

# City – “a Point of Economic Growth and Social Development”. or Otherwise?

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**Abstract—Background/Objectives:** city has been viewed as a place of location of productive forces; therefore, it attracts investment and skilled personnel. At the same time, urban sprawl causes multiple acute social issues. The main city development concepts are given and methods of evaluation of the city socio-economic development have been analyzed.

**Methods:** the main steps of the city dynamics analysis have been suggested where methods of correlation and regression analysis are used to rank the main factors of sustainable development.

**Findings:** it is established that the social factor is the most significant and positive factor having an impact on the gross municipal product, with the investment lag being minimum three years.

**Applications/Improvements:** to ensure the increase in the gross municipal product the socio-economic interests of local residents should be coordinated with the interests of local businesses which is, first of all, expressed in the municipal socio-economic policy. Areas of interaction between the main structural elements of the city system have been identified.

**Keywords—***City development concept, Econometric model, “convolution” of indicators, Sustainable development, Growth of economic indicators.*

## I. INTRODUCTION

City has always been viewed as a place of location of productive forces. Territorial proximity of companies and enterprises, concentration of various institutions in a relatively small area, availability of social and economic infrastructure plays its role in cost reduction which, in its turn, increases the interest of the business community in production development and, consequently, attracts investments and skilled personnel thus favoring the city growth and development. Evolution of cities increasingly turns them into the community center in all of its aspects (economy, politics, culture, science, etc.) and generates new problems becoming the subject of new researches and new approaches [1].

At the same time, the growth of cities, in its turn, leads to accumulation of too many people in small areas and comes with increasing inconveniences which gives rise to multiple acute social issues related with economic disparity, crime (which is much harder to tackle in urban conditions), rising resource consumption, and urban pollution. Excessive increase in resource consumption results in sophistication of traffic streams and rise in cost of cargo transportation, increase in costs for development and maintenance of urban economy, and upset of necessary interrelations within the city structure [2-3].

## II. LITERATURE REVIEW

But is the growth of cities always reasonable? There are various concepts of growth and development of cities (Table 1).

TABLE I. MAIN CITY DEVELOPMENT CONCEPTS

Key points	Characteristics
1 A concept of primary and non-primary city activities: city <i>justifies</i> its existence and development in case if it can provide for: – external functions: reproduction processes conditioned by social and territorial division of labor and aimed at the communication with the outside world; – internal functions: reproduction processes satisfying various needs of city-dwellers themselves and intraurban needs	Comprehensive approach to development of cities taking into account economic and social aspects.
2 A concept of local communities: city may function properly if a combination of production factors in this city provides for the income which is normal for such community and for the corresponding level of satisfaction of the population needs.	Social development of the territory is of the highest priority.
3 A concept of sustainable development: combines the aims of stable and dynamic social and economic growth on the one hand and reliable natural, resource and ecological safety of development on the other hand.	System approach taking into account not only economic and social aspects but also the ecological aspect which includes limitations on the growth of large cities.

The city dynamics and sustainable development are the key factor of the economic growth of the region and the entire country. The city sustainable development is understood as a growth of economic indicators, improvement of life quality of city residents (increase in social indicators) and increase in these indicators as compared with the previous period, i.e. monitoring of changes. Now we analyze the results of researches of sustainable development of the urban economy in works of Russian academic economists [4] - [8]:

– production functions have been made based on panel data for various urban economy sectors;

- the industrial output is chosen as a resulting value indicating the economic status, and the local government revenue per head of population - as the resulting value of social status (for the single-industry city economy);

- to measure the development level of a city such indicator as the gross municipal product (GMP) is being used and econometric models have been worked out to reflect the dependency of this indicator per head of the city population upon changes of various factors. Still there is no established unified procedure of this indicator calculation and it is not used in the Russian statistical records. The following main methods of this indicator calculation have been documented in scientific literature (production method (income approach); expenses approach and factorial method [9]); all of them have both strengths and weaknesses.

### III. RESEARCH METHODS

Is the increase in the GMP always linked to the upward trend of economic indicators? In other words: does the GMP increase influence the city sustainable development?

To answer this question, we build an econometric model reflecting the GMP's dynamics. Then we analyze how the GMP's dynamics correlate with the growth of economic indicators and reveal the most significant ones. Below we systematically examine the main steps of analysis of the city development dynamics.

