Research article

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Study of the Factors Relevant to the Management Model for Developing Russia's Regional Socio-Economic Systems

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Abstract

The Russian economic space is characterised by a significant differentiation in the levels of socio-economic development of the country's various regions, which manifests itself in natural, territorial, socio-cultural, economic, political and other aspects. The results of socio-economic differentiation are unique regional socio-economic systems, which necessitates the formation of individual approaches to managing their development. Therefore, management decisions made at the federal centre, as well as by regional authorities, affect the activities of economic entities in the regions and the population's level of well-being in different ways. Social security is an integral element of the high quality of life of the population and is largely the basis for improving the economic status of the region, increasing the value of human capital. Thus, it is necessary to develop methods and tools for ensuring the social safe development of regional socio-economic systems, considering the specific characteristics of each region. From these perspectives, we can discuss the stability and social performance of the regional economy. Despite a broad scientific background, the factors contributing to the development and the results of regional socio-economic systems, considering the need for social security, have not been examined. The present research aims to fill this gap by developing a management model for the social and safe development of Russia's regions, using the city of St Petersburg as the case study.

Keywords: management model for regional development, tone of news flow, resource classification principles, management factors' impacts, regional social security, regional economy's stability

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Исследование Факторов Модели Управления Социально-Безопасным Развитием Региона

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Аннотация

Для российского экономического пространства характерна значительная дифференциация уровней социально-экономического развития различных регионов, проявляющаяся как в природном, территориальном, так и в социокультурном, экономическом, политическом и ином аспектах. Результатами социально-экономической дифференциации становятся уникальные региональные социально-экономические системы, что обуславливает необходимость формирования индивидуальных подходов к управлению их развитием. Поэтому управленческие решения, генерируемые федеральным центром, а также региональными органами власти, неодинаково сказываются на деятельности хозяйствующих субъектов региона и уровне благосостояния населения. Социальная безопасность является составным элементом высокого качества жизни населения, более того, социальная безопасность во многом является базисом для повышения экономического статуса региона, роста стоимости человеческого капитала. Вследствие этого необходима разработка методов и инструментов обеспечения социально безопасного развития региональных социально-экономических систем с учётом специфики регионов. Именно с этих позиций можно говорить об устойчивости региональной экономики и о её социальной результативности. Целью данного исследования является разработка модели управления социально-безопасного развития региона на примере города Санкт-Петербург. Исследовательский разрыв заключается в том, что несмотря на достаточно широкий научный задел, существует явный научный пробел в определении факторов и результатов развития региональных социально-экономических систем с учётом необходимости обеспечения социальной безопасности.

Ключевые слова: модель управления социально-безопасным развитием региона, тональный окрас новостного потока, принципы классификации ресурсов, воздействие факторов, социальная безопасность региона, устойчивость региональной экономики.

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1. Introduction

The competitiveness of a national economy is determined by the distinct capabilities of regional socio-economic systems, considered as local centres for generating benefits, in connection with which the choice of directions for regional development becomes critical. The main goal of the development of regional and national socio-economic systems is to improve the population's quality of life, based on stable economic growth and compliance with environmental restrictions. The Russian economic space is characterised by a significant differentiation in the levels of socio-economic development of the country's various regions, which manifests itself in natural, territorial, socio-cultural, economic, political and other aspects. The results of socio-economic differentiation are unique regional socio-economic systems, necessitating the formation of individual approaches to managing their development. Thus, the purpose of this study is to develop a management model for the social and safe development of the regions, based on the example of the city of St Petersburg.

Despite a fairly broad scientific background, determining the factors contributing to the development and the results of regional socio-economic systems, considering the need to ensure social security, remains a research gap. Significant differences in the results of the managerial influences of the federal centre and the regions on regional socio-economic development reveal the need for additional research in this area.

2. Literature Review

To form a conceptual model for ensuring the socially safe management of the development of regional socio-economic systems, it is necessary to identify the factor specificity. One of the key signs of differentiation can be the principle of classifying economic resources. The most complete classification of economic resources as factors influencing the development of regional socio-economic systems is presented in a previous study (Kisurkin, 2012). The author identifies five main groups – natural, labour, financial, entrepreneurial and knowledge factors. Each of the presented groups of factors can act as the core of the model for managing the development of a regional socio-economic system.

A graphic systematisation and brief descriptions are shown in Figure 1.

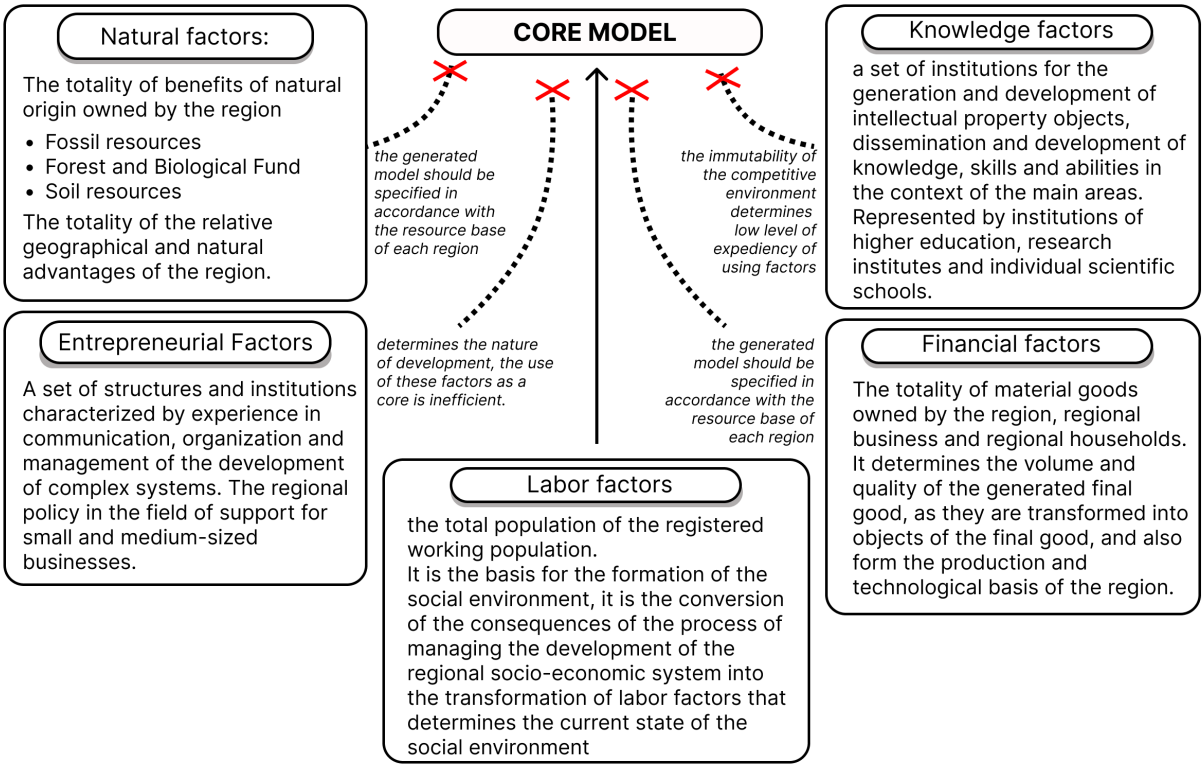

Figure 1. Systematisation of economic factors

However, taking into account this study's purpose to improve the tools for the socially safe development of regional socio-economic systems, instead of labour factors, the model will consider human factors as the group that fully covers all human resources and human potential located in the territory of a particular region. Through the reactions of human resources, people can most fully assess how socially safe their region of residence is and use this effect in strategic regional planning.

