies that intend to mitigate the impact of shrinkage. The paper consists of three sections. The first section discussed analytical issues, including the definition of a shrinking city, which can be used for international comparative research. Based on the definition, this paper examined Japan's depopulation in the coming decades at the national and municipal level. Then, this paper illustrated that the population loss in regional cities and their change of economic structure have been closely related as parts of a vicious circle. This paper claimed that restoring and improving business activities by local SMEs is a necessary, if not a sufficient condition for revitalization of shrinking cities in Japan.

The second section of the paper examined the desired policy goals for shrinking cities, along with strategies and approaches to achieve such goals. This paper stressed that impacts of the shrinkage should be mitigated and economic resilience should be enhanced. The strategies that Japan's national government has employed since 2014 were inadequate to these goals. An alternative initiative – economic gardening – to complement the government initiative in terms of job creation and income generation was proposed in this paper. Economic gardening, implemented in the US, Australia, and Japan, can be a good strategy for further economic development in shrinking cities in Russia.

The third section of the paper is a case study of a Japanese shrinking city, which has been implementing the economic gardening model. This case study is based on the proposed framework for comparative case study analysis of Russian and Japanese shrinking cities. Sammu City, with the population of about 51,600, officially started the economic gardening project in 2016 after two years' preparation. The City's business support program was unique in that the city government and a local economic organization formed an equal partnership. There has been no such partnership for local economic cooperation in Japan. Sammu City has not conducted any post-program surveys on the current situation of SMEs to confirm the effectiveness of the initiative, and the official statistics are not available yet. However, sales and employment of the local firms that participated in the program have improved or at least remained at the same level.

Future research might examine the effectiveness of programs for revitalizing shrinking cities in resource-dependent regions in different countries such as Russia and Australia, to make insightful suggestions and provide recommendation for adequate policy formulation and implementation.

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The impact of competition on regional food security (the case of the milk and dairy market in the Republic of Tatarstan)

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ABSTRACT
Regional food markets are important structural elements of the national market. Development of the market environment is one of the key methods of stimulating food production. As the agro-industrial policy changes its focus from import substitution towards export-oriented production, the role of competition in the agricultural sphere becomes particularly prominent. The authors propose a new indicator characterizing the level of concentration of producers on the market – the Herfindahl-Hirschman Index (HHI) for the share of gross profit of economic entities. This article is aimed at giving a theoretical justification of this approach and at providing practical recommendations for the development of regional food markets based on the regulation of food producer concentration levels. Multi-dimensional statistical calculations were used to test the hypothesis that the development of large economic entities (including monopolies) has a positive impact on the affordability and accessibility of locally produced foods. The authors measured the strength of the correlation between the socio-economic indicators that affect regional food security by using the case of the milk and dairy market in the Republic of Tatarstan. The proposed methodology is based on the decision matrix method applied to analyze the situation in local food markets, which gives us a better understanding of the situation in the whole region regarding the accessibility and affordability of foods. The correlation-regression analysis enabled us to integrate the indicators that show the impact of competition on affordability of foods with those that show the impact of producers' efficiency on accessibility of foods in the region. The proposed approach considers profitability of economic entities, accessibility of foods and competition on the producer market and can thus be used to enhance food security by revealing the optimal priority areas for governmental policies and programs on the national, regional and local levels.

KEYWORDS
food market, food security, regional markets, local market, industry, competition, concentration, regional development, industrial policy, competition policy, regional policy

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Влияние конкуренции на региональную продовольственную безопасность (пример рынка молока и молочной Республики Татарстан)

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АННОТАЦИЯ
Региональные продовольственные рынки являются важными структурными элементами национального рынка. Развитие рыночной среды является одним из ключевых способов стимулирования производства продуктов питания. Поскольку агропромышленная политика меняет фокус с импортозамещения на экспортно-ориентированное производство, роль конкуренции в сельскохозяйственной сфере становится особенно заметной. Авторы предлагают новый показатель, характеризующий уровень концентрации производителей на рынке, – индекс Херфиндаля-Хиршмана (HHI) для доли валовой прибыли хозяйствующих субъектов. Цель данной статьи – дать теоретическое обоснование этого подхода и дать практические рекомендации по развитию региональных продовольственных рынков на основе регулирования уровней концентрации производителей продуктов питания. Многомерные статистические расчеты использовались для проверки гипотезы о том, что развитие крупных экономических субъектов (включая монополии) оказывает положительное влияние на доступность продуктов местного производства. Авторы измерили степень корреляции между социально-экономическими показателями, влияющими на региональную продовольственную безопасность, на примере рынка молока

Ключевые слова
продовольственный рынок, продовольственная безопасность, региональные рынки, местный рынок, промышленность, конкуренция, концентрация, региональное развитие, промышленная политика, конкурентная политика, региональная политика

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и молокопродуктов в Республике Татарстан. Предлагаемая методология основана на методе матрицы решений, применяемом для анализа ситуации на местных продовольственных рынках, что позволяет нам лучше понять ситуацию во всем регионе в отношении доступности продуктов питания. Корреляционно-регрессионный анализ позволил нам объединить показатели, которые показывают влияние конкуренции на доступность продуктов питания, с показателями, которые показывают влияние эффективности производителей на доступность продуктов питания в регионе. Предлагаемый подход учитывает прибыльность хозяйствующих субъектов, доступность продуктов питания и конкуренцию на рынке производителей и, таким образом, может использоваться для повышения продовольственной безопасности путем выявления оптимальных приоритетных областей государственной политики и программ на национальном, региональном и местном уровнях.

