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INTRODUCING SECTORAL
MODELS INTO REGIONAL
MANAGEMENT:
AN ASSESSMENT
OF REGULATORY
IMPACTS
ON THE ECONOMY

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Regardless of the geography of regions, management at the regional level, both in Russia and the Baltic Sea countries, faces many challenges. Hence, it is necessary to search for new effective economic management tools, since traditional approaches and modeling practices at the regional level are not suitable for either analysing various types of impact on regional economy (production, market (product), sector, region), or assessment of their consequences and identification of the necessary measures in any given economic conditions. The authors construct sectoral models to assess regulatory impacts on regional economic performance. Assessments of regulatory impacts on product value chains, economic sectors, and regions as a whole show good repeatability, which makes it possible to provide a rationale for economic decision-making. The authors propose new sectoral models using the Kaliningrad region as an example. The models are used in a comprehensive analysis of conditions for a GRP growth resulting from an increase in sectoral contributions. To this end, the study uses the well-known approaches of simulation modelling, as well as qualitative and quantitative methods in combination with economic-mathematical optimisation models. The article presents a pilot model of regulatory impacts for selected sectors of the Kaliningrad economy. The developed and tested models suggest that a rationale for economic decision-making and consequent actions should be based on the assessment of the impact of different groups of external, internal, and independent factors on value chains, based on the criterion of optimal factor income. In conclusion, the authors offer recommendations for using the proposed models in business, public administration and regional economic modeling.

Key words: region, economic sectors, simulation models, regulatory impact, value chain

Introduction

Today's complicated political and socioeconomic situation and limited budgetary resources prompt the question as to the priorities and preferred measures of public administration.



At a regional level, an economic dependence on external factors, which is the case in the Kaliningrad exclave [5; 22], translates into an urgent need for efficient public administration. This requires an analysis of traditional tools and mechanisms for supporting regional economies and the effect of such instruments on the performance and development of individual sectors, industries, or large businesses. Another avenue to explore is the search for new approaches and additional means to ensure a relatively stable socioeconomic situation and to lay the groundwork for economic growth.

Public administration and regulation practices suggest that authorities are increasingly faced with the need to take emergency measures in various spheres of social and economic life of Russian federal subjects. Such measures are needed to prevent negative consequences of the crisis variously manifested at all levels. It is very important to make an informed choice and find a rational solution for the effective use of limited resources to tackle the widest possible range of tasks.

The information support for regional decision-making usually involves using automated information systems (AIS) in public administration. Recently, Russian regions have increasingly benefitted from applying mathematical economic models and complexes developed by Prognoz, IBS, BARS-Group, Keysystems, Volgoinformset, etc. However, the most widely used approach is based on extrapolating current trends. Unfortunately, the great uncertainty and changeability of the environment render this approach increasingly ineffective and the use of current trends in estimating control actions is becoming inappropriate. Most mathematical economic models are tailored to the socioeconomic performance of individual regions. Although, taking into account changes in the national macroeconomic conditions, such models do not make it possible to estimate external effects on a regional system. A major methodological challenge is to develop tools suitable for providing a rationale for individual approaches and techniques for selecting control actions and relevant objects.

This study analyses the consequences of control actions and considers rationales for the selections of control action types and objects in public administration at a regional level. To this end, the authors investigate the effect of control actions on the current performance and development of economic sectors in the generation of factor income along value-added chains.

The object of this research constitutes an important area of study not only because of the relevance of the problems solved in public administration and governance. Of significance is the influence of the state on the socioeconomic situation in the region. This influence cannot be reduced to administrative or regulatory public policy tools (licensing, accreditation, control, monitoring, etc.). In influencing the economy and relevant social processes, the state uses different economic incentives and takes measures to prompt economic agents towards the desired behaviour and economic strategies in line with the goals and objectives of the national economic policy.