1. Building ARIMA model reflecting the GMP's dynamics and determining investment lags.

2. Identifying factors that form the GMP's tendency. We identify the following factors: economic, ecological, social and exogenous (factors which may not be influenced at the municipal level). To analyze these factors various indicators are required which are calculated based on the available statistical records. Indicators may be grouped. Each group of indicators characterizes a certain aspect of the city development process. Indicators are grouped and represented in the form of the X-matrix. A minimum number of indicators is required for the analysis that reflect the reasons and expected impact of dynamic processes generated by the taken managerial decisions.

3. Transfer to the aggregates that characterize the economic and social aspects of the city life. Therefore, we use a method of "convolution" of indicators which is described by us in detail [10].

We shall shortly mention here that "convolution" (quantity reduction) of indicators is performed by conversion to aggregate  $Z_k$ , where  $k=1,2$ , which corresponds to the economic and social aspect. Each element of k-aggregate is calculated according to the following formula:

$$z_{ki} = \sum_{j=1}^{m_k} w_{kj} * x_{ij}^k / m_k, \quad (1)$$

where  $z_{ki}$  –  $i^{\text{th}}$  element of  $k$ -aggregate;  $m_k$  – number of indicators in the group which is related to  $k$ -factor;  $x_{ij}^k$  –  $i^{\text{th}}$  value of the  $j^{\text{th}}$  indicator included in  $k$ -group;  $w_{kj}$  – weight of  $j^{\text{th}}$  indicator in  $k$ -group which is calculated according to the formula (2)

$$w_{kj} = R_{YXj}^k / \sum_{j=1}^{m_k} R_{YXj}^k \quad (2)$$

where  $Y$  – vector of GMP values for the selected period of record;  $R_{YXj}^k$  – correlation factor between  $j^{\text{th}}$  indicator in group  $k$  (the corresponding column of the X-matrix) and the vector of GMP values.

4. Building a multiple linear regressive model based on the aggregates [11-12]; comparative analysis of regression coefficients, and elasticity coefficients calculated based on the regression coefficients.

5. Selecting a most significant factor. Elasticity coefficients allow ranking the factors in order of importance of their influence on the GMP increase. The maximum coefficient of elasticity in absolute value will correspond to the most significant factor. The sign of both elasticity coefficient and the regression coefficient indicates what impact (positive or negative) the factor has.

6. Based on the obtained results the municipal authorities take political decisions to increase the impact of positive factors and neutralize the impact of the main negative factors.

### IV. RESULTS

The suggested approach was used to assess the sustainable development of the city of Vladivostok. The choice was conditioned by the fact that Vladivostok is the largest city in the East of Russia in the region where economy is undergoing through intensification and where there is increasing economic interest from the countries of the Asia-Pacific region. A time series was used as background data for model building with the following elements: the GMP annual growth rate and a period of record from 2003 to 2016. The model was implemented in Gretl software package for econometric analysis. As a result of model fitting and validity check ARIMA model was obtained (2, 1, 1). Calculation data are given in Table 2.

TABLE II. CALCULATION DATA OF ARIMA MODEL COEFFICIENTS (2, 1, 1)

Model: ARIMA, observations 2003-2016 were used (T = 14)				
Estimated using the Kalman filter (exactly Max likelihood method)				
Dependent variable: (1-L) VMP_temp				
Standard errors are calculated based on Hessian				
Coefficient	St. error	z	P-value	
const	-0,0191301	0,00591884	-3,232	0,0012 ***
phi_2	-0,404941	0,245212	-1,651	0,0987 *
theta_1	-1,035000	0,246846	-4,051	5,10e-05 ***

All model coefficients are significant; residues do not fall outside the credible intervals and are normally distributed. Actual value of GMP2016 = 224.8 thousand rubles per head, model-based calculated value of GMP2017 = 228.4 thousand rubles per head. Against the background of a general downward trend of the GMP growth rate the forecast for 2017 demonstrates a small increase in the GMP volume as compared to the previous year. Investment analysis showed that the investment lag is 3 years; to obtain this value we successively calculated correlation coefficients between the GMP and the volume of investments raised by the municipal budget with time lags of

1-4 years:  $R_1 = 0.222$ ;  $R_2 = 0.589$ ;  $R_3 = 0.656$ ;  $R_4 = 0.327$ . Based on preliminary analysis of statistical data [13] - [18] base values  $X_1 - X_{11}$  (Table 3) were selected which were convolved (formulas 1 – 2) into aggregates  $Z_1 - Z_3$ .