ДЛЯ ЦИТИРОВАНИЯ
Sabirova, A. I., Nizamutdinov, M. M., Safiullin, A. R., & Kharisova, F. I. (2019) The impact of competition on regional food security (the case of the milk and dairy market in the Republic of Tatarstan). *R-economy*, 5(3), 137–143. doi: 10.15826/recon.2019.5.3.014

Introduction

National food security is entirely dependent on regional food markets. Regional authorities are expected to design their own strategies of developing their food markets by following the federal legislation[1] and taking into account the natural, climatic, economic and other characteristics of their territories. Some Russian regions, such as Moscow, St. Petersburg, Tatarstan, Bashkortostan, Nizhny Novgorod, Sverdlovsk, and Ulyanovsk, made the principles of food security a part of their regional legislation. In the light of the changing external and internal conditions and the current geopolitical situation, for example, Russia's entry into the WTO and the intensification of the integration processes in the Eurasian Economic Union, the Russian Ministry of Agriculture and other governmental agencies are now developing a draft for the new Food Security Doctrine[2]. According to this Doctrine, the state is responsible for maintaining a certain guaranteed level of food security in the country and it is necessary to enhance trust and cooperation between the participants of the national food market.

In the light of the above, this study aims to give a theoretical justification of the proposed approach to investigating food security on the local and regional levels and to provide practical recommendations for the development of regional food markets based on the regulation of food producer concentration.

Literature review

Food security is forecast to become the main global issue in the nearest decades[3] as it is expected that by 2050, there will be 9.6 billion people in the world[4], which means that food production will have to increase by 70–110% to feed the global population [1].

Economic assessment and realization of the strategic potential of the agricultural sector has been the key goal of state regulation in the last two decades[5]. It has also become a central strategy for the development of state and non-state programs [2]. Assessment of the regional sustainable development encompasses the environmental, economic and social aspects[6] and relies on such economic indicators as food demand, population growth rate and the rates of growth of factor productivity in the region [3; 4].

In the recent decade, there has been an upsurge of scholarly interest in small business and entrepreneurship in agriculture and farming[7]. At the same time, the national competition policy and agro-industrial policy should take into consideration the interregional differences in living standards and the differentiation of economic potential.

[1] Decree of the President of the Russian Federation of 30.01.2010 No. 120 "On the Food Security Doctrine of the Russian Federation".

[2] Draft Decree of the President of the Russian Federation "On Amendments to the Food Security Doctrine of the Russian Federation Signed by the President of the Russian Federation on 30 January 2010 No. 120" (prepared by the Ministry of Agriculture of Russia, 25.01.2018). Retrieved from: https://www.garant.ru/products/ipo/prime/doc/56641501

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Methodology

The development of competition is considered as a priority both by economists and by state policy-makers in all spheres (with the exception of military monopoly and natural monopolies). According to Joseph Schumpeter, firms in highly concentrated markets can redistribute resources more efficiently than in highly competitive markets [5]. Therefore, hypothetically, large economic entities may have a positive impact on the affordability and accessibility of foods due to the economy of scale, reduced production costs and the production of highly processed foods. We are going to test this hypothesis by applying mathematical and statistical methods (regression analysis with Gretl software) to evaluate the interrelation of the above-described indicators. Our analysis will focus on the case of local food markets in Tatarstan and use the official data from the Federal State Statistics Service and the Ministry of Agriculture and Food of the Republic of Tatarstan.

The Russian Ministry of Agriculture changed the methods of calculating food security indicators and introduced a new indicator to measure the extent to which domestic production can satisfy the demands of the market. In addition to this, we propose an indicator "index of food item accessibility" calculated according to Formula 1:

$$F_i = \frac{V \cdot k_{\square}}{P \cdot N_{\square}}, \quad (1)$$

where F_i is the index of accessibility of the i^{th} food item;

V is the production volume of this food item in the region;

$k_{\square}$ is the input-output coefficient;

P is the mid-year population in the region;

$N_{\square}$ is the minimum recommended dietary intake[8].

The proposed accessibility index (F) is based on the comparison of the market size calculated by using the medical norms, population size and the actual local production volume for the given food item.

a) $F > 1$ means that the local production volume is sufficient and able to meet the local demand;

b) $F < 1$ means that the local production volume is insufficient.

It should be noted that the raw materials for food markets are not turned entirely into finished food products, a part of these materials (seeds, livestock feed, young growth for internal production) is used for companies' own consumption. Therefore, in research literature it is recommended to consider economic entities in terms of full food production, that is, to consider all their production as commodities [6; 7]. In our study we are going to calculate this indicator by using the milk and dairy market of a Russian region – the Republic of Tatarstan. We are also going to conduct a matrix analysis to determine the best priority areas for the national industrial and competition policies.