As new administrative objectives and challenges arise, national and international studies focus primarily on the efficiency of public regulation tools or the RIA system in the context of either individual sectors or the

economy in whole [see, for instance 1; 3; 11]. However, the information and analytical support for decision-making has been poorly studied. This also holds true for rationales for the selection of control actions. Such rationales require a comprehensive assessment of actions' consequences from the perspective of expected result.

The analysis of theoretical and methodological works on regional modelling and forecasting [4] suggests that, in an ever-changing environment, sectoral models should be built using the simulation approach. This article presents sectoral models for the agricultural, transport, manufacturing, and transport and recreation industries. The models were tested in the context of the Kaliningrad region. The experimental validation suggests that the models can be used effectively as a tool to assess control actions. The model can also be instrumental in identifying areas for further research and their practical application in public administration and governance and the RIA system.

Public administration efficiency: Objectives and new challenges for regions

Recently, the world economy has been faced with serious challenges. This inevitably affects regions and their socioeconomic development. Today, regions of the Baltic Sea region, the Kaliningrad exclave making no exception, must solve new problems relating to public administration efficiency. These problems stem from the need for proactive measures against the background of limited budgetary resources.

For instance, after 2014, the performance and development of the Kaliningrad region has been affected by the following regional factors and conditions:

- a high degree of institutional uncertainty (this encompasses the special economic zone (SEZ) regime, the legal framework for a special entrepreneurial regime (draft federal law), growing transaction costs, a lack of inter-institutional coordination, etc.);

- enervated financial leverages (a decrease in the proportion of non-repayable transfers in the 2017—2019 Kaliningrad regional budget, including a reduction in support for legal entities; limited availability of financial resources and loans to business; a lack of 'long-term money', etc.);

- falling demand for regional produce on both Russian and EU markets; a narrow regional market;

- the volatility of the region's environment (the dollar-euro basket exchange rate, sanctions, sales geography, external institutional conditions and barriers, the geopolitical situation — given that the region is surrounded by EU and NATO states, etc.);

- external factors alongside political and economic instability aggravate traditional regional problems — its exclave position, high dependence on imports, low labour efficiency and capital/labour ratio, insufficient infrastructure, etc.



Amidst new challenges, public administration priorities should deliver the principal goals of ensuring socioeconomic stability in the region and of attaining results in the shortest possible time using minimal resources. However, such public administration measures and functions as programming, planning, and strategizing have little effect on solving the above problems. An important objective is selecting the quality and types of actions aimed at a regional economy. Such actions will have a regulating effect on economic agents and ensure stability in line with the national policy goals. In the process, both administrative-legal and economic tools can be employed. The type of action is not prescribed. In certain conditions, priority might be given to either control or regulatory impacts.

In this study, a 'regulatory impact' is considered within the OECD [37] definition of public regulation, i. e. 'an independent area of public economic policy, distinct from fiscal and monetary policies' [11, p. 8]. As to 'control actions', the authors rely on a more traditional approach. Since an established terminology and a single definition of these concepts are missing in legal and economic literature ('public regulation' and 'public administration' have been considered by G. V. Atamanchuk [2], A. V. Klimenko and O. S. Minchenko [11], V. A. Kozbabnenko [8], M. V. Kostennikov [12], and B. A. Raizberg [16]), this study will focus on different types of control actions. Firstly, such an approach meets the aim of the research, which seeks to identify tools to provide a rationale for control actions' consequences rather than to select action types. Secondly, although control functions belong to administration, they focus on individual functions. Thirdly, under certain conditions, the institutes and tools of direct and indirect influence, whose performance will be analysed below, may serve as either regulatory or control impacts.

Thus, the problem of creating effective public mechanisms to influence a regional economy consists in finding appropriate tools to justify the approaches to and methodologies for selecting different action and object types rather than a matter of choosing between control and regulatory impacts. This problem pertains to both control and regulatory impacts, including those comprising the RIA system.

In developing necessary tools for assessing and justifying the selection of public action types and objects, it is necessary to consider the current level of information and analytical support for decision-making and modelling.