Using the state of human resources as the core of the model being developed involves the formation of a system of input impact factors and a system of input conversion results. The system of input impact factors should be understood as a set of quantifiable variables that are exogenous in relation to the state of human resources. At the same time, it should be noted that being fully or partially controllable is an invariably obligatory property of these factors. It is expedient to make these factors distinct in accordance with the specifics of the differentiation of economic resources described earlier. Thus, in the first place, natural factors can be distinguished. As a manageable indicator that characterises the impact of management entities on the development of a set of natural factors influencing the regional socio-economic system, an investment in a fixed asset aimed at protecting the environment and the rational use of natural resources can be singled out. This indicator is differentiated in accordance with the areas of investment, namely investments in the protection of atmospheric air, the protection and rational use of water resources, as well as the construction and maintenance of wastewater treatment plants. The selected set of investment areas is not exhaustive; however, these areas comprise the majority of the totality. The increment of these parameters in the medium and long terms has an impact on improving the level of environmental safety of a specific region, which in turn has a positive effect on the overall average state of the physical and moral health of the population. The presented formal–logical connection determines the conversion of the process of incremental investments in fixed assets aimed at environmental protection and rational use of natural resources into a change in the state of human resources, which in turn can potentially affect the overall development of the regional socio-economic system. In addition to the selected investment indicator, which invariably has a positive impact on the state of human resources, it is necessary to highlight indicators that reflect the negative impact on the natural resources of a region. The necessary condition of full or partial controllability determines the technogenic nature of these indicators. Thus, the most appropriate indicator in this case is the volume of emissions of harmful (polluting) substances. This indicator is multidimensionally manageable, which is determined by the possibility of reducing the volume of manufacturing products, the technological process of production, accompanied by significant emissions of pollutants, and the possibility of compensating for this impact by improving the systems for cleaning and making up for emitted pollutants. The impact of changes in this indicator on the state of human resources is reversible, which determines the need to reduce it. The combination of the above indicators is necessary and sufficient for describing natural factors' impact on human resources in the framework of the development of a regional socio-economic system. Other natural factors are neither fully nor partially controllable, forming the basis for an exclusive evaluation model that is unsuitable for managing the development of regional socio-economic systems.

Next, it is necessary to consider a set of factors that multidimensionally describe the state of material resources that form both internal and external environments. This set can be conditionally divided into production factors and infrastructure factors. The essence of production factors is determined by the state of the material resources used in the process of generating wealth. This set of resources can be divided in accordance with the sign of turnover, as well as with the nature of the participation in the production process. The general comparative state of fixed production assets can be described by the indicator of the use of production capacities. It may also be conditionally expedient to use the value of accumulated depreciation as the analysed indicator of the input influence. However, this indicator has significant industry specifics, which determines the need for an industry specification of the model, in turn contradicting the goal set in this study. The indicator of production capacity utilisation is measured as a percentage, essentially reflecting the share of the actively used production potential of the region under study. This indicator is exclusively manageable and can be largely regulated by the subjects of management of the regional socio-economic system, both directly, by placing a state order, and indirect-

ly, by setting special conditions for the functioning of regional enterprises. The increase in this indicator has a direct impact on the state of human resources, primarily due to the regional labour market saturation with supply and the decrease in social tension in this regard, as well as the creation of a socially safe environment. The GRP per capita should also be considered as a complex factor of production. This indicator is dualistic in nature, and in many respects is the result. However, in modern conditions of the development of regional socio-economic systems, the complex result, which is directly the GRP per capita, is determined not so much by the conditional efficiency of able-bodied human resources, as by the efficiency, adaptability and predictability of the process of its formation, at both the technological and administrative levels. At the same time, it is the GRP per capita that essentially reflects the population's level of well-being, which in turn directly affects the state of human resources. Thus, the GRP per capita is the most appropriate factor to use as an indicator of the input impact.

In parallel with the development of the production environment, the integrated development of regional socio-economic systems invariably involves the development of infrastructure as a connecting inter-production resource. The degradation and unsatisfactory state of the regional infrastructure determine the increase in logistics costs, in turn leading to greater complexity of the interaction between the population and the business in both the production process and the consumption process. Among the indicators reflecting the state of infrastructure factors, it is most appropriate to single out the indicator of the availability of road transport, differentiated into public (in particular, buses, representing the most versatile type of public transport) and private (in particular, cars). This indicator can also be supplemented by an indicator of the length of public roads.

The presented set of input influence factors can potentially be supplemented by a set of indicators reflecting the state of the healthcare system, education and other social indicators. As part of this study, among the indicators reflecting the state of the social environment, it was decided that the following would be used: the number of students in general education institutions receiving meal subsidies, the ratio of healthcare institutions using the internet to the total number of healthcare institutions, as well as real accrued wages as a percentage of those earned in the corresponding period in the previous year.

Next, it is necessary to consider the totality of the resulting indicators in relation to the human resources. Such an environment is manifested in a set of indicators reflecting the level of social security, such as the number of offences in the context of the main articles of the Criminal Code of the Russian Federation, as well as in a set of indicators reflecting the conditional "improvement" of society, such as the volume of consumed alcoholic beverages and drugs.

It is also essential to separately note the increase in the unemployment rate as a result of the reverse conversion of the increment in the main indicators of input influence. The totality of the resulting indicators is presented in Table 2.

The above set of indicators can be aggregated in a single conceptual model (Figure 2).

