

CONTRIBUTIONS TO ECONOMICS

Kosra Normend

Vector Calculus in Regional Development Analysis

Comparative Regional Analysis
Using the Example of Poland



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Book first published in Polish under the title Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2008 “Rachunek wektorowy w analizie rozwoju regionalnego”

ISBN 978-3-7908-2178-9 e-ISBN 978-3-7908-2179-6
DOI: 10.1007/978-3-7908-2179-6

Contributions to Economics ISSN 1431-1933

Library of Congress Control Number: 2009921251

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Cover design: WMXDesign GmbH, Heidelberg

Printed on acid-free paper

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List of Variables and Notation

X	Matrix of objects describing variables
x_{ik}	Value of k th variable of i th object (first index – object number, second index – variable number)
w	Number of objects
n	Number of variables
z_{ik}	Standardized value of k th variable of i th object
s_k	Standard deviation of k th variable
\bar{x}_k	Mean value of k th variable
v_k	Variability level measure of k th variable
S_i	Standard deviation of i th object's variables
I	Stimulants set
K	Destimulant set
L	Nominants set
P_i	Point representing i th object
P_o	Point representing the standard
d_{ij}	Similarity measure between i th and j th objects
$d(P_i, P_j)$	Similarity measure between i th and j th points
m_i	Development measure of i th object
\bar{m}	Mean measure of development of all objects
s_m	Standard deviation of synthetic measure
wg_k	Weight of k th variable
r_k	Coefficient of object's scale change along k th variable
Δ_k	Coefficient of object's translation along k th variable
\vec{A}	Designation of vector
g_{ij}	Metric tensor
gr_{ij}	Border between classes
odl_{ijk}	Distance of i th object from the border between class j th and class k th
$odl_i \cdot wzgl_{jk}$	Percentage distance of i th object from the border between class j th and class k th
pas	Coefficient controlling width of border belt
$\overline{szer_{klas}}$	Mean width of class
pp_{ij}	Percentage reliability of i th object membership of j th class

$roz_{\vec{A}\vec{B}}$	Similarity between two objects represented by two vectors \vec{A} and \vec{B} calculated as length of their vectors difference
$\frac{\vec{A}}{ \vec{A} }$	Unit vector along vector \vec{A}
$c_{\frac{\vec{A}}{ \vec{A} } \frac{\vec{B}}{ \vec{B} }}$	Projection of unit vector $\frac{\vec{A}}{ \vec{A} }$ onto unit vector $\frac{\vec{B}}{ \vec{B} }$
reg_k	Value at point P_k of regular grid
$nreg_i$	Value at point P_i of irregular grid
l_{klas}	Number of classes

Introduction

Methods used for regional development analysis are employed mainly to make forecasts and comparisons. Forecasting models of various types (e.g. econometric models) are usually used for forecasting. Recently, vector-autoregressive models (VAR) have become popular. These models were proposed by Sims in 1980. On the contrary, taxonomic methods (that are in the center of attention as far as the present publication is concerned) are most often employed to make comparisons. Linear ordering methods, including standard methods, are the most popular among taxonomic methods. They are based on different distance and similarity measures, which leads to the fact that they do not always provide reliable information. When, for example, one construes the standard for a base year and then compares it with data for other years, it may turn out that the measure determined will have worse values than the standard for a real object (region, micro region) although this object is better from the standard. Hence, one must look for new methods employed in regional development analysis or improve hitherto existing ones in such a way so that information obtained reflects the reality to a larger extent.

The main aim of the present publication is to work out methodological basis for regional development analysis based on vector calculus together with assumptions about computer system supporting the implementation of the method suggested.

In the context of the present discussion, the following three statements have been adopted as research hypotheses:

1. Methods hitherto used for regional development analysis do not meet requirements of objective assessment of regions and micro regions both for the purpose of science and economic practice.
2. Author's system of regional development assessment (made with the use of vector calculus) presented in the publication describes in detail the quality of socio-economic and environmental processes in the area examined and hence it could be useful in making economic and investment decisions.
3. Adaptation of regular and irregular grids from the systems of spatial information for the purpose of spatial correlation analysis may make decision makers aware of the influence that particular groups of factors have on socio-economic development.

