

# Management of the development of the region: the attractiveness of the region and human potential

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**Abstract:** Using a comparative analysis of the data of the "passive" experiment, it was shown that an increase in the attractiveness of the region can be achieved by long-term, purposeful increase in human potential and by attracting corresponding additional investments

**Keywords:** predictive control, "passive" experiment, attractiveness, human potential, investments.

## 1. INTRODUCTION

The top-level control of the region – a large-scale socio-economic system (SES) – is the complicated process of realizing adequate administrative measures aimed at maintaining commensurate flows of material, labor, information and other resources in a regime that ensures a sustainable increase in the level of well-being. Such a goal can be achieved by a steady increase in the total productive potential (TPP) - the main driving force for the evolution of the system. From the positions of the top level of the regional control hierarchy, such a multidimensional and multilevel process is reduced to the activity of forming the desired channel of "attracting" solutions (the attraction channel in terms of nonlinear dynamics). At the same time, the top level of regional governance should be taken into account that the total productive potential is determined not only by material assets (physical capital, investments), but also by intangible (nonmaterial) assets. And the main component of intangible assets is human potential. It should also be noted that for developed economies of the world, the share of human potential in the total volume of TPP is 50-60% (see, for example [1]). Increasing the attractiveness of the region in physical (material) capital (for investment), as well as the desire to increase the human potential of the system is therefore the main objective of long-term predictive control of the region. In the competitive environment for resources, this task is quite difficult to fulfill. Success is largely determined by the long-term control activity to create favorable conditions for ensuring the social-economic merits of the governed region using the cultural and historical heritage. In the proposed letter, using the modified Poincare transversal surface method, using the "passive" experiment, the possibilities of improving the population welfare of the region by attracting qualified human resources and additional investments are considered.

## 2. INVESTIGATION CONCEPTS

Given the relatively slow process of establishing a dynamic equilibrium in the flow of a dissipative administrative environment, the rate of change in the chosen "order parameter" C

(the level of social-economic well-being) determined largely by the specific value of the regional gross product (of  $GDP_{reg}$  per person) can be determined with sufficient accuracy in the gradient approximation by the expression

$$\frac{dC}{dt} = \frac{\partial W(C, R)}{\partial C} + \xi(t) \equiv \frac{\partial (P_{nonmat} + P_{ph})}{\partial C} + \xi(t) \quad (1)$$

Here,  $W(C, R)$  is the total productive potential (TPP) of the system,  $R(t)$  is the vector of control actions,  $P_{ph}$  - the physical potential of the SES (based assets, investments),  $P_{nonmat}$  - is nonmaterial assets (human potential and its components). The second term -  $\xi(t)$  on the right side of the equation expresses the possibility of the influence of random perturbations on the trajectory of the SES development.

Dynamic equation (1) allows to study the process of long-term planned approximation of the region to the realities of the outside world from the results of observations of the course of socio-economic development using the "passive" experiment - using the basic provisions of the qualitative theory of nonlinear dynamics and physics of society

Analyzing (1) it can be seen that with the increase in the share of nonmaterial assets in the TPP system the dynamics of socio-economic development of the region will increasingly be determined by a skilful increase in the human potential. And, simultaneously, increasing the effectiveness of its use at all levels of the hierarchy of management of the system. The strategy of long-term predictive control therefore requires an adequate assessment of the main components of the human potential of the system and the identification of possible ways to increase them.