Theoretical rationale for sectoral models

Complex multi-aspect regional models, for instance IMPLAN or REMI are widely used across the world. The RIM model (Institute of Economic Forecasting of the Russian Academy of Sciences), SIRENA, SIRENA-2 (Institute of Economics and Industrial Engineering of the Russian Academy of Sciences), economic growth models, SAM models and numerous information and analytical systems of varying complexity, tailored to the needs of

individual territories, have gained popularity in Russia [4; 5]. Relevant software and models incorporate different forecasting approaches and techniques, which intersect and supplement each other. The most widely used are: the trend, balance, simulation, econometric, CGE and DSGE, and other models.

The well-known types of regional models make it possible to analyse macroeconomic trends very effectively. In the framework of current institutional 'rules of the game', and given smooth changes in the structure of the regional economy, those models can predict a significant number of socio-economic indicators, including assessment of alternative measures of economic policy at a regional level.

However, in a situation of high uncertainty accompanied by abrupt changes in business conditions, the existing regional models do not warrant any acceptable convergence of forecasts. Moreover, variously detailed calculations do not make it possible to assess regulatory impacts. As a consequence, decision making is reduced to expert judgments or historical analogies, which leads to biased views and erroneous assessments resulting in ineffective measures, and, in a worst-case scenario, to inadequate budget allocations and expenditures.

Some instances of the Kaliningrad region's economic performance in 2014—2016 are a case in point: their assessment cannot be made without additional economic and mathematical calculations within the framework of specially created regional software products or add-ins to the known regional models. The range of factors includes: a change in the geography of supplies caused by US- and EU-imposed sanctions against the Russian Federation; recently introduced subsidies to support the labour market; subsidies to compensate for railway costs; alternative mechanisms to develop the Kaliningrad special economic zone (concessions and preferences granted to advanced development territories, electronic visas for foreign nationals, tax concessions for certain categories of economic entities, lower minimum investment for SEZ residents, etc.). One should take into consideration a small number of large players (industries and sectors), whose production development results in significant displacements in the structure of gross value added (GRP) and foreign trade operations since the region primarily specialising in the production of final products has to import raw materials. In the Kaliningrad region, this is especially true for the manufacturing of food, machinery and equipment, electric equipment, electronic and optical devices, and vehicles.

It should be noted that these issues require prompt response and elaboration — which is not the case, given considerably long, and often expensive, programme development.

In this regard, it seems reasonable to work out simulation models that are rationally aggregated at the level of economic sectors. They can coherently interact with the tested regional models, complementing each other and giving an opportunity to take into account indirect reactions to changes of circumstances and regulatory impacts, both in the sectors and in the regional economy as a whole (fig. 1).