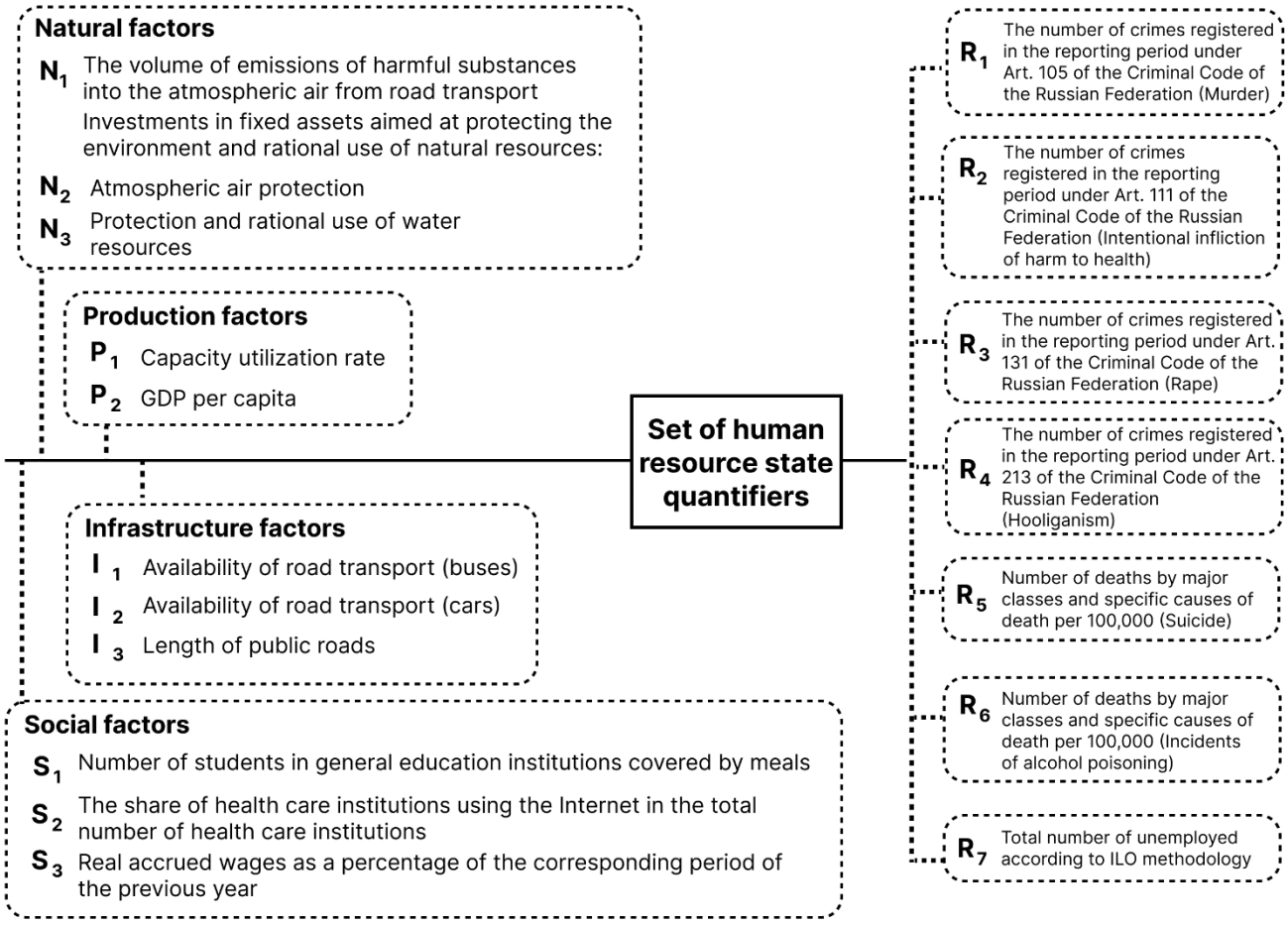

Figure 2. Conceptual model for managing the development of regional socio-economic systems (Rodionov et al., 2021)

As shown in Figure 2, the core of the conceptual model for managing the socially safe development of regional socio-economic systems is the set of quantifiers of the state of human resources. These quantifiers can be aggregated, based on the analysis of the comparative state of the communicative manifestations of a region's population. Such a thesis assumes that the psychological state of the representatives of society relates to the results of their professional activities and other social manifestations.

The state of human resources can be differentiated in accordance with a variety of classification features (Kulibanova, Teor, 2018; Kulibanova, 2018); however, the most appropriate one in this study is the allocation of social (Karpenko et al., 2018) and emotional characteristics of human resources. Two of the key properties of the process of forming these characteristics are consistency and duration, which determine the need to consider the significant time lag in the conversion of managerial impact, which theoretically takes several years.

Development requires a methodology for assessing the emotional characteristics of human resources, effectively reflecting the state of such resources. The key properties of primary information in the framework of the analysis are objectivity, relevance and universality.

As a rule, the key emotional (tonal) characteristics of natural information, include positivity, negativity and neutrality. These tonal characteristics can be called primary. The assessment of these parameters in relation to the information flow of the regional socio-economic system can be differentiated by the following indicators:

$T_{c_i}^{neut}$ – the level of neutral sentiment of information unit *i*, which describes the state of the regional socio-economic system

$T_{c_i}^{pos}$ – the level of positive sentiment of information unit *i*, which describes the state of the regional socio-economic system

$T_{c_i}^{neg}$ – the level of negative sentiment of information unit *i*, which describes the state of the regional socio-economic system

$T_{com_i}^{neut}$ – the level of neutral tone of information unit *i*, which describes the human resources' reaction to the state of the regional socio-economic system

$T_{com_i}^{pos}$ – the level of positive sentiment of information unit *i*, which describes the human resources' reaction to the state of the regional socio-economic system

$T_{com_i}^{neg}$ – the level of negative sentiment of information unit *i*, which describes the human resources' reaction to the state of the regional socio-economic system

The presented set of indicators, based solely on the analysis of primary information, may not fully reflect the dynamic changes in the state of human resources. An addition to this parameter is the general level of emotionality of the information unit, equal to the ratio of the sum of the levels of positive and negative sentiments to the level of the neutral sentiment of the information unit. The mathematical interpretation of these indicators is represented by formulas 1–4.

$T_c^{dis} = \frac{T_c^{pos}}{T_c^{neg}}$	(1)	$T_{com_i}^{dis} = \frac{T_{com_i}^{pos}}{T_{com_i}^{neg}}$	(3)
$T_{c_i}^{full} = \frac{\left(T_{c_i}^{pos} + T_{c_i}^{neg}\right)}{T_{c_i}^{neut}}$	(2)	$T_{com_i}^{full} = \frac{\left(T_{com_i}^{pos} + T_{com_i}^{neg}\right)}{T_{com_i}^{neut}}$	(4)

with the following definitions:

$T_{c_i}^{dis}$ – the level of the tonal gap of information unit *i*, which describes the state of the regional socio-economic system

$T_{com_i}^{dis}$ – the level of the tonal gap of information unit *i*, which describes the human resources' reaction to the state of the regional socio-economic system

$T_{c_i}^{full}$ – the general level of emotionality of information unit *i*, which describes the state of the regional socio-economic system

$T_{com_i}^{full}$ – the general level of emotionality of information unit *i*, which describes the human resources' reaction to the state of the regional socio-economic system

The above set of indicators allows us to describe the tonal colour as a general news flow and a reactive information flow. The key characteristic reflecting the state of human resources is the ratio of these tonal characteristics, which determines the tonal gap. The mathematical interpretation of these indicators is represented by formulas 5–9:

$$D_i^{neut} = \sqrt{\left(T_{c_i}^{neut} - T_{com_i}^{neut}\right)^2} \quad (5)$$

$$D_i^{pos} = \sqrt{\left(T_{c_i}^{pos} - T_{com_i}^{pos}\right)^2} \tag{6}$$

$$D_i^{neg} = \sqrt{\left(T_{c_i}^{neg} - T_{com_i}^{neg}\right)^2} \tag{7}$$

$$D_i^{dis} = \sqrt{\left(\frac{T_{c_i}^{pos}}{T_{c_i}^{neg}} - \frac{T_{com_i}^{pos}}{T_{com_i}^{neg}}\right)^2} \tag{8}$$

$$D_i^{full} = \sqrt{\left(\frac{\left(T_{c_i}^{pos} + T_{c_i}^{neg}\right)}{T_{c_i}^{neut}} - \frac{\left(T_{com_i}^{pos} + T_{com_i}^{neg}\right)}{T_{com_i}^{neut}}\right)^2} \tag{9}$$

with the following definitions:

D_i^{neut} – a break in the level of the neutral tone of information unit *i*, which describes the state of the regional socio-economic system and the reactive information units in relation to it

D_i^{pos} – a gap in the level of positive sentiment of information unit *i*, which describes the state of the regional socio-economic system and the reactive information units in relation to it

D_i^{neg} – a gap in the level of negative sentiment of information unit *i*, which describes the state of the regional socio-economic system and the reactive information units in relation to it

D_i^{dis} – a gap in the tone of information unit *i*, which describes the state of the regional socio-economic system and the reactive information units in relation to it

D_i^{full} – a gap in the general level of emotionality of information unit *i*, which describes the state of the regional socio-economic system and the reactive information units in relation to it

The literature review is based on the materials presented by the cited authors (Karpenko et al., 2018; Rodionov et al., 2021).