In order to verify the first mentioned research hypothesis, the analysis of classical methods used for examining regional development has been carried out. This analysis will allow to indicate premises that these methods should meet, which will make it possible to achieve the aim of the present publication. In order to verify the second mentioned hypothesis, empirical research has been conducted with the use of both classical synthetic measures as well as taxonomic vector measure of regional development proposed by the author. The empirical research relates to Polish counties as a case-study. The presented in the work measure can be used in wide variety of regional studies.

At the same time, the application of standards construed not on the basis of maximal and minimal values of variables but on the basis of quartiles is a novelty here. Furthermore, in order to simplify the procedure for putting the approach suggested into practice, assumptions about computer system were made and the prototype of this system was developed. The system discussed has been equipped with a module enabling to examine spatial relations among groups of variables, which was possible thanks to author's adaptation of regular and irregular grids from systems of spatial information for the purpose of spatial correlation analysis.

The layout of the present publication was determined by the research purpose and hypotheses. The publication consists of five chapters preceded by introduction and succeeded by conclusion.

In the *first chapter*, the notion of "regional development" was analyzed together with factors determining this development. Moreover, the importance of regional data monitoring in the procedure for regional development examination was highlighted. Finally, indicators taken into account in the research were discussed.

In the *second chapter*, issues relating to methodology of regional development analysis were raised paying special attention to classical methods. Furthermore, reasons behind looking for new methods or improving the existing ones (in order to make the research apparatus more precise) were presented.

While discussing the issues raised in the first and second chapters, the author employed elementary analysis method with the use of which the subject matter of research was divided into several parts and discussed individually. Causal analysis was used for determining the relationship between phenomena under examination, and deduction method – for discussing the questions important as far as the fulfillment of the main aim of the present publication was concerned. Discussion made in these chapters have deductive-logical and review character. The main method of justification is logical argumentation.

In the *third chapter*, methodical basis of regional development analysis (with the use of vector calculus methods) was presented. Particular stages of research procedure based on the method suggested were described. Moreover, the author also indicated features of the method thanks to which measures (obtained with the use of this method) were more accurate than classical measures. The possibility of presenting the results of analysis in 3D space was discussed as well.

The *fourth chapter* includes the description and results of research conducted by means of the method suggested. The research was carried out for NUTS IV level, i.e. for 314 Polish counties and at the same time, 42 diagnostic variables were taken

into account. The research results were collated with analogical results received with the use of classical methods in order to present advantages of the method suggested. In this sense, the fourth chapter formed a basis for verifying the research hypothesis formulated.

Finally, in the *fifth chapter*, the author had presented assumptions about computer system supporting the regional development analysis that was supposed to provide computer environment for the implementation of the method suggested. This method is based on a complex mathematical apparatus and hence, can be difficult for persons who deal with shaping regional policy. In order to make it available to a wider circle of not only theoreticians, researchers and professionals dealing with regional analyses, but also practitioners, decision makers and politicians, one must create a computer system equipped with a friendly interface that could be used by persons who are not IT specialists. Additional advantage of the system is the possibility of scaling it, i.e. using objects at different levels of spatial hierarchy, namely in communes, counties and voivodships, etc. for the analysis. Apart of the concept of the system discussed, its functioning had also been presented quoting the example of particular analyses.

In the last part, the author has presented the most important general conclusions from theoretical discussion and the research conducted. Furthermore, practical possibilities of using regional development analysis method devised as well as plausible directions of work on improving computer system created particularly for the purpose of this method have been presented.

Chapter 1

Regional Development: Economic Perspective

1.1 Notion and Factors Determining Regional Development

Region is a notion used in many spheres of life. Its meaning is generally similar in economy, science, politics and every-day life. Analyzing the sense of “region”, one should notice that this notion has different connotations in each of the aforementioned spheres.