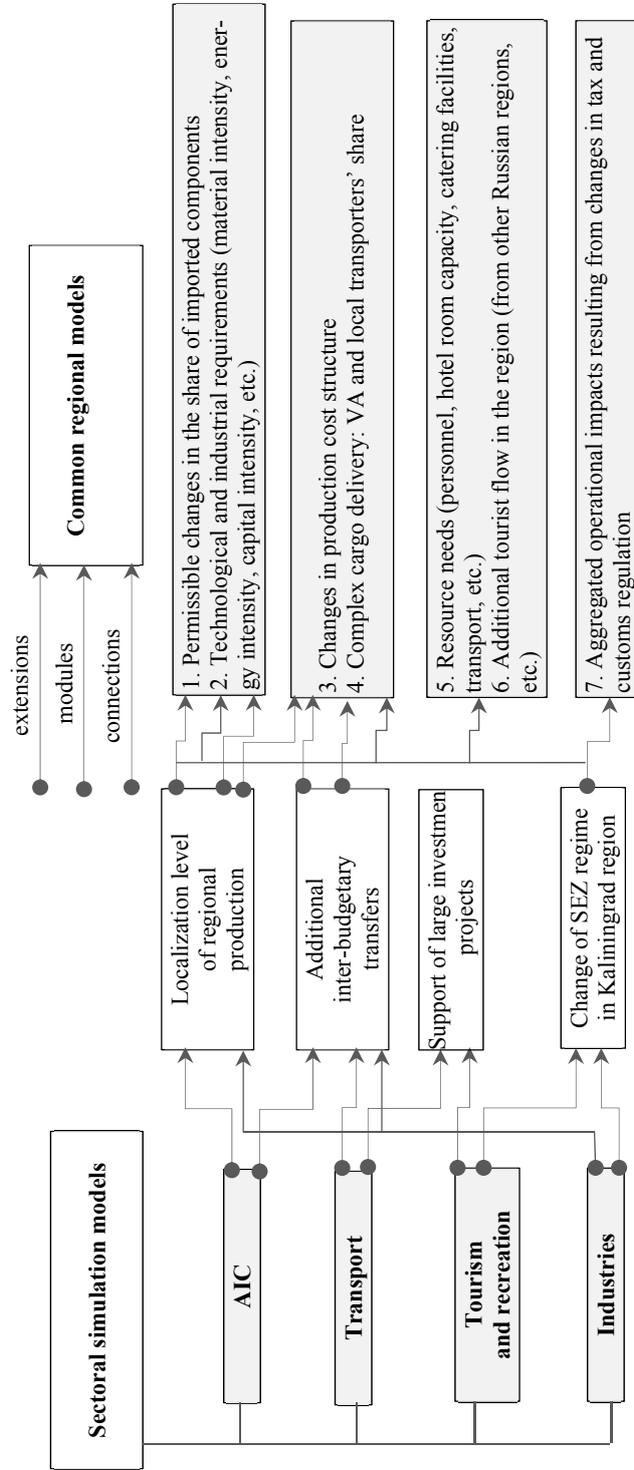


Fig. 1. New factors and conditions taken into account by sectoral models, as applied to universal regional models (fragment)

Comment: AIC stands for 'agricultural industry complex', SEZ for 'special economic zone', and VA for 'value added'.
 Source: compiled by the authors.



Research conducted in Russia and beyond shows that the methodology for creating such models most often hinges on the theory of value chains [15]. However, the structure of such models is not universal, as it is largely determined by concrete goals and objectives set by researchers and practitioners. So far, no models have been identified that could suit the purpose of rapid analysis of regulatory impacts on the sectors crucially important for individual regions (such as the Kaliningrad region); no such models can be integrated with regional ones either.

Therefore, the aim of this work was to form a methodological basis for the research project; to develop, and, in formats suitable for interfacing with regional models, to test a system of particular models on individual product chains and in certain sectors (manufactures). For implementation purposes, sectoral models are regarded, provided they are interconnected with the software analysis of situational forecasting and the socio-economic development strategy of the Kaliningrad region (Certificate of state registration of the computer program No. 2016617454 of July 06, 2016; the right holder: IKBFU)¹.

This necessitates searching for tools to assess the generation of value added at the level of individual markets and industries, since the process has an immediate bearing on competitiveness. The best solution to this problem still lies in analysing value chains. Researchers are increasingly focussing attention on value chains [see, for example, 13; 19; 20; 24; 25; 27—30; 33], whereas the methodology is gravitating towards input-output table analysis [see 21; 23; 34; 35; 38; 39]. Despite a shift in research priorities, it remains a fact that analysing value chains makes it possible to investigate different aspects of inter-company interactions, barriers to, and restrictions on, the development and competitiveness of individual economic agents. Such an analysis also helps to identify factors and conditions affecting redistribution of value added and growth.

Methodological support for building and testing regional sectoral models

Pilot modelling was performed for such regional industries as agriculture, transport, manufacturing, and tourism and recreation. The following objectives aimed at designing the necessary methodological framework and tools were attained:

- to work out a methodological approach to the description of product value chains and their aggregation within the framework of industries, complexes, and sectors;
- to formalize the representation of product value chains;
- to analyse the availability of baseline data for building product value chains in relation to the industries, complexes, and sectors under study;
- to develop toolkits for collecting and aggregating data to be used to construct value chains and supplement them, in case complete and reliable information from their individual links or participants is unavailable;
- to work out a technique of interfacing it with regional models.