Results

In order to estimate food supply in the food market we need to take into account such indicator as food affordability and the following socio-economic indicators: the purchasing power of the population in relation to milk and dairies; the share of milk and dairy products expenditures; the milk price index; the average producer prices; and the average consumer prices. These indicators characterize the affordability of the

[8] Recommended dietary intake levels corresponding to the modern nutrition standards (approved by the Ministry of Healthcare of the Russian Federation of 19 August 2016 No. 614).

Table 1

Socio-economic indicators characterizing the affordability and accessibility of milk and dairies in Tatarstan in 2011–2017

Year	Milk accessibility index	Per capita consumption of milk and dairies, L	Purchasing power of the population in relation to milk, dairies, butter and margarine, L	Share of expenditures for milk and dairies, %	Raw cow's milk price index, %	Average producer prices for raw cow's milk, rbs/ton	Average consumer prices for raw cow's milk, rbs/L	Consumer price index of milk and dairies, %
2010	0.81	368	1120	5.0	141.0	11902	25.28	119.0
2011	0.78	367	1226	4.2	85.9	12635	25.87	101.3
2012	0.77	367	1408	4.0	101.7	11789	27.89	104.4
2013	0.70	364	1374	3.5	150.2	14269	35.81	121.5
2014	0.75	364	1343	3.8	103.1	18361	36.79	108.1
2015	0.77	362	1249	4.0	100.2	18644	39.52	109.6
2016	0.79	362	703	4.5	120.9	20253	41.28	108.0

Source: Regional Office of the Federal State Statistics Service in the Republic of Tatarstan. Retrieved from: http://tatstat.gks.ru

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given food item for local communities. Table 1 shows the data for each of these indicators in Tatarstan.

The situation in the regional market of milk and dairy products looks promising although the region does not meet the required 90% of self-reliance stipulated by the Doctrine[9]. As Table 1 illustrates, the current level of self-reliance for milk and dairies in Tatarstan is 70–81%. In the given period, the level of accessibility of locally produced milk for the local community was 77%.

We calculated the coefficients of correlation between the indicators of concentration (HHI and market concentration for profit, production volume in physical terms and gross profit) and the key socio-economic indicators reflecting the accessibility and affordability of milk and dairies in the region. Table 2 shows the statistically significant correlation coefficient for the milk market.

Table 2

Coefficients of paired linear correlation between the socio-economic indicators and the level of concentration on the milk market in Tatarstan from the beginning of 2011 to 2017

Indicators	HHI in physical terms	HHI for gross profit	HHI for net profit	CR3 in physical terms	CR3 for gross profit	CR3 for net profit
Share of expenditures on milk and dairies	0.74	0.67	0.27	0.66	0.57	0.10

We found that the milk market in Tatarstan was characterized by a strong correlation between the HHI in physical terms and the share of expenditures on milk and dairies. This correlation looks the following way:

$$y = 3{,}3 + 42{,}74 \cdot x_8 \qquad (2)$$

where is the share of expenditures on milk and dairies;

x_8 is the HHI for the milk market in physical terms.

This regression equation is statistically robust and leads us to the conclusion that an increase in the concentration of producers on the market will have a negative influence on the affordability and accessibility of milk.

If we take into consideration the fact that food producers receive state support in almost all countries, it is pertinent to evaluate the impact of economic entities' efficiency on the accessibility index.

According to the non-linear regression equations, in the milk market, producers' profitability has a positive impact on the accessibility index, although the model explains only 16% of the dependent variable and looks the following way:

$$\ln y = 1{,}37 + 0{,}67 \cdot \ln x_{14} \qquad (3)$$

where y is the index of milk accessibility;

x_{14} is milk producers' profitability.

This regression equation is statistically robust and we can interpret it the following way: producers' efficiency has a negligible impact on the accessibility index, which means that milk producers can enhance the level of milk accessibility considerably only if their real production volumes increase. Such qualitative indicators as price and cost per unit or subsidies do not affect the index of accessibility.

In terms of regional food security, the development of regional food markets entirely depends on the development of the constituting local markets [8]. The existing research literature, however, does not give us a clear understanding of this category [9–12]. For our analysis we used municipal districts of Tatarstan as equivalents for local markets [13]. This approach takes into account the common conditions in which producers operate and the distribution logistics [14].

Conclusion

Milk production in Tatarstan is characterized by the following: the average production profitability is 20%, the average level of the accessibility index calculated for 43 local markets of the region is 1.95.

In order to choose the optimal tools for the competition policy and agro-industrial policy for this region, we have applied a decision matrix method. Local markets (with their own food production) are placed in the matrix, where the diameter of the figure is the HHI for the production volume in physical terms; the x-axis corresponds to producers' profitability; and the y-axis, to the accessibility of the food item. The origin of y-axis is 1 in order to identify those municipal districts where the local demand for the food item is satisfied by local producers. Recommended measures are going to be chosen depending on which quadrant this or that district belongs to.