3. Methods and Materials

The above technique can be automated using the Python programming language. At the initial stage of the presented methodology, both the information describing the state of the regional socio-economic system and the reactive information in relation to it are searched and aggregated. As part of the implementation of this algorithm, it is advisable to use the social network VKontakte. This choice is primarily due to the breadth of coverage of the population, which is on average 90% at the regional level. To test the developed methodology, the city of federal significance, St Petersburg, was chosen as the case study. One of the most dynamic and widespread concentrators of news information of the regional socio-economic system in the case of St Petersburg is the Vesti St Petersburg community. As an officially registered mass media, this community exclusively contains news information of regional importance and targets the most communicatively active audience.

The Dostoevsky instrumental library was chosen for the purpose of assessing the sentiments of both news information and reactive information. Based on the results of assessing the primary characteristics of the tonality of the information units, the previously presented characteristics of the tonal gap, which directly characterise the state of human resources, are calculated and aggregated.

In accordance with the previously presented conceptual model for managing the development of regional socio-economic systems, its core determines the conversion of the set of quantifiers of the state of human resources, expressed by the tonal gap of the information environment. The average dynamics of the primary indicators of the tonal gap are formally logically justified, which indirectly confirms the feasibility of the mathematical formalisation of the built conceptual model through the classical methodology of regression analysis.

The regression quality criteria applied in this work are defined as follows:

- the significance of the models is assessed using Fisher's F-test. In the framework of this study, the limit value of this criterion is taken to be 0.1 or 10%;

- the quality of the model is determined primarily by the volume of the explained variance of the endogenous variable, as indicated by the coefficient of determination (R2);

- the level of significance of the relation between the endogenous variable and the exogenous variables included in the model is determined by the p-level of significance of each variable. In the multiple regression equations, the specificity of the sample described above determines a potentially sufficiently high p-level of significance for the studied regressors. Therefore, compared with Fisher's F-test, a significantly more significant threshold is determined for this indicator, up to 0.2 or 20%. The backward method is used as an optimisation method in this study;

- the applied quality of describing the variance of an endogenous variable by the variance of exogenous variables is determined by the average approximation error, standard deviation, characteristics of structural outliers and structural gaps, among many others;

- the most significant binary quality criterion of a regression model is the rationale for the direction of the impact of an exogenous variable on an endogenous one.

4. Results and Discussion

Let us consider the impact of natural factors on the gap in the level of the positive tone in a regional socio-economic system's information environment. Based on the results of the primary analysis and optimisation, the following regression equation is obtained (formula 10):

$$D_i^{pos} = -0,037 + 0,0004 * N_{1_i} + (1,3-06) * N_{3_i} \quad (10)$$

In the framework of the resulting equation, the p-significance level of all regressors corresponds to the established criterion. The value obtained from Fisher's F-test is 0.0018, indicating the high significance of the resulting regression equation. The coefficient of determination of this equation is 0.955, from which it can be concluded that the variance of the "volume of emissions of harmful (pollutant) substances into the atmospheric air from road transport" and the variance of "investments in fixed assets aimed at protecting the environment and rational use of natural resources (protection and rational use of water resources)" explain about 96% of the dispersion of the gap in the level of positive sentiment in the regional socio-economic system's information environment. Of course, a significant part of the uniformity of variances is determined by systemic changes; however, even taking into account possible errors, this value indicates the high quality of the generated regression equation. To assess the applied quality of the model, we should compare the theoretical and actual values of the endogenous variable, as well as the boundaries of the acceptable interval (Figure 3).

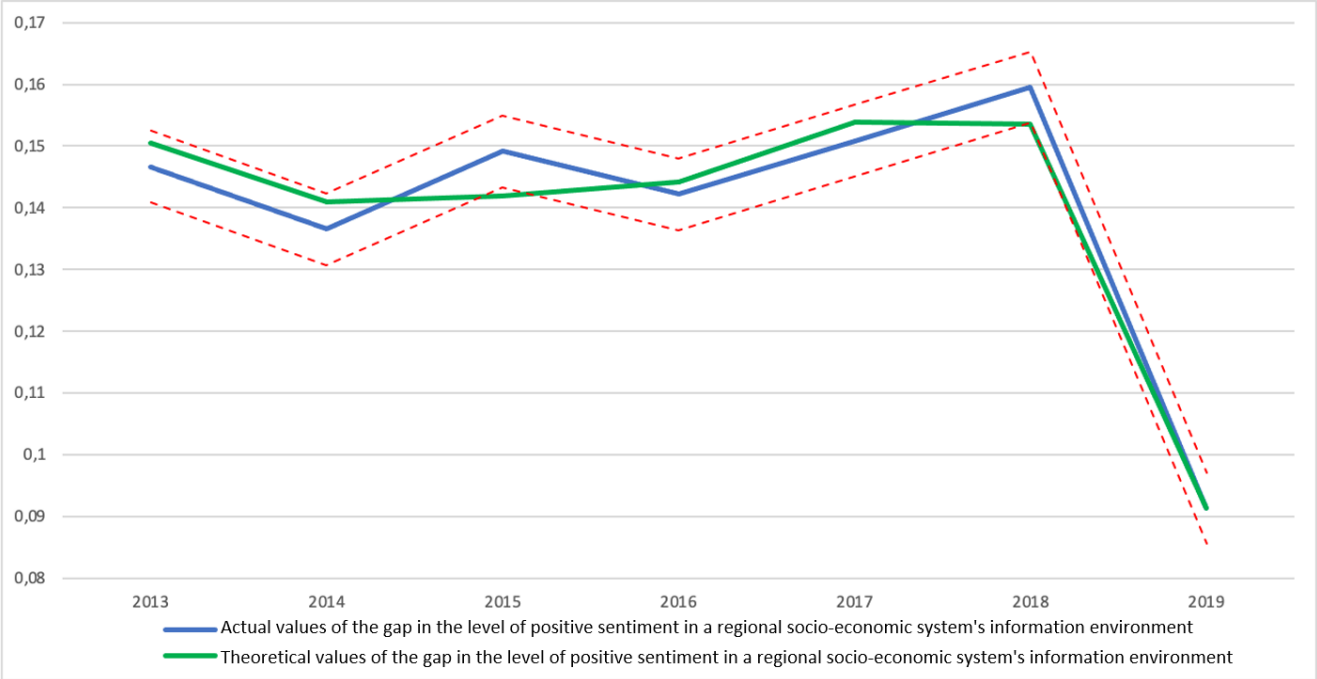

Figure 3. Dynamics of actual and theoretical values of the gap in the level of positive sentiment in a regional socio-economic system's information environment, depending on natural factors (Karpenko, 2021)

As shown in the graph (Figure 3), the overall dynamics of the actual and theoretical values of the gap in the level of positive tonality in a regional socio-economic system's information environment are comparable, indicating the high quality of the generated regression equation. Of course, an insignificant structural outlier appears in 2015, primarily due to the insignificant value of the standard deviation because of which the boundaries of the permissible interval are extremely strict. Due to this specificity, the corresponding structural outlier can be ignored.