¹ It is based on the ‘Region’ model of regional socioeconomic performance developed by Prof. V.A. Tsybatov (Samara State University of Economics) [18].



The following pilot studies were carried out for the Kaliningrad region's economic sectors (agribusiness, transport, industry, tourism and recreation):

- development of pilot models of product value chains;
- construction of scenarios for the application of pilot types of regulatory impacts;
- calculation of scenarios for the formation of value added in accordance with the selected pilot types of regulatory impact;
- analysis of convergence of results and stability of models;
- recommendations based on the pilot studies results regarding the justification of the selected types of regulatory impacts in industries, complexes, and sectors.

Within the framework of this study, product value chains were analysed for selected economic sectors in the Kaliningrad region. The detail level of the product chains was determined through the analysis of inter-branch relations [1; 28], starting from the sources of raw materials and materials for suppliers, and ending with finished products delivered to the end user and after-sales service. This approach makes it possible to establish the main activities (links) of chains involved in creating product value for the end user.

We took into account that business specialization does not automatically imply company's participation in a single chain of value creation. Economic agents become links of a value chain under these two conditions: 1) joint production with other links and appropriation of economic rent; 2) coordination of actions with other participants through management (a) within the framework of the classical hierarchy or (b) quasi-integrated (hybrid) structure [17]. Ideally, identification of a value chain and all its participants should involve a specialized research project based on the priority of a qualitative methodology with heavy reliance on quality interviews and case studies. For lack of reliable and adequate results of value chain identification in the Kaliningrad region in the course of the present study, the identification was done through in-depth interviews; quantitative methods were also used for the survey of businesses in the Kaliningrad region.

The exhaustiveness and quality of expert evaluations serves as a basic limitation in investigating economic agents and applying the data obtained in modelling. With these issues in view, cross-interviews were conducted to ensure the desired correctness and representativeness of baseline data; the results of in-depth interviews and questionnaires were compared with statistical information and industry reviews based on independent experts' evaluations of the obtained results.

Expert estimates reinforced by statistical data from the Rosstat (Federal State Statistics Service) and Kaliningradstat (Kaliningrad Statistics Service) were used as baseline data for constructing sectoral models; verification procedures and supplementing the original data ensured representativeness of results.

Within the framework of sectoral models, modelling of value added was carried out; to that end, the interaction of participants in value chains was to be optimized to meet the criterion of the maximum value added at the point of selling finished products — that is, at the output of the chain. Thus, the optimality criterion is the total amount of factor incomes created in the chain. The initial impetus for optimization comes from defining the parame-

ters of the demand function for the end product of the value chain, which makes sense both in terms of motivating the participants of the chain, and forming a value for the ultimate consumer.

In this setting, value added is determined in the links of the production chain of raw materials and their processing (finished products), constraints considered. An optimization model of cooperation with the interval values of some key parameters is constructed. In the course of modelling, the interactions of the chain participants are taken into account (all technologically interconnected industries and stages of material flows; all economic entities and activities — all those are combined into a single production and economic system). Thus all the cooperative processes in the chain are described with the help of a block structure [17].

The work resulted in implementing the sectoral models using MS Excel™ software.

Methodologically, construction of sectoral models enjoys the following possibilities. Firstly, to solve a direct problem: to identify the degree of influence of individual, or a combination of several, regulatory factors on the change in value added in the sector (specified by the user as scenario parameters). Secondly, to solve an inverse problem: which regulatory impacts are required to achieve the desired (target) state of the sector. These impacts are identified through the target value of the value added in the sector, or the conditions that affect its change. Thirdly, search for the value added (both direct and inverse tasks), involves calculating all related and derivative indicators that characterize the state and development of the sector and the value chain. Those indicators include financial and economic, production, technical and technological ones.