The word region derives from Latin *regio, regionis* that has two meanings in a direct translation. The first sense refers to a movement in a certain direction, whereas the other one refers to the direction outlining the space (in other words, surroundings, land, district). The last-mentioned sense, relating to area, has acquired more and more profound significance and become widely accepted over the course of time. As a result, the word region is found in many languages and countries.¹

Polish economist Ponikowski highlights the polysemy of the notion discussed. He presents two premises that form a basis for creating the definition of a region. The first one has a central character, i.e. it describes region as area connected with a big city and treats interrelation and gravity force between center and surroundings as crucial elements of a region. The other one (zonal) treats region as a cohesive and at the same time homogenous area outlined on the basis of certain features determining its profile. Definitions offered by Ponikowski emphasize borders between regions in relation to its surroundings. Such an approach results in administrative division that plays a profound role in the way one comprehends regional phenomena, which may contribute to concentration or artificially reduce the actual intensity of occurring phenomena.²

Parteka, architect and urban planner, understands “region” as a material area that is a part of space usually used by people, i.e. a fragment of a larger whole. It is

¹Korenik S.: *Development of Economic Region quoting the example of Dolny Śląsk*. [In Polish] Wyd. Akademii Ekonomicznej we Wrocławiu, Wrocław 1999., p. 9.

²Ponikowski H.: *About Properties of Regional Phenomena Space*. In: *Local and Regional Economy in Theory and Practice*. [In Polish] Red. D. Strahl. Prace Naukowe Akademii Ekonomicznej we Wrocławiu nr 1124. Wrocław 2006, p. 194.

not easy to outline and name this area. In spatial economy (just as in geography), region is an area in which the character of particular elements of spatial relations make up a homogenous and cohesive whole. This whole has been isolated from a larger area by means of specific criteria and is homogenous or cohesive only in the scope of these criteria.³ As there is no uniform and commonly accepted definition of a “region”,⁴ objective and criterion are the most important while outlining the part of the space. Parteka, although does not specifically mention elements of a region, expands this notion via establishing criteria on the basis of which it is possible to isolate a particular area and form a homogenous whole known as a region. Parteka, just as Ponikowski, pays attention to demarcation lines between regions. The difference between views held by the authors quoted is fundamental. The first-mentioned author states that borders are established in an explicit way, while the last-mentioned author claims they are natural and it is not plausible to mark them clearly.

Taken the character of the present publication into account, one should fully analyze differences in comprehending natural region (i.e. physical-geographical) and economic region. Economic region is understood as a set of elementary spatial units which constitutes a part of a larger whole, clearly stands out from this whole in geographical terms and shares certain common or complementary features. Furthermore, it can be treated as a clearly developed or just developing economic agreement the elements of which are connected with one another and with natural environment by means of co-existence and interdependence relations, and with external environment by means of intense interdependence relations.⁵

In the literature, economic region is classified in many different ways, for instance Kuciński divides economic region in the following way⁶:

1. Zonal region (surface, homogenous) that is homogenous in certain respects;
2. Central region (nodal), i.e. area of gravities or economic links with a center of a region;
3. Extensive region, i.e. manufacturing complex of a certain production-service specialization.

It is also worth mentioning the typology of economic region proposed by Korol who, having adopted the specialization of a region as a basis for division, distinguished the following types of economic regions⁷:

- Industrial, further divided by specialization (taken particular types of production into account),

³Cf. Domański R.: *Spatial Development*. [In Polish] Wyd. Naukowe PWN, Warszawa 2002, p. 109.

⁴T. Parteka: *Regional Development Strategy*. In: *Regions*. [In Polish]. Red. Z. Brodecki. Lexis Nexis, Warszawa 2005, p. 63.

⁵See: R. Domański: *Shaping Open Economic Regions*. [In Polish] PWN, Warszawa 1972, p. 7.

⁶K. Kuciński: *Economic Geography*. [In Polish] SGH, Warszawa 2004, p. 175.

⁷J. Korol: *Indicators showing Sustainable Development in Regional Processes Modelling*. [In Polish] Wyd. Adam Marszałek, Toruń 2007 p. 15.

- Agricultural (can be divided further as well),
- Industrial-agricultural,
- Agricultural-industrial, depending on promotion between main production departments,
- Tourist-recreational.

This typology is in accordance with what Kuciński has proposed. Types of specialist regions coincide with zonal, central and extensive regions.