The above equation determines the direct nature of the impact of the "volume of emissions of harmful (pollutant) substances into the atmospheric air from road transport" and "investments in fixed assets aimed at protecting the environment and rational use of natural resources (protection and rational use of water resources)" on the gap in the level of the positive tone in a regional socio-economic system's information environment. Regarding the first factor, a formal–logical connection is observed, while the impact of the second factor shows a contradictory nature. This impact can be substantiated by a potential lag in the impact on the specifics of the use of water resources. Consequently, from the management perspective, the "volume of emissions of harmful (polluting) substances into the air from road transport" is primary (indicator N1). The coefficient of elasticity of this indicator is 1.008%.

Let us consider the impact of production factors on the gap in the level of positive tonality in the regional socio-economic system's information environment. Based on the results of the primary analysis and optimisation, the following regression equation is obtained (formula 11):

$$D_i^{pos} = 2,269 - 0,021 * P_{2_i} \quad (11)$$

In the framework of the resulting equation, the p-significance level of the residual regressor corresponds to the established criterion. The value obtained from Fisher's F-test is 0.07, indicating a sufficient significance of the resulting regression equation. The coefficient of determination of this equation is 0.5, from which it can be concluded that the dispersion of "GRP per capita" explains about 50% of the dispersion of the gap in the level of positive sentiment in the regional socio-economic system's information environment. This value is insufficient to interpret the model as having high quality but enough to accept the model. For a paired regression model with macrospecificity, such value is acceptable for further re-

search. To assess the applied quality of the model, the theoretical and actual values of the endogenous variable, the boundaries of the acceptable interval, are compared (Figure 4).

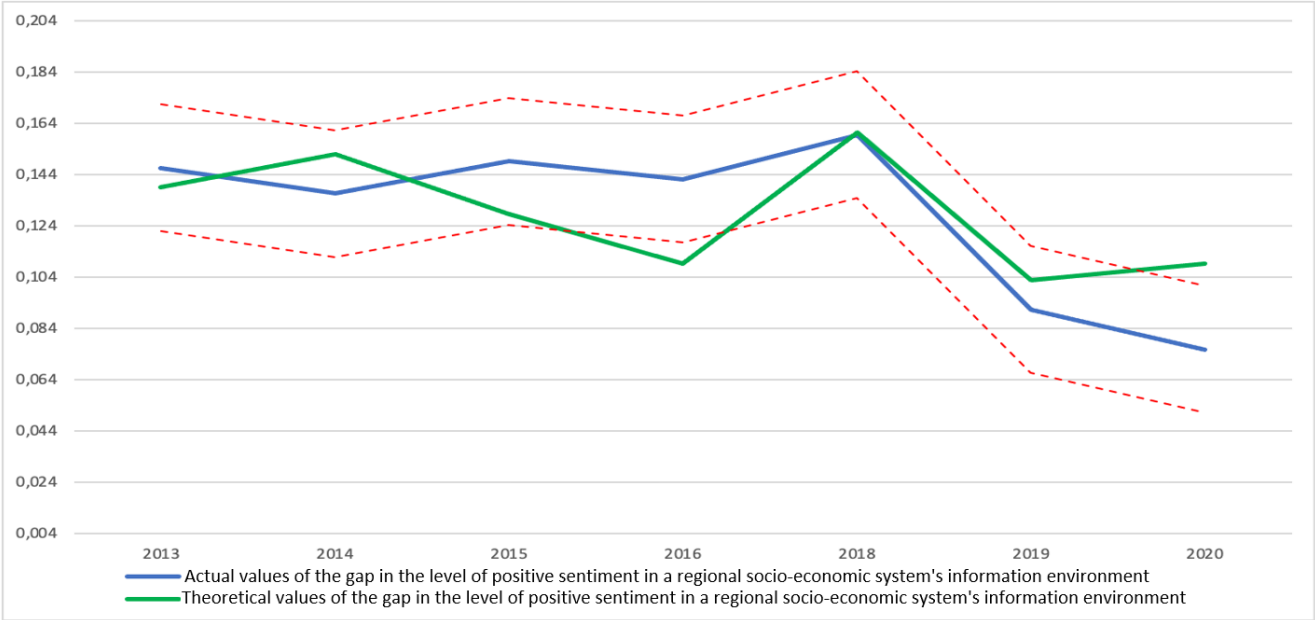

Figure 4. Dynamics of actual and theoretical values of the gap in the level of positive sentiment in a regional socio-economic system's information environment, depending on production factors (Karpenko, 2021)

As shown in the graph (Figure 4), the overall dynamics of the actual and theoretical values of the gap in the level of positive tonality in the regional socio-economic system's information environment are comparable, indicating the sufficient quality of the generated regression equation. However, structural gaps are observed in 2016 and 2020. This specificity is due, first of all, to significant non-economic shocks in these periods, particularly the COVID-19 pandemic. Due to this specificity, the corresponding structural outliers can be ignored.

The given equation of pair regression (formula 11) reflects the reverse effect of the change in the "GRP per capita" on the gap in the level of positive tonality in the regional socio-economic system's information environment, which in turn is formally and logically substantiated. At the same time, the coefficient of elasticity of this indicator is -16.6%, indicating an extremely strong influence of production specifics on the change in the gap in the level of positive sentiment. Thus, this indicator is primary in terms of managing the development of the regional socio-economic system.

Let us consider the impact of infrastructural factors on the gap in the level of positive sentiment in the regional socio-economic system's information environment. Based on the results of the primary analysis and optimisation, the following regression equation is obtained (formula 12):

$$D_i^{pos} = 0,589 - 0,00013 * I_{3_i} \quad (12)$$

In the framework of the resulting equation, the p-significance level of the residual regressor corresponds to the established criterion. The value obtained from Fisher's F-test is 0.14, indicating the insufficient significance of the obtained regression equation. This fact determines the need to exclude this model from the previously formulated conceptual equation. However, the coefficient of determination of this equation is only 0.32, which indicates the relative secondary nature of factor I3, "length of public roads". Moreover, the relation is inverse, which is not logically interpreted. Thus, it can be established that infrastructural factors have no significant impact on the gap in the level of positive sentiment in the regional socio-economic system's information environment. This fact may be due to the extreme differentiation of the infrastructural conditions of the regions, as well as the human resources' relative

adaptation to these conditions.

In conclusion, it is necessary to consider the impact of social factors on the gap in the level of the positive tone in the regional socio-economic system's information environment. Based on the results of the primary analysis and optimisation, the following regression equation is obtained (formula 13):

$$D_i^{pos} = -3,54 + 0,038 * S_{2_i} - 0,0007 * S_{3_i} \quad (13)$$

In the framework of the resulting equation, the p-significance level of the residual regressor corresponds to the established criterion. The value obtained from Fisher's F-test is 0.017, indicating the sufficient significance of the obtained regression equation. The coefficient of determination of this equation is 0.71, from which it can be concluded that the variance of the "ratio of healthcare institutions using the internet to the total number of healthcare institutions" and the variance of "real accrued wages as a percentage of those earned in the corresponding period in the previous year" explain about 71% of the variance of the gap in the level of positive tonality in the regional socio-economic system's information environment. This value is necessary and sufficient for the interpretation of the model as having high quality. To assess the applied quality of the model, we should compare the theoretical and actual values of the endogenous variable, as well as the boundaries of the acceptable interval (Figure 5).