The sectoral models for the Kaliningrad region were tested through solving local tasks of the agricultural, transport, manufacturing, and tourism and recreation industries.

AIC. The value added in the Kaliningrad AIC was modelled for the key types of regional produce — processed and preserved vegetables (salted vegetables, peeled and boiled vegetables, sauces, ragout, fruit preserves and jams, etc.), meat and meat products, and milk and dairy products. The model solves the problem of optimising interactions between chain elements, based on the criterion of maximum value added with interval estimates of certain key parameters. The effect of control actions is taken into account, with such variables as: currency exchange rates, level of production localisation, crop yield, production capacities, output, etc.

The model for AIC was used to investigate the conditions for the development of milk and dairy products markets, and for cultivating and processing of vegetables, with regard to the prohibited import of certain agricultural products, raw materials and foodstuffs to the Russian Federation introduced in response to the sanctions imposed by EU, US, and other states. The required increase of localization (reduction of imported raw materials, components, equipment, etc.) was estimated to preserve a guaranteed value added.²

² Guaranteed value added is the value added by regional agricultural producers or processors in the previous (base) period.



Transport. Modelling of the transport sector in the region is based on the SATTKO software (the System for Ascertainning the Transport Tariff and Value added for the Organization of Transportation by Various Types of Transport in the Kaliningrad Oblast). Calculations were made to estimate transportation and total delivery cost of certain cargoes, by the mode of transport and by destinations (export and import; import to, and export from the Russian Federation; transit). The model makes it possible to gauge the conditions of inter-transport switching by certain types of cargo, and to estimate value added at the stages of its formation in the sector: legal support, insurance, storage (forced and contractual), loading and packaging, transport leasing, and transportation. In the transport sector, modelling of value added revealed factors influencing an increase thereof. A stress scenario in the Kaliningrad Oblast was assessed, in case only a sea transport connection with other parts of the Russian Federation is available (via the Baltic Sea); with the seaport as an example, subsidizing of the transport tariff was also regarded.

Manufacture. Furniture manufacturing in the Kaliningrad region was taken as an example for modelling in industry. On the basis of the value added chain of hypothetical furniture products in the region, an operating model was constructed for a specific case of commercial production and sales through wholesale-retail channels.

The model is meant for optimizing the interaction of the chain participants according to the criterion of maximum value added, with the interval values of some key parameters. The example of exchange rate fluctuations and the level of localization illustrate the possibilities of scenario modelling of value added in the furniture production.

In the 'industry' section of the research, the inverse problem was solved, with furniture manufacturing as an example. The formation of value added in value chains was evaluated for pessimistic, optimistic and compromise scenarios (exchange rate fluctuations, purchasing power of the population, cost of labour, consumer preferences, cost of funds, tax burden, end of the transitional period of the SEZ, etc.). Thus it became possible to identify regulatory factors promoting long-term sustainability and production in the sector. Crucial role is played by the measures influencing technical and technological levels of production and transport tariffs, and the measures taken to support integration in unfavourable market conditions.

Tourism and recreation. For creating value added in the tourism and recreation sector of the Kaliningrad region a two-dimensional model is presented here for estimating the value added when major investment projects are planned for implementation, with resource constraints taken into account.

The estimation was carried out for the total value added in the sector, as well as that for individual services as part of the tourist product (accommodation, catering, tourism, guided tours). The model determines the required investment size in the fixed capital, and achieved multiplier effect for the region's economy, which is reflected in the change in value added in related industries.

The following investment in tourism and recreation planned for implementation in the Kaliningrad region were estimated with the help of the

above model: modernization of the Khrabrovo airport, construction of a variety show venue, construction of the World Cup 2018 facilities, construction of The Amberland in Kulikovo, etc. The limitations and constraints taken into account were as follows: human resources, infrastructure, capacity of recreation, entertainment and service facilities. The required amount of resources for implementing investment projects and possible multiplicative effects were estimated.