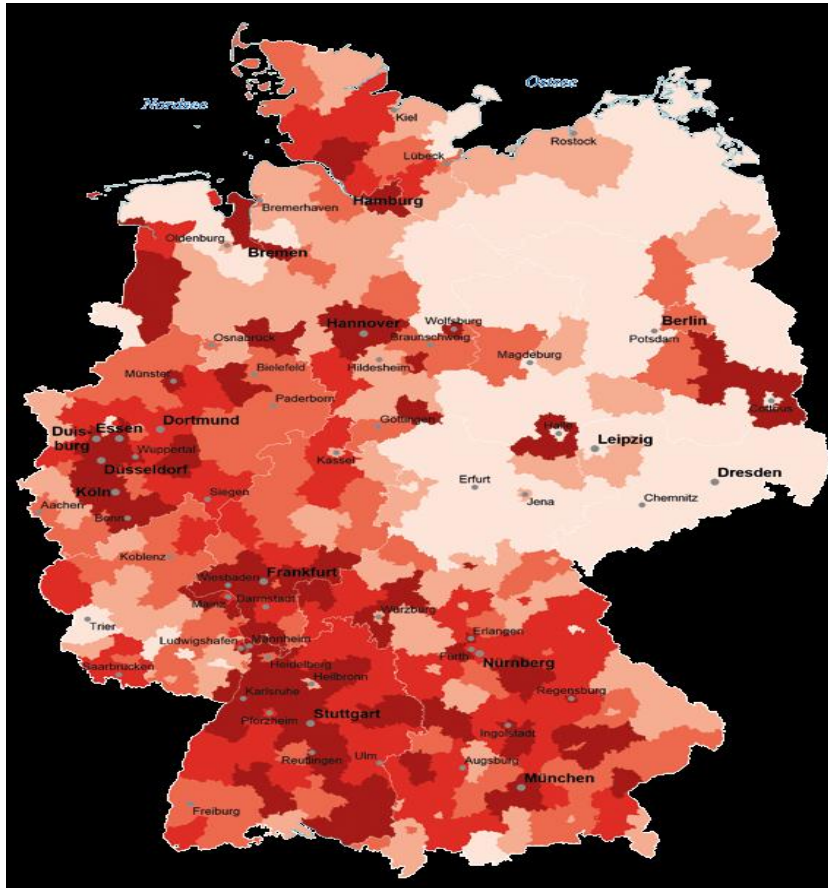
A qualitative assessment of the value of the human potential components of SES can be performed using the Human Development Index (HDI) - until 2013 as an index of human development. The determination of the HDI value is performed taking into account three groups of basic indicators.. These groups of indicators are estimated: life expectancy - longevity (determined mainly by the level of development of medicine); the level of literacy of the population (determined by the availability of educational institutions); the standard of living, estimated through the value of  $GDP_{reg}$  per capita at purchasing power parity.. It should be expected that it is the first two components of the HDI (the state of medicine and, accordingly, the level of literacy) that will determine the level of the third component of the HDI -  $GDP_{reg}/capita$ . Creation of conditions ensuring the increase of human.potential in the predicted control can be ensured by the steady increase of its social and cultural components

Increasing in this way the attractiveness of the region for a growing population (and, accordingly, the saturation of the region by initiative, efficient skilled personnel) therefore seems to be the main task of the top level of the governance hierarchy in planning long-term development of the region.

As the object of the "passive" experiment, the federal lands of Germany were chosen. Earlier it was noted that for Germany there are two groups of federal lands: "new" (former GDRs) and "old", more developed in industrial relation (see, for example, [2]). The newest statistical data confirm the sharp heterogeneity of the level of regional well-being achieved by various regions (federal lands and individual cities in Germany), estimated by the level of  $GDP_{reg}$  per person employed. (see Fig.1).

### 3. RESULTS AND DISCUSSION

Analyzing the spstial distributions ( $GDP_{reg}/person$  empl. data) presented in Fig. 1, it can be seen that the largest values of  $GDP_{reg}/person$  employed. were achieved in the "old" federal lands of Germany: Bavaria, Baden-Württemberg, North Rhine-Westphalia, Hessen, Hamburg). This level of the state of the objects of research makes it possible to compare the effectiveness of long-term planned control of the development of the region more fully based on the representative results of the "passive" experiment



**Fig.1.** Spatial distribution of regional  $GDP_{reg}/person\ empl.$   
 The brightest areas are the  $GDP_{reg}/person\ empl. < 52.7 \cdot 10^3$  Euro.  
 The darkest areas are  $GDP_{reg}/person\ empl. > 65.2 \cdot 10^3$  Euro.

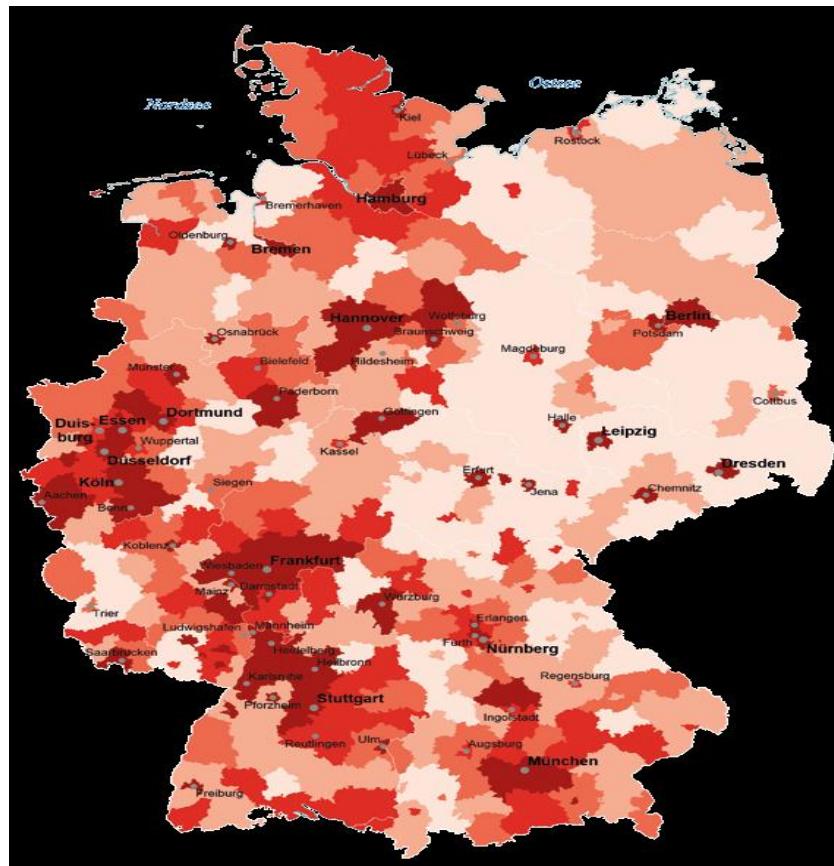
Fig. 1 obtained on the base of [3].