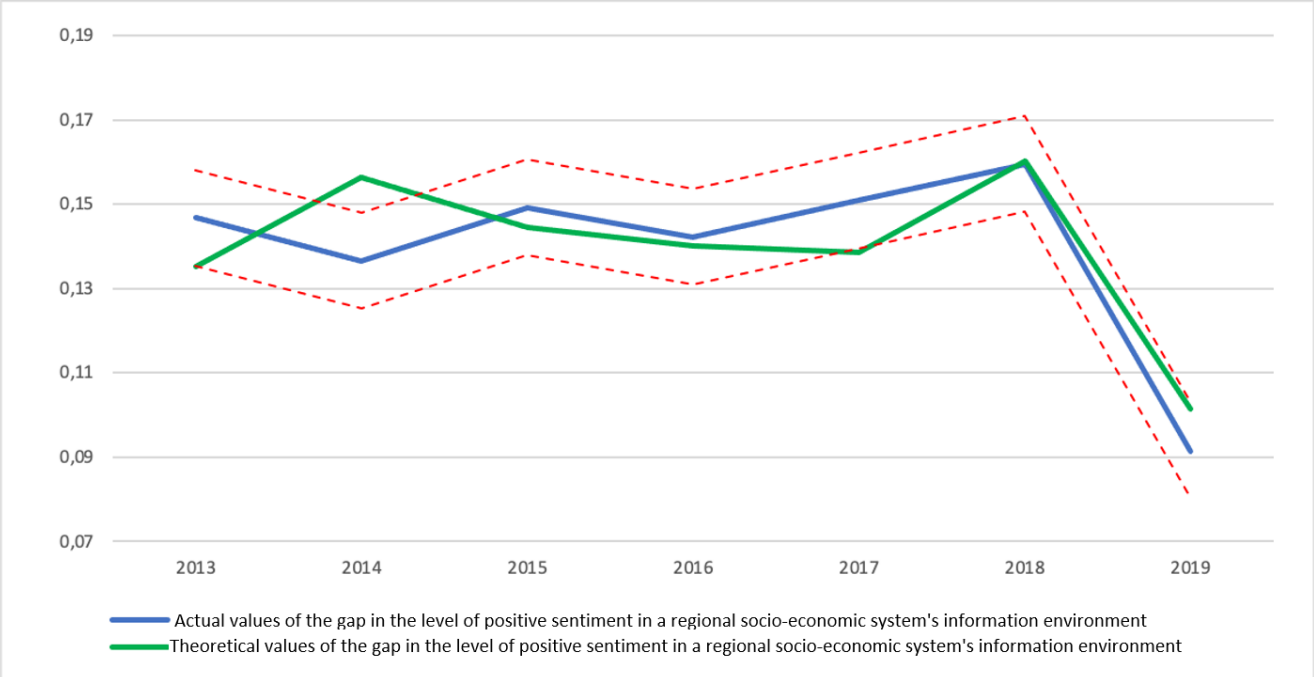

Figure 5. Dynamics of actual and theoretical values of the gap in the level of positive sentiment in the regional socio-economic system's information environment, depending on social factors (Karpenko, 2021)

As shown in Figure 5, the overall dynamics of the actual and theoretical values of the gap in the level of positive tonality in the regional socio-economic system's information environment are comparable, indicating the sufficient quality of the generated regression equation. However, a structural gap appears in 2014. This specificity is due, first of all, to economic shocks caused by fluctuations in the exchange rate of the national currency. Due to this specificity, the corresponding structural outlier can be ignored.

The above regression equation reflects the reverse effect of the change in "real accrued wages as a percentage of those earned in the corresponding period in the previous year" on the gap in the level of positive sentiment in the regional socio-economic system's information environment, which in turn is formally and logically substantiated. However, the direct impact of the change in the "ratio of healthcare institutions using the internet to the total number of healthcare institutions" determines the need to

exclude it from further analysis. Thus, in this case, indicator S3, "real accrued wages as a percentage of those earned in the corresponding period in the previous year", is decisive. At the same time, the coefficient of elasticity of this indicator is -0.52%. Based on the results of the regression analysis, infrastructural factors, as well as some natural, industrial and social factors, can be completely excluded.

Next, it is necessary to consider the resulting part of the conceptual model, which describes the impact of the core (the state of human resources) on the set of resulting indicators. The system of criteria described earlier is also preserved for these paired regression equations. First, we consider the impact of changing the gap in the level of positive sentiment in the regional socio-economic system's information environment on indicator R1, "the number of crimes (murder) registered in the reporting period under Art. 105 of the Criminal Code of the Russian Federation". Based on the results of the analysis, the following regression equation is obtained (formula 14):

$$R_{1_i} = 75,6 + 930,7 * D_i^{pos} \quad (14)$$

The value obtained from Fisher's F-test is 0.05, indicating the model's sufficient level of significance. However, the coefficient of determination is 0.49, which explains less than 50% of the variance of the endogenous variable. Since only a pairwise regression model is considered, it can be assumed that this level is sufficient in an isolated form. A comparison of the dynamics of the actual and theoretical values of the endogenous variable confirms this thesis.

As shown in Figure 6, the actual dynamics of the number of crimes (murder|) registered in the reporting period under Art. 105 of the Criminal Code of the Russian Federation are sufficiently different from the theoretical one. Thus, it can be argued that the management of this indicator through the administration of the information environment is mathematically possible but not effective enough.

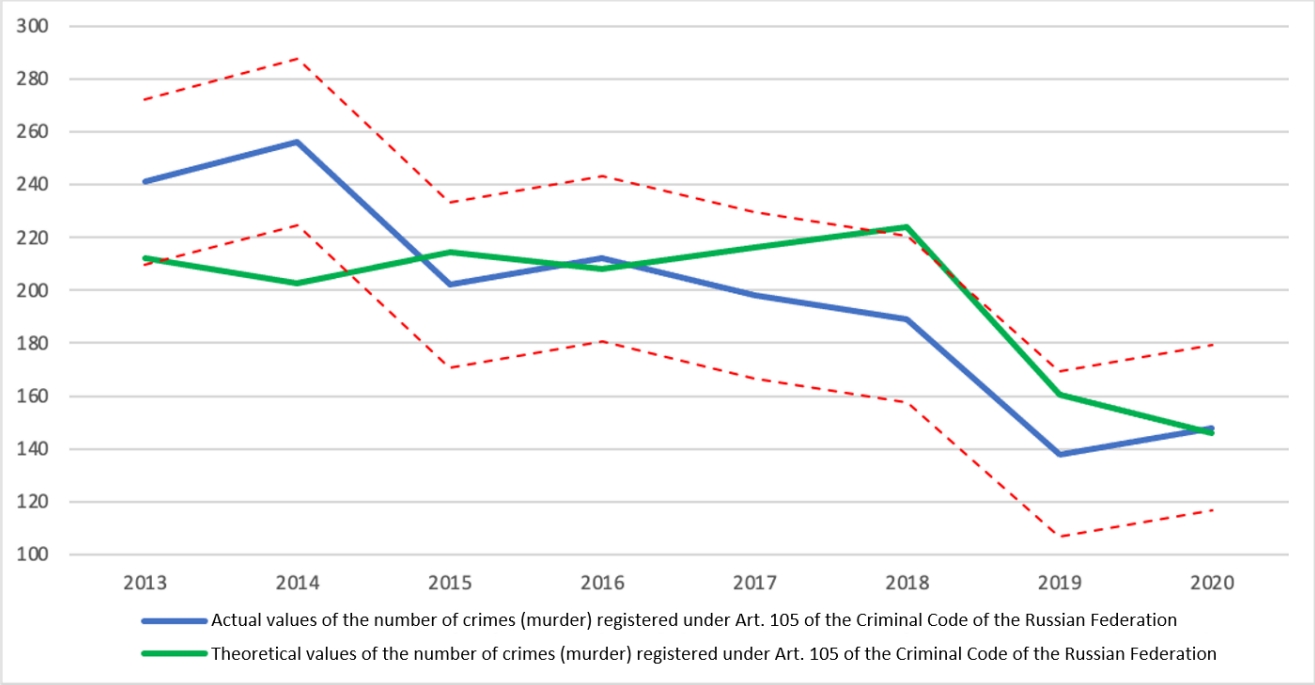

Figure 6. Dynamics of actual and theoretical values of the number of crimes (murder) registered under Art. 105 of the Criminal Code of the Russian Federation, depending on the gap in the level of positive sentiment in the regional socio-economic system's information environment (Karpenko, 2021)

The use of this approach to management is expedient only in combination with other, more effective tools. The coefficient of elasticity in this case is 0.62%, which is logically justified.