[9] Decree of the President of the Russian Federation of 30.01.2010 No. 120 "On the Food Security Doctrine of the Russian Federation" Retrieved from: http://base.garant.ru/1217271

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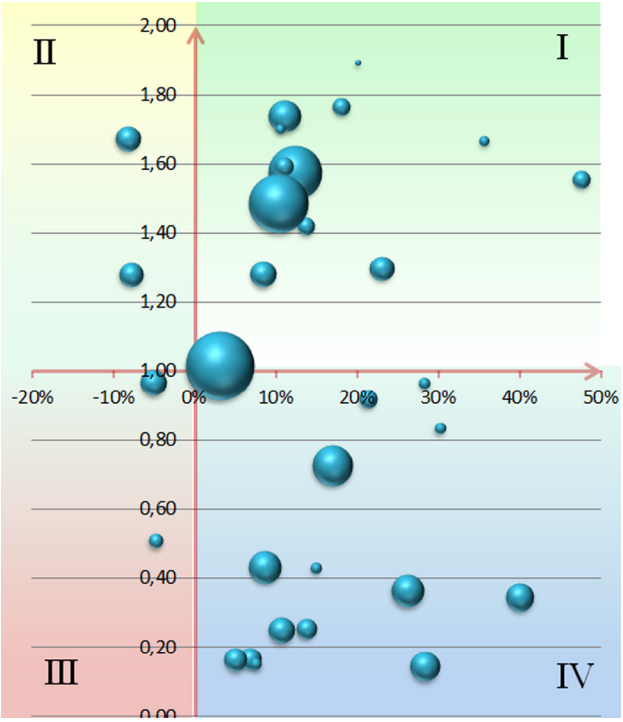

Figure 1. *Decision matrix for the selection of priorities for the agro-industrial and competition policies in regional milk production*

The first quadrant (index of accessibility > 1; profitability > 0) comprises 26 local markets or 63% of the local economic entities out of 336. The economic entities proved to be the most efficient in Kukmorsky District (59%) while the highest accessibility index was in Atninsky District (12.40), which means that in 26 districts of Tatarstan governmental policies should be aimed at supporting new and relatively small economic entities and at stimulating competition. Farmers are currently facing a number of issues which should be addressed on the national but also on the municipal level: it is necessary to lower the bureaucratic barriers to starting a business, provide subsidies not only for large producers but also for smaller ones (at the moment livestock subsidies are granted depending on the number of livestock heads in a certain territory). Consumers are ready to pay more for higher quality foods and to go on-line to buy fresh produce. Therefore, farmers should be offered assistance regarding distribution channels and logistics management. This would stimulate the development of smaller enterprises and enable them to compete with larger ones. In developed regions, wholesale merchants buy produce from farmers with a higher profit margin than factories [18].

The second quadrant (index of accessibility > 1; profitability < 0) includes loss-making districts Zainsky and Sarmanovsky with an average loss of 8%. However, the accessibility index for these districts is 1.5. In these local markets there are seven economic entities. We believe that it is necessary to support the existing economic entities (formation of large entities) in order to enhance the profitability of production and help farmers stay afloat. Moreover, as our regression analysis has shown, an increase in profitability has a positive impact on accessibility of foods while market monopolization leads to an insignificant increase in consumers' expenditures on milk and dairies.

The third quadrant (index of accessibility < 1; profitability < 0) includes Cheremshansky and Aznakaevsky districts (21 economic entities or 6%). Since it is essential to ensure accessibility and affordability of food in the region, it is necessary to support large and already existing producers in order to reach the level of the accessibility index corresponding to the reference daily intake. Since the companies in the third quadrant are unprofitable, the government can choose to focus on maintaining the existing producers and enhancing their efficiency (this measure can prove to be effective since an increase in profitability and in subsidies leads to an increase in the accessibility of foods).

The fourth quadrant (index of accessibility < 1; profitability > 0) includes 14 local markets. The average production profitability of 18% is characteristic of 27% of milk producers in the republic. Nevertheless, the 14 local markets in this quadrant fail to provide the necessary level of accessibility of locally produced foods. In this case, the optimal solution would be to focus on ensuring the required level of accessibility of locally produced foods. For example, in Bavlinsky, Rybno-Slobodsky, Laishevsky and Verkhneuslonsky districts, where the accessibility index equals 1, measures should be taken to develop competition. In the remaining districts, it is recommended to support the existing producers.

Our results demonstrate that the decision matrix method is quite effective for planning soft state regulation in food production. These results, however, should be interpreted with a certain caution since the data used for our analysis were limited to the specific region. Nevertheless, this approach can be applied to the study of other regions and countries. The above-described matrices, which include indicators of competition and socio-economic indicators, can be used to devise governmental policies and programs to enhance food security on the national, regional and local levels.