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As it follows from the definition of the Human Development Index (HDI), the influence of nonmaterial assets (human potential and its components) on the dynamics of the region's long-term development is largely realized through skilled and highly motivated work at all levels of regional control activity (including also and the institutional stage of governance). It is the achieved level of social and cultural development of the region that determines the possibility of increasing the share of scientific and productive activities in the process of SES-control operation. The process of this increase is determined by the requirements of the modern (global) economy of high technology production. At the same time, regions with previously developed industrial infrastructure have the advantage of reinforcing the transition to a new "postindustrial" period – to the knowledge economy – with the corresponding additional investments in physical capital and human potential. Such a

complex relationship between necessity and obligation (the need for a transition to a knowledge economy, the necessity for additional investment and the need to increase the effectiveness of human potential use) largely determines the planned increase in well-being – and the value of the specific regional gross product -  $GDP_{reg}/capita$ . At the same time, the historical past of the region is of great importance. For example, the agglomeration of large cities (Duisburg, Dusseldorf, Essen, Cologne, Bonn) in North Rhine-Westphalia (based on the Ruhr industrial region) is characterized by a close relationship between the  $GDP_{reg}$  per worker (parameter, which characterizes the labor productivity achieved) – Fig.1 – and the share of highly skilled workers engaged in high technology production – Fig. 2.



**Fig.2.** Proportion (in %) of workers employed in the high-technology industry. The brightest areas - the share of workers employed in science-intensive production is less than 1%. The darkest areas – this share is more than 10%. Fig. 2 obtained on the base of [3].

Comparison of the spatial distributions of  $GDP_{reg}$  per worker and the share of highly skilled workers (Figure 1 and Figure 2) makes it possible to visually compare and estimate the effectiveness of predicted control implemented in the course of evolution using the planned increase in the components of human potential for improving the welfare of the population of the region.

Comparative analysis presented in Fig. 1 and Fig. 2 spatial distributions of labor productivity ( $GDP_{reg}$  per worker employed in production) and the share of workers employed in science-intensive production allows you to notice numerous local deviations from the mean (by federal land) values. These local positive outbursts of GDP are characterized not only by certain regions, but also by individual cities, attractive both for investment in physical capital and for increasing human potential. This ability of the region to social and economic development is largely determined by the long-term activity of the top level of the control hierarchy of the region (city) in creating and maintaining an attractive image of a controlled SES. The hastily developing metropolitan cities (Munich, Stuttgart, Düsseldorf, Hamburg, Bremen) and urban agglomerations (for example, the urban

agglomerations of North Rhine-Westphalia and Bavaria) are a good example of the implementation of such positive predictive control.

One of the tools for creating an attractive image of the region is the predictive control activity associated with employment in scientific and technical research and innovation (STRIA) This control activity is impossible without the corresponding costs for highly qualified scientific and engineering specialists (STRIA-expenses). In their origin, these STRIA-expenses are due to the costs of training and saturating the region's economy by graduates of the higher school of science and technology.

The values of STRIA-expenses largely depend on the region's economics possibilities – on region's values of  $GDP_{reg}/capita$ . There are peculiar feedbacks: the dependence of  $GDP_{reg}/capita$  on the amount of investment (the specific value of investment) and the amount of expenditure on STRIA, and, at the same time, the dependence of  $STRIA_{reg}/person$  on  $GDP_{reg}/capita$ . This dependence for two groups of German federal lands was detected using a modified Poincare method of a transversal cutting surface (see, for example, [2]). The  $STRIA_{reg}/person$  dependences on the  $GDP_{reg}/capita$  for the "old" and the "new" federal lands of Germany are shown in Fig. 3. . It can be seen that the highly developed Bavaria could have specific costs for STRIA/person  $\approx 900$  Euro – within  $\approx 2.4\%$  of  $GDP_{reg}/person$ . Such opportunities Bavaria could have due to the implementation of a multi-year development program - to create the conditions for a more effective exchange between scientific achievements and the economy (see, for example, [4]). At the same time, most of the funds for development programs were invested in education and training, research and development, in the development of information and communication technologies. As a result of the chosen strategy, Bayern was able to reach the front lines in the aviation and space industries, biotechnology and medical technology, and other high-tech industries. This provided Bavaria with an average  $GDP_{reg}/capita$  of about 40,000 Euros and, accordingly, a sufficiently high attractiveness.