Next, we consider the impact of changing the gap in the level of positive tonality in the regional socio-economic system's information environment on indicator R2, "the number of crimes (intentional

infliction of harm to health) registered in the reporting period under Art. 111 of the Criminal Code of the Russian Federation". Based on the results of the analysis, the following regression equation is obtained (formula 15):

$$R_{2_i} = 257,7 + 1434,5 * D_i^{pos} \quad (15)$$

The value obtained from Fisher's F-test is 0.08, indicating the model's sufficient level of significance. However, in this case, the coefficient of determination is 0.41, which explains only 41% of the variance of the endogenous variable. A comparison of the dynamics of the actual and theoretical values of the endogenous variable is shown in Figure 7.

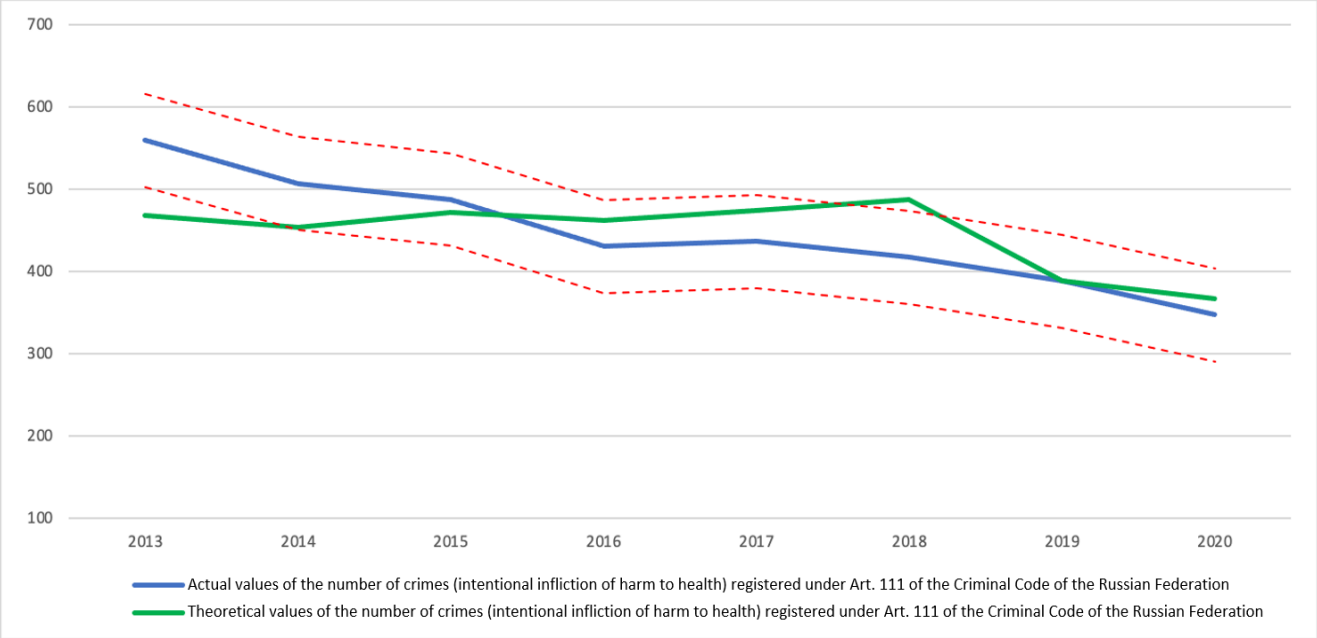

Figure 7. Dynamics of actual and theoretical values of the number of crimes (intentional infliction of harm to health) registered under Art. 111 of the Criminal Code of the Russian Federation, depending on the gap in the level of positive sentiment in the regional socio-economic system's information environment (Karpenko, 2021)

As illustrated in Figure 7, the actual dynamics of the number of crimes (intentional infliction of harm to health) registered in the reporting period under Art. 111 of the Criminal Code of the Russian Federation sufficiently differ from the theoretical one. At the same time, until 2018, the dynamics have been multidirectional, indicating a potentially extremely low efficiency of influencing this indicator by managing the region's information environment. The use of this approach to management is expedient only in combination with other, more effective tools. The coefficient of elasticity in this case is 0.42%, which is logically justified.

Next, we consider the impact of changing the gap in the regional socio-economic system's information environment on indicator R3, "the number of crimes (rape) registered in the reporting period under Art. 131 of the Criminal Code of the Russian Federation". Based on the results of the analysis, the following regression equation is obtained (formula 16):

$$R_{3_i} = 30,67 + 234,46 * D_i^{pos} \quad (16)$$

The value obtained from Fisher's F-test is 0.075, indicating the model's sufficient level of significance. The coefficient of determination is 0.43, which explains only 43% of the variance of the endogenous variable, representing an insignificant result. A comparison of the dynamics of the actual and theoretical values of the endogenous variable is shown in Figure 8.

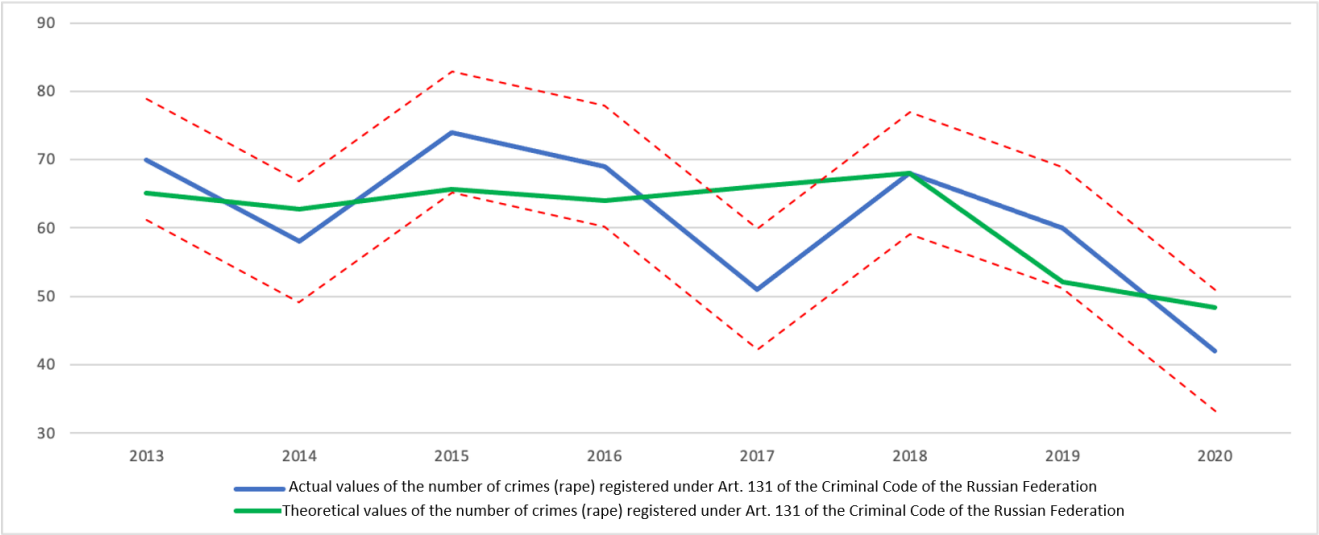

Figure 8. Dynamics of actual and theoretical values of the number of crimes (rape) registered under Art. 131 of the Criminal Code of the Russian Federation, depending on the gap in the level of positive sentiment in the regional socio-economic system's information environment (Karpenko, 2021)