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Facilities connectivity in eastern regions of China and Russia and the "Belt and Road" initiative

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ABSTRACT
Enhancement of facilities connectivity and construction of the necessary infrastructure is an important element of the "Belt and Road" Initiative. The lack of facilities connectivity is seen as a major impediment to the development of Sino-Russian trade and other spheres of cooperation between the two countries. This paper provides an overview of the current approaches to the concept of facilities connectivity in the context of Sino-Russian cooperation within the framework of the "Belt and Road" initiative. The author examines the progress in the construction of transport infrastructure aimed at improving the facilities connectivity in China's and Russia's eastern regions over the past five years. A specific focus is made on such large-scale projects as the construction of China-Mongolia-Russia economic corridor, the construction of bridges (for example, Tongjiang Railway Bridge and Heilongjiang Bridge), the construction of the Harbin-Russia International Freight Line and so on. The case of Heilongjiang Province in China is described in the article to illustrate the benefits of the "Belt and Road" initiative for regions along the border of China and Russia. Greater facilities connectivity and establishment of cross-border economic cooperation zones are expected to enhance the economic prosperity of these regions. The author proposes recommendations regarding further development of the railway and other transport connections between Russia and China and shows how these improvements could help both countries to efficiently meet the goals of the "Belt and Road" initiative and achieve mutually beneficial results.

KEYWORDS
China, Russia, Far East, Belt and Road, facilities connectivity

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Транспортная инфраструктура в восточных регионах Китая и России и инициатива «Один пояс, один путь»

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АННОТАЦИЯ
Расширение возможностей соединения объектов и создание необходимой инфраструктуры является важным элементом инициативы «Один пояс, один путь». Отсутствие связи между объектами рассматривается как серьезное препятствие на пути развития китайско-российской торговли и других сфер сотрудничества между двумя странами. В данной статье дается обзор современных подходов к концепции соединения объектов в контексте китайско-российского сотрудничества в рамках инициативы «Один пояс, один путь». Автор рассматривает прогресс в строительстве транспортной инфраструктуры, направленной на улучшение связности объектов в восточных регионах Китая и России за последние пять лет. Особое внимание уделяется таким масштабным проектам, как строительство экономического коридора Китай-Монголия-Россия, строительство мостов (например, железнодорожного моста Тунцзян и моста Хэйлунцзян), строительство международной грузовой линии Харбин–Россия и пр. Пример провинции Хэйлунцзян в Китае описан в статье, чтобы проиллюстрировать преимущества инициативы «Один пояс, один путь» для пограничных регионов Китая и России. Ожидается, что расширение возможностей соединения объектов и создание трансграничных зон экономического сотрудничества повысят экономическое процветание этих регионов. Автор предлагает рекомендации по дальнейшему развитию железнодорожного и других транспортных связей между Россией и Китаем и показывает, как эти улучшения могут помочь обеим странам достичь взаимовыгодных результатов.

КЛЮЧЕВЫЕ СЛОВА
Китай, Россия, Дальний Восток, Пояс и Дорога, связность объектов

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Introduction

Connectivity of the facilities within the "Belt and Road" initiative plays a key role in the success of this project. Good infrastructure is a prerequisite for the development of a country or region; connectivity of infrastructure networks, in its turn, is crucial for economic cooperation and technological exchange, it is also one of the factors that determine the economic and trade cooperation between Russia and China. The construction of cross-border transportation infrastructure between China and Russia has recently made some major breakthroughs, but the interconnection between transportation trunk lines and modernization construction has yet to be improved. Once the construction of the interconnectivity infrastructure is finished, the freight routes from Eastern Russia to the northern provinces of China will become shorter, which, in its turn, will cut the costs of shipping Chinese goods to Russia and enhance the trade between the two countries. Moreover, it will also stimulate economic development of Northeast China, which serves as a bridge in China-Russia trade.

The majority of up-to-date Chinese studies discuss the significance of facilities connectivity and provide interpretations for the concept of facilities connectivity and the relevant policies in this sphere. In this article we are going to focus on the construction of cross-border transportation infrastructure and describe the possible means and ways for enhancing the connectivity of facilities within the "Belt and Road" project and for harmonizing Russian and Chinese respective development strategies.

Literature review

The "Vision and Actions on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road" issued by the Chinese government states[1] that facilities connectivity is the priority area of the "Belt and Road" Initiative. The project aims to stimulate the construction of traffic facilities in the countries participating in the project, especially the construction of the missing sections and links. Regarding the concept of facilities connectivity, we can identify three categories of studies in China.

The first group of studies deals with the concept of facilities connectivity. Liu Xu and Chen Yao [1] define this term as construction of transportation, communications, networks, ports, and other kinds of infrastructure. The general understanding is that the "Belt and Road" initiative seeks to enhance the interconnection of transportation, energy and communications, especially regarding large passageways [2].

According to the "Report of the Five-Pronged Approach Index of the Countries along the Belt and Road" published by the research group of Peking University[2], the connectivity of transport infrastructure should be provided through cooperation among the participant countries. At the same time, these countries' sovereignty and security concerns should be respected and taken into consideration. Border countries should coordinate their efforts in infrastructure construction planning and harmonize their technical guidelines and systems. The first problem to be addressed is that of "disconnection and impassability": the countries are expected to build the missing sections, set up an international three-dimensional transport corridor and build the infrastructure network linking Asian sub-regions and Asia, Europe and Africa.