**Fig. 3.** Influence of the value of the regional gross domestic product  $GDP_{reg}/person$  on the specific value of expenditure for  $STRIA_{reg}/person$ . The upper line is the "old" lands of Germany. . (1- Bavaria, 2- Baden-Württemberg, 3- Hessen, 4- Lower Saxony, 5- North Rhine-Westphalia, 6- Rhineland-Pfalz, 7-Schleswig-Holstein). Lower (left) line - new "lands" of Germany Lower (left) line - new "lands" of Germany. (1- Thuringia, 2- Saxony-Anhalt, 3- Saxony, 4- Mecklenburg, 5- Brandenburg).

For a relatively backward Thuringia (as an example), it was possible to provide  $STRIA_{reg}/person$  only in the amount of  $\approx 220$  Euros – within  $\approx 1\%$  of the achieved level of the

$GDP_{reg}/person$ . Insufficiently large  $GDP_{reg}/person$  values in Germany's "new" lands cause relatively small financial allocations for scientific and technological development, and innovations ( $STRIA_{reg}/person$  expenditures). Under such circumstances, the region's achievement of attractiveness for additional investments in physical capital and human potential becomes difficult. Accordingly, the subsequent achievement of a high standard of living for the "new" German lands (for lands as a whole) is also difficult.

As a result, the achievement of a high standard of living in the "new" federal lands of Germany was mainly realized only in the regional metropolises and individual centers of the previously achieved scientific and technological development. Illustrative examples of such metropolitan cities are Potsdam (Brandenburg land), Leipzig and Dresden (Saxony). In these cities, the leading scientific centers, knowledge-intensive industries are concentrated. These large cultural and historical centers have an anomalous attracting effect. These conglomerate cities have the advantage of competing for skilled labor, which gives an additional impetus to their development. As a result, these cities were included in the top ten cities of Germany with the largest population growth (Potsdam – 6.3%, Leipzig – 7%, Dresden – 5.8%)

For the federal land of Thuringia (the average  $GDP_{reg}$  per capita for the country = 23,000 Euros), cities – islands of local development – are (as can be seen in Figure 2) Jena, Erfurt, Weimar. The city of Jena – has a university and is the center of electronic-optical engineering – and has a regional  $GDP_{reg}/person$  employed =  $58,2 \cdot 10^3$  Euro. The city of Erfurt – the capital of the federal land and the university city – has  $GDP_{reg}/person$  employed =  $54,3 \cdot 10^3$  Euro. At the same time in Erfurt there is a well-established system of social insurance of employees, which contributes to the inflow of labor. The city of Weimar – known for its university and its adjoining research institutions (precision instrumentation making) – has  $GDP_{reg}/person$  employed =  $54,3 \cdot 10^3$  Euro. The listed cities have  $GDP_{reg}$  per capita roughly twice the average for the federal state of Thuringia [5]. But in the nearby city of Ingolstadt (Bavaria) – a flourishing center of the automobile industry – the value of the  $GDP_{reg}$  per capita is  $123 \cdot 10^3$  Euro. Such cities in Bavaria as Erlangen and Regensburg have the value of  $GDP_{reg}$  per capita =  $83 \cdot 10^3$  Euro. Naturally, the "old" federal lands of Germany continuously "suck" the qualified specialists from the "new" lands. Especially noticeable is this effect in small provincial towns and rural areas [3, 6].

### 3. RESULTS AND DISCUSSION

The study of the level of social and economic development of the "old" and "new" German lands (using a comparative analysis of the data of the "passive" experiment – Figures 1, 2 and Figure 3) shows that a balanced growth of regional welfare requires from the regional governance structures a long-term program for switching the economy to knowledge-based industries, aimed at creating a new value. The implementation of such a program requires, in turn, the expansion and modernization of the relevant educational institutions and the creation of an advanced training system at all levels of the regional management hierarchy. In the conditions of the existence of the federal land, as an open SES, the fulfillment of all these requirements for the "new" lands of Germany is quite a difficult task. To prevent the outflow of human and financial resources into the "old" federal lands, it is therefore necessary to develop and implement appropriate preferences and benefits.

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