As shown in Figure 8, the actual dynamics of the number of crimes (rape) registered in the reporting period under Art. 131 of the Criminal Code of the Russian Federation are comparable to the theoretical one. However, the much smaller amplitude of the change indicates a relatively low level of conversion of a potential managerial impact. The coefficient of elasticity in this case is 0.5%, which is more significant relative to the indicators considered earlier. Thus, the management of the information environment in the context of reducing the number of crimes (rape) registered in the reporting period under Art. 131 of the Criminal Code of the Russian Federation is expedient only in combination with other, more effective tools.

Next, we consider the impact of changing the gap in the level of positive tonality in the regional socio-economic system's information environment on indicator R4, "the number of crimes (hooliganism) registered in the reporting period under Art. 213 of the Criminal Code of the Russian Federation". Based on the results of the analysis, the following regression equation is obtained (formula 17):

$$R_{3_i} = 140,9 - 295,269 * D_i^{pos} \quad (17)$$

The value obtained from Fisher's F-test is 0.12, indicating the model's insignificance. In combination with the inverse nature of the established relation, it can be unequivocally stated that the management of the information environment in the context of reducing the number of crimes (hooliganism) registered in the reporting period under Art. 213 of the Criminal Code of the Russian Federation is statistically inappropriate. An identical situation applies to indicator R5, "the number of deaths (suicide) by main classes and individual causes of death per 100,000 people". The value obtained from Fisher's F-test of the generated equation is 0.17, which also reveals the model's insignificance.

Next, we consider the impact of changing the gap in the level of positive tonality in the regional socio-economic system's information environment on indicator R6, "the number of deaths (cases of alcohol poisoning) by main classes and individual causes of death per 100,000 people". Based on the results of the analysis, the following regression equation is obtained (formula 18):

$$R_{6_i} = 3,016 + 20,12 * D_i^{pos} \quad (18)$$

The value obtained from Fisher's F-test is 0.04, indicating the model's high level of significance. The coefficient of determination is 0.52, which is a relatively high result. A comparison of the dynamics of the actual and theoretical values of the endogenous variable is shown in Figure 9.

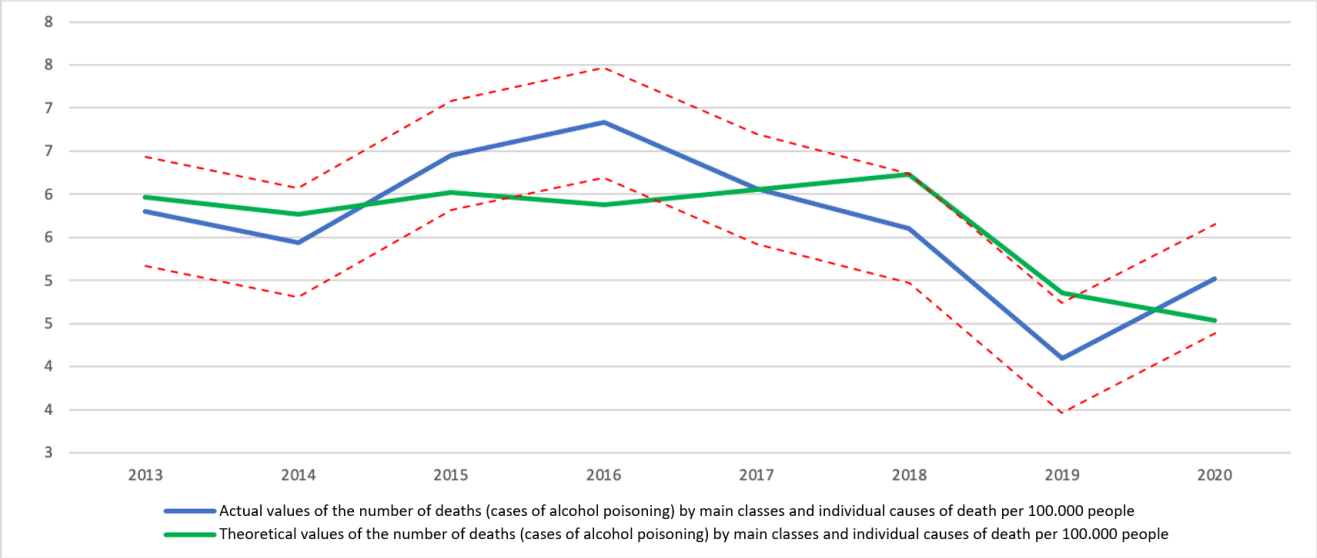

Figure 9. Dynamics of actual and theoretical values of the number of deaths (cases of alcohol poisoning) by main classes and individual causes of death per 100,000 people, depending on the gap in the level of positive sentiment in the regional socio-economic system's information environment (Karpenko, 2021)

As depicted in Figure 9, the actual dynamics of the number of deaths (cases of alcohol poisoning) by main classes and individual causes of death per 100,000 people are comparable to the theoretical one. The minor structural breaks in 2016 and 2018 most likely have economic and social underlying causes. The coefficient of elasticity in this case is 0.47%, which is significant enough. Thus, the management of the information environment in the context of reducing the number of cases of alcohol poisoning is quite appropriate.

In conclusion, let us consider a more specific indicator, which differs significantly from the previously considered "total number of unemployed in accordance with the methodology of the ILO" (R7). The value obtained from Fisher's F-test is 0.15, indicating the model's insignificance. In combination with the inverse nature of the established relation, it can be unequivocally stated that the management of the information environment in the context of reducing the total number of unemployed is statistically inappropriate.

5. Conclusion

In accordance with the confirmed conceptual model, it can be concluded that the volume of emissions of harmful (polluting) substances into the air, the GRP per capita and real accrued wages as a percentage of those earned in the corresponding period in the previous year play a decisive role in managing the region's information environment. This specificity determines the primacy of economic factors in the formation of a tonal gap in the information environment. Consequently, it is the economy that acts as the primary mediator of the development of the regional socio-economic system. Thus, a direct beneficial impact on the population's welfare outside the context of improving the infrastructure and social environment will significantly reduce the resulting indicators associated with mortality, whose conversion can be effectively managed through continuous monitoring of the tonal gap in the information environment and can affect the regional authorities' provision of social security. However, regional specifics must also be considered. Since this model is specified for St Petersburg, based on its management analysis, it is necessary to formulate a set of recommendations for the socially safe development of the regional socio-economic system.

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