The second group of studies deal with the significance of facilities connectivity. Li Jinzao, Tang Min, Li Ruogu and other scholars see the construction of transport infrastructure within the "Belt and Road" Initiative as the key condition for enhancing regional economic integration [3]. Infrastructure is crucial for the success of the project, roads and communications should be opened in the first place, it is necessary to build an efficient, convenient and safe infrastructure network [4]. The interconnected infrastructure built in compliance with the standards is the basic condition for the development of trade, capital allocation, personnel flow and industrial cooperation. As the global experience shows, regional economic cooperation is heavily dependent on the quality of the infrastructure, in particular its connectivity. Many countries attach great importance to infrastructure construction and enhancement of connectivity. For instance, regional economic organizations, such as the European Union and ASEAN, have implemented special policies and plans to improve their facilities connectivity [5].

Building infrastructure is particularly important as it provides the basis for unimpeded trade

[1] http://en.ndrc.gov.cn/newsrelease/201503/t20150330_669367.html

[2] Peking University. (2016). "Belt and Road" Five-Pronged Index Research Group: National Five-Pronged Pronged Pronged Index Report along the "Belt and Road". *The economic daily press*, 11, 36

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and, therefore, affects economic development and living standards in the region [6]. Participation in the "the Belt and Road" facility construction will help the countries maximize their respective advantages and achieve mutual benefit and win-win results [7].

Improved transport interconnection can accelerate China's economic development, ensure balanced development of regional economy, promote economic and trade exchange, and contribute to the economic development of other participants of the "Belt and Road" project.

A separate group of studies present a Russian perspective on the "Belt and Road" project. For example, Ostrovsky stresses that the rapid development of the Russian Far East requires the implementation of large-scale infrastructure projects, which makes China Russia's best partner in this respect. Russia can benefit from the opportunities to develop its transportation infrastructure in the Far East and Eastern Siberia by participating in the construction of the China-Mongolia-Russia Economic Corridor [8]. Suslov believes that the cooperation between Russia and China in the implementation of the International Transportation Corridor project will improve cargo transportation from provinces of Northeast China through the ports of Primorsky region and help to solve the development problems in Russia's Far East and Northeast China [9].

The third category of studies focus on what is referred to as the "structural adjustment" of facilities connectivity: Han Kedi and Wang Zhiyuan believe that the countries along "the Belt and Road" have a great potential for complementary development [10]. From the perspective of Sino-Russian cooperation, facilities connectivity mainly refers to three aspects: cross-border water transportation, transportation, and customs clearance at ports. As for cross-border water transportation, over the years, China has been quite active in bridging the border areas between China and Russia, and there has been some progress in the construction of Tongjiang and Heilongjiang Bridges. In terms of transportation, China and Russia have basically reached consensus on expanding transport in Eurasia and strengthening cooperation with countries along the Silk Road Economic Belt. In recent years, the opening of the Siberian Land Bridge, and the launch of "Madrid-Yiwu Train", "Chongqing-Sinkiang-Europe International Railway", "Harbin-Europe International Railway" and "Harbin-Russia International Railway" have marked important stages in promoting the development of trade between the two countries. In terms of port customs clearance, for the construction of the "Silk Road Economic Belt", it is necessary to solve the problem of the bottleneck of port infrastructure [10]. This can be achieved with the help of free trade zones around the key port areas and by improving the efficiency in the logistics sector.

There is still a lot of room for exploring the opportunities for enhancing facilities connectivity both for China and Russia, but special attention should be given to the existing structural problems. For efficient implementation of the project it is necessary to consider resource allocation and mobilize effectively the governments, enterprises and other stakeholders [11].

Expected Goals of China-Russia Facilities Connectivity

Since the "Belt and Road" initiative was put forward, China and Russia have launched a number of major construction projects. In this article, we are going to look at the progress of building the Tongjiang Railway Bridge and Heilongjiang Bridge in Heihe, which reflects the efforts of both countries to improve facilities connectivity. We are also going to analyze the significance of strategic cooperation between the two countries.

Russia's Far East is adjacent to Northeast China, which means that Russia's development of the Far East is beneficial for Northeast China. In 2004, China made a major decision to implement the strategy of revitalizing the old industrial bases in Northeast China. In 2016, the State Council put forward a new round of plans for the revitalization of this region. In September 2019, President Xi Jinping visited three northeastern provinces and hosted a symposium on promoting the revitalization of Northeast China, where he spoke of a series of decision-making arrangements of the Party Central Committee.

It should be noted that the local revitalization strategies of Russia and China have a lot in common and have significant potential for strategic synergy. During the 4th Russian Eastern Economic Forum, the Sino-Russian Dialogue of Local Leaders briefed on the progress of construction of infrastructure projects such as bridges and highways, showing the success of Sino-Russian cooperation in the eastern region.