At present, work is underway to automatically configure the extensions of the IKBFU software-analytical complex for situational forecasting and the development of socio-economic strategy of the Kaliningrad region; the considered sectoral models are to serve as a basis for creating additional modules.

Practical application of sectoral models

The table below shows possible areas of application for sectoral models. These include technology, labour efficiency, individual companies, institutions, system of support measures, etc.

Table

Practical applications of sectoral models (fragment)

Assessment parameters and development factors	Region's choice (in view of a region's development conditions and potential)	Outcome
Labour efficiency	HR and labour market equivalent	GRP
Manufacturing and services	Potential of value added growth and regulatory impact selection	Sectors' contribution to GRP
Business support measures	Lowering of barriers; solving the problem of excessive and unjustified concessions	Production. New companies. GRP
Institutions	Rationale for entrepreneurial regimes	Business activity and investment climate
Investment projects (Including infrastructure)	Anchor investors and strategic priorities	Selective support for priority projects
Agent integration and interactions (global chains)	Efficient forms of integrating businesses into global value chains	GRP, exports, income
Stress scenarios under changed conditions	Package of preventive and crisis intervention measures	Regional system stability
RIA	Selection filters	RIA efficiency
Labour efficiency	HR and labour market equilibrium	GRP

Source: compiled by the authors.



The results obtained for companies and sectors are integrated in view of the macroeconomic indicators. The following additional effects are achieved at the regional level:

- budget: reduction in R&D, forecasting, analysis, and software purchase and maintenance costs;
- HR: reduction in funds and staff training time; recruitment of forecasting specialists;
- forecasting: accurate forecasts, a comprehensive vision for markets and sectors;
- decision-making: accurate assessment of the efficiency of decisions and the economic effects of selected measures; an analysis of decisions in view of macroeconomic indicators;
- databases: generation of analytical data and information in markets, companies, and sectors, and their effect on a region's performance and development.

Sectoral model construction and aggregation is a vertical processes proceeding from the level of a company to that of a region. From a business perspective, the following analytical information can be obtained:

- assessment of value added by products and businesses; value added in the context of business processes and production costs. This is instrumental in analysing both efficiency and bottlenecks;
- connection between an increase/decrease in value added and growth/reduction in operational operating efficiency (sales, costs, revenues). Identifying the causes of inconsistencies;
- estimating consequences of public regulation measures for business, from the perspective of operational efficiency and changes in value added;
- identifying optimal mechanisms for yield growth, including support for interactions within value chains.

The approach and model presented are not exclusively regional tools, since regional administrations focus primarily on operational tasks, available resources, and the boundaries of impacts and effects on the regional economic policy. The proposed tools may prove helpful at the federal level, as regards solving administration problems, including strategic issues, or providing a rationale for selected measures aimed to improve the situation in regions.

Conclusions

The proposed tools and sectoral models have been used in assessing the impact of hi-tech businesses (entry of large players), the efficiency of import substitution projects, increase in labour efficiency, and the effectiveness of industry-specific strategies and programmes.

The testing and pilot application of sectoral models proved their effectiveness and development potential. The features of sectoral model construction make them available to different territories across Russia and the Baltic Sea region. The obtained assessments provide the rationale for decision-making, which translates them from the level of intuitive expert judgements to that of a rational choice.

A promising area for further research is to solve the methodological problem of constructing a comprehensive regional model based on sectoral models. The regional model will use the system of macroeconomic indicators to obtain an aggregate assessment of the consequences of control actions.

The relevance of the theoretical basis and practical importance of the obtained results in the assessment of regulatory factors with the use of sectoral models has triggered preparation of a series of publications on the use of specific types of models (agribusiness, transport, industry, and tourism and recreation) in public administration at the regional level.

The authors express their gratitude to the IKBFU group of experts, young researchers, and post-graduate students for their participation in constructing sectoral models. The latter were developed within the project for creating university analytical software for regional R&D support system in the socio-economic sphere.

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