TABLE III. ASSESSMENT OF FACTORS OF DEVELOPMENT OF VLADIVOSTOK CITY, FOR THE PERIOD OF 2002-2016

Factor	Indicators of the level of development of Vladivostok city, modified to the level of 2002, %	Weight factors $w_i$	Regression coefficients	Elasticity	Factor rank
$Z_1, m_1=3$ Economic	$X_1$ Mining operation	0.30	0.79	0.44	2
	$X_2$ Manufacturing	0.35			
	$X_3$ Generation and distribution of power, gas and water	0.35			
$Z_2, m_2=4$ Social	$X_4$ Average monthly salary	0.43	0.86	1.54	1
	$X_5$ Amount of registered crimes	0.28			
	$X_6$ Number of passengers carried by buses per year using intraurban routes	0.19			
	$X_7$ Area of built domestic houses	0.10			
$Z_3, m_3=4$ Ecological	$X_8$ Atmospheric emissions of particulate matters	0.31	-0.48	-0.09	3
	$X_9$ Nitrogen dioxide emissions	0.16			
	$X_{10}$ Sulphur dioxide emissions	0.38			
	$X_{11}$ Carbon dioxide emissions	0.15			

Each of them assays one of the main factors having impact on the GMP growth. The aggregates were used to build an equation of multiple linear regression. Dependent variable  $Y$  – the GMP per head of population of Vladivostok city, rubles per person, modified to the level of 2002. Not all aggregates are significant according to the Student's t-test which may be explained by a short period of record. But we do not set ourselves a task of forecasting, that is why we included them in the regression model based on economic feasibility.

## V. DISCUSSION

Analysis of data given in Table 3 provides for the following conclusions. The most significant and positive is not the economic but the social factor – the highest elasticity coefficient corresponds to it. Therefore, the more funds are invested in the development of social spheres and city infrastructure, the higher the GMP growth rate and the more attractive the city becomes for the population. Ecological factor has a significantly strong negative impact on the GMP growth of Vladivostok city despite significant investments in this field. Elasticity value of this factor is not the highest one which is explained by a signif-

icant time lag between hazardous substances emission and consequences affecting the health of the city population. We consider that improvement of environmental situation in the city shall be one of the most important areas of the outward-looking municipal policy. To ensure the growth of the BMP it is necessary to reconcile the social and economic interests of local residents and local businesses which is expressed, first of all, in a comprehensive municipal policy (Fig. 1).

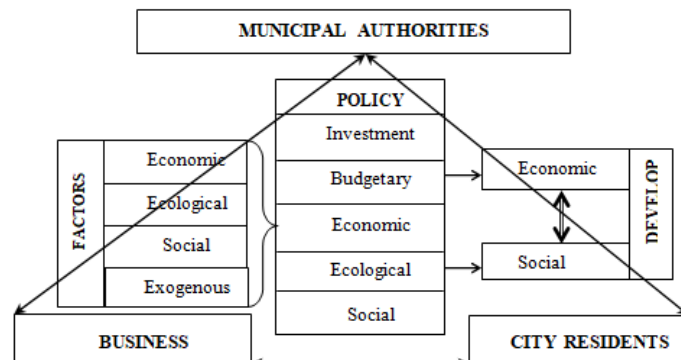


Fig.1. Pattern of interaction between city structures.

Various forms of interaction are required to create and maintain partnership relations between representatives of business, municipal authorities and urban community. We identify three key points of interaction.

1 Municipal authorities – Business, areas: implementation of priority national projects and programs of the city socio-economic development; financial backing of ecological projects; promoting the development of various businesses.

2 Municipal authorities – City residents, areas: transparency and awareness; exposure of information about budget expenditures in the social sphere; civil responsibility and public involvement.

3 Business – City residents, areas: job security for people; financial backing of donation funds.

## VI. CONCLUSION

Our model will allow creating scenarios and justifying predictive and analytical indicators of the city economy. But to assess the effectiveness of the municipal socio-economic policy a system of feedback monitoring is required, i.e. the decision-making process shall be coordinated between all structural elements of the city system. Otherwise, the city will only be a point of attraction of federal investments, and not the “point of economic growth and social development”.

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