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In 2017, the government of Heilongjiang Province proposed[3] the following goals for the "Belt and Road" construction: "making a window (an important window for China's opening to the North) and building four zones (Heilongjiang (China-Russia) Free Trade Area, key open pilot areas along the border, demonstration zones for cross-border economic cooperation and Eurasian logistics hub areas)". These goals include construction of the Eurasian logistics hub area, which also means enhancing the collection and distribution system, promotion of cross-border infrastructure interconnection, building international economic and trade corridors, creating professional logistics parks, logistics groups and logistics enterprises, as well as modern intelligent logistics industrial clusters[4]. As an open window to the north, Heilongjiang Province is not only shouldering the heavy responsibility of ensuring facilities interconnectivity between China and Russia, but is actually taking the lead in this process.

In June 2017, Heilongjiang Provincial Government adopted the Thirteenth Five-Year Plan for the Development of the Modern Integrated Transport System, which proposed to strengthen the province's cooperation with Russia in the sphere of cross-border infrastructure construction. It was also planned to upgrade the functions of the "Harbin-Russia-Europe" corridor and the "Harbin-Russia-Japan-Korea" land-sea joint transport channels, to open new international road transport lines, to construct a large land-sea-air Silk Road corridor and China-Mongolia-Russia economic corridor[5]. Let us look at these plans in more detail.

China-Mongolia-Russia economic corridor

The concept of China-Mongolia-Russia economic corridor expands and complements the idea behind the "Belt and Road" initiative. The purpose of building this corridor is to gradually improve the interconnection between these countries, thus enhancing their economic cooperation and economic development. Better connectivity means addressing the problem of transport bottlenecks and turning the struggling border areas into prosperous cross-border economic zones. This is true in particular for Heilongjiang Province, which has the potential to become the core part of the corridor [12].

The 12th Party Representatives Congress of Heilongjiang Province declared the intention of the Province's government to "focus on optimizing the pattern of opening up to the outside world", which includes "focusing on cooperation with Russia, and promoting cooperation with Europe, the United States, Northeast Asia, Central Asia, Australia, New Zealand, Mongolia and other countries and regions, working closely with Hong Kong, Macao and Taiwan, and deepening economic and trade cooperation and human exchanges" [13].

Heilongjiang is an important hub and the main channel between China and the rest of Eurasia. The province has the potential to become a major regional center for international cooperation. This will be made possible by the construction of a cross-border railway transport system between China, Russia and Europe, the supporting infrastructure, and the Eurasian Continental Bridge. Other priority areas include land-sea transportation, river-sea transportation, Suifenhe-Manzhouli Expressway, Harbin Airport Economic Zone, Japan Sea Route, Arctic Route and other cross-border channels.

Projects to enhance highway and railroad connectivity

The "Vision and Actions on Jointly Building the Silk Road Economic Belt and 21st-Century Maritime Silk Road" highlights 18 key provinces, including Heilongjiang Province, and describes the main priorities of international cooperation. Among other things, it is planned to improve Heilongjiang's railway access to Russia and its regional railway network. Yet another area outlined by the document deals with strengthening of land-ocean cooperation between the province and Russia's Far East[6].

[3] The Provincial Party Committee Convened the First Meeting of the Provincial Leading Group on "the Belt and Road" Construction (2017). *Heilongjiang Development and Reform Commission*. Retrieved from: http://www.hljdpc.gov.cn/art/2017/8/18/art_350_19546.html

[4] The Provincial Party Committee Convened the First Meeting of the Provincial Leading Group on "the Belt and Road" Construction (2017). *Heilongjiang Development and Reform Commission*. Retrieved from: http://www.hljdpc.gov.cn/art/2017/8/18/art_350_19546.html

5 The 13th Five-Year Plan for the Development of Modern Comprehensive Transportation System in Heilongjiang Province (2017). *Heilongjiang Provincial Government Information Disclosure*. Retrieved from: http://www.chinahighway.com/news/2017/1113184.php

[6] *Visions and Actions of Promoting the Construction of the Silk Road Economic Belt and the Marine Silk Road in the 21st Century* (2017). Retrieved from: http://ydyl.people.com.cn/n1/2017/0425/c411837-29235511.html

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So far the government of Heilongjiang Province has gone to great lengths to accelerate the construction of railway links along the Russian border, to build high-speed railway loops, railway ports links, key highway networks and civil aviation airports. In this respect, it is important to mention such significant projects as the building of Tongjiang Railway Bridge, China-Russia Heihe Highway Bridge, Dongning Cross-Border Highway Bridge, Heixiazi Island Land Port, and the construction and management of Vladivostok Port. All these projects will make a considerable contribution to the cooperation between Russia and China.

After the project of constructing Tongjiang Railway Bridge is officially completed, Tongjiang Port will be connected with the Trans-Siberian Railway, linking Khabarovsk, one of the largest cities in the Far East, and Europe. It is expected that 20 million tons of cargo will be transported via the bridge in the future [14].

Heihe Highway Bridge, connecting Heihe in Heilongjiang province and Blagoveshchensk in Russia, will be the first modern highway bridge on the Amur River. After its completion, a new international highway will provide a direct connection between the two cities of China and Russia, playing an important role in promoting Sino-Russian trade.

The transnational transportation system (mainly railway freight trains) in Heilongjiang Province currently comprises trains running from Harbin to Europe and to Russia as well as the land-sea transport line "Harbin-Suifenhe-Vladivostok-Busan". Since its opening in June 2015, the volume of the rail traffic between Harbin and Europe has been increasing continuously. According to the statistics, the full loading rate has increased from 21.34% to 49.6%.

On May 13, 2017, Heilongjiang-Belgium Volvo special line project was launched. Then the line Harbin-Minsk was opened, which is the first central European line to reach Minsk directly. Harbin-Russia international freight line, opened in February 2016, is now operating on a regular basis and has been playing an important role in freight transportation between China and Russia. It now takes 7-10 days to ship a container with cargo from China to Russia or in the opposite direction.

On January 5, 2017, Harbin-Europe and Harbin-Russia railway lines were formally incorporated into the Central European Trains Operation Map. These railway lines link China with Europe, playing a key part in the development of cross-border e-commerce and other related spheres. The development of railway transportation holds massive potential for the development of Heilongjiang province [15].

In August 2015, the first land-sea container train with Chinese goods departed from Harbin, heading all the way to Vladivostok, and then to Busan by sea. A transport line from Harbin, Vladivostok to Busan was opened. After nearly a year of trial operation, in April 2016, this line started its normal operation. It takes two days for a train to reach The implementation of the projects aimed at creating China-Mongolia-Russia economic corridor, the international transport corridor between Vladivostok and Harbin "Binhai No. 1", and the land-sea transport line "Harbin-Suifenhe-Vladivostok-Busan" has been a great contribution to building a reliable and efficient transportation system in Russia's Far East and Heilongjiang province.

The Future of China-Russia Cooperation for the Improvement of Facilities Connectivity

In recent years, Russia has been severely affected by Western sanctions and the global financial crisis. As a result, the state investment in fixed assets became inadequate, which seriously impeded the construction of the necessary transport infrastructure. The authorities of Russia's Far East attach great importance to attracting foreign investment to building the infrastructure, which provides opportunities for China-Russia cooperation in this sphere. China-Russia infrastructure construction should meet the needs of both countries resulting in a win-win situation and be implemented step by step; government and enterprises should play a synergistic role in improving the utilization rate of infrastructure, focusing on solving the problems of high risk and poor profitability.

There are several aspects that need to be considered when thinking about the future China-Russian cooperation in the sphere of facilities connectivity and construction of the necessary transport infrastructure.

First, one cannot overestimate the significance of China-Mongolia-Russia economic corridor. The key directions of China-Russia cooperation in this area are to jointly plan and develop infrastructure resources such as tripartite roads,

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railways, airports and sea ports, strengthen cooperation in establishing international transport corridors, border infrastructure and cross-border transport organizations. China-Mongolia-Russia economic corridor will also provide the necessary support for Manzhouli-Suifenhe railway, which connects with the Northeast China Railway Network in the south and extends to North China. It is also linked to the Russian Trans-Siberian Railway in the north and extends to the Russian Far East through the Baikal-Amur Railway. Thus, it is a core railway line in Northeast Asia.

Second, the Russian socio-economic advanced development zone in the Far East is one more step towards the creation of the modern transportation infrastructure on the route between China and Russia, which enable both countries to efficiently transport such resources as oil, natural gas, timber and coal. At present, the Russian government has already approved the establishment of ten advanced development zones with preferential tax policies across the Far East. It should be noted that this region is now suffering from a serious shortage of investment. This problem could be addressed through joint efforts of the two countries, which could include funding from the Asian Investment Bank and the Silk Road Fund to invest in the key projects of the Russian Far East [16].

Third, one must be fully aware of the significance of mutual trust between the countries. In order to expand cooperation and partnership, it is necessary to strengthen friendly ties between the people, which will thus provide a solid social foundation for realizing the "Belt and Road" project. In terms of facilities connectivity, it is necessary to balance the interests of both countries, improve the internationalization norms and transparency within the project, and avoid or reduce the differences caused by misjudgments. Mutual trust and cooperation should be strengthened in line with the concepts of coordinated development and green development [17].

Conclusion

At present, the initial stage of enhancing the facilities connectivity within the "Belt and Road" project has been already completed, although many routes and plans are still a work in progress. A certain success was achieved in the eastern area, where China and Russia have joined their efforts.

In this paper, we explored the ways of improving facilities connectivity in the east, in particular in Heilongjiang Province. We conducted some field research, especially regarding cross-border water transport and land-sea transport, which allowed us to fill the existing research gap.

On the other hand, since facilities connectivity of the "Belt and Road" is a relatively new idea, there is still much room for improvement. The success of the project depends on the successful of specific projects such as the construction of China-Mongolia-Russia economic corridor and the establishment of a socio-economic advanced development zone in Russia's Far East. The process is also influenced by the economic situation in China and in Russia.

In 2019, the 70th anniversary of China-Russia diplomatic relations was celebrated. The comprehensive strategic partnership between the two countries encompasses a wide range of spheres, including trade and transportation. It is expected that by 2024, the volume of Sino-Russian trade will reach US$200 billion, which makes one quite optimistic about the future of this mutually beneficial relationship.

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