Discussion on the notion of economic region is relevant in the context of defining regional development. It is difficult to determine the essence and specificity of regional development.⁸ The notion of development is based on such categories as change and structure. Development is a kind of chain of directed and irreversible changes occurring in the structure of complex objects, i.e. systems.⁹ Borys believes that this notion is not only polysemous and has not been defined yet but also that it is not possible to define it (and hence, it is a primary notion).¹⁰ As aptly noticed by Piontek, the notion of “development” is used very widely. *Dictionary of Polish Language* defines development as a progression from a simpler or lower to a more advanced, mature, or complex form or stage.¹¹ However, it has not

⁸Regional development process is the subject of a large number of research work whose authors show difficulties connected with defining the specificity and essence of the notion under consideration, e.g. M. Pięta: *Factors and Determinants Shaping the Development of Economic Region*. [In Polish]. Prace Naukowe Akademii Ekonomicznej we Wrocławiu nr 938. Wrocław 2002; K. Secomski: *Theory about Regional Development and Planning*. [In Polish] PWE, Warszawa 1987; T. Kudłacz: *Regional Development Programming*. [In Polish] Wyd. Naukowe PWN, Warszawa 1999; J. Chądzyński, A. Nowakowska, Z. Przygodzki: *Region and its Development in Globalization Conditions*. [In Polish] CeDeWu, Warszawa 2007; Kudłacz T.: *Programming Socio-economic Development at a Local Level*. [In Polish] Wyd. Akademii Ekonomicznej w Krakowie, Kraków 1993; K. Gawlikowska-Hueckel: *Regional Development Processes in the European Union*. [In Polish] Wyd. Uniwersytetu Gdańskiego, Gdańsk 2003; S. Korenik: *Disproportions in the Development of Polish Regions – Chosen Aspects*. [In Polish] Wyd. Akademii Ekonomicznej we Wrocławiu, Wrocław 2003; *Development, Regional and Local Policy in Poland*. [In Polish] Red. J. Kaj, K. Piech. SGH, Warszawa 2005; A. Jewtuchowicz: *A Territory and Contemporary Dilemma over its Development*. [In Polish] Wyd. Uniwersytetu Łódzkiego, Łódź 2005; J. Adamiak, W. Kosiedowski, A. Potoczek, B. Słowińska: *Management of Regional and Local Development, Theoretical and Practical problems*. [In Polish] Wyd. Dom Organizatora, Toruń 2001; B. Winiarski: *Regional Policy*. [In Polish] PWE, Warszawa 1976.

⁹Cf. Z. Szymba: *Determinants of Regional Development*. [In Polish] Akademia Ekonomiczna w Krakowie, ZNiO, Kraków 2000, p. 33; W. Krajewski: *The Notion of Development and Progress*. [In Polish] In: *Theoretical Assumptions in the Research on Historical Development*. [In Polish] Red. J. Kmita. PWN, Warszawa 1977, p. 26.

¹⁰T. Borys: *Axiological Foundations of Development*. [In Polish] In: *Humanistic, Economic and Environmental Aspects of Development*. [In Polish] Red. F. Piontek i J. Czerny. Zeszyty Naukowe nr 40. WSEiA, Bytom 2005, after B. Piontek: *Contemporary Determinants of Socio-economic Development*. [In Polish] Akademia Techniczno-Humanistyczna w Bielsku-Białej, Wyd. ATH, Bielsko-Biała 2006, p. 16.

¹¹*The Free Dictionary by Farlex*. Available on the Internet: <http://www.thefreedictionary.com/development> (accessed November 08, 2008).

been explicitly specified who is supposed to gain benefit from it or what criteria must be met.¹²

In order to define regional development, one should understand the notion “development” first. In the literature on the subject, one may come across many definitions of the notion under consideration. In general, development is treated as both product and process. Employment, wealth, investments, standard of living and working conditions (i.e. matters important to people who live, work and invest in particular regions, and to be more precise – increase or improvement in these indicators) are products associated with economic development. On the other hand, industry support, infrastructure, labour force and market development (that are dealt with by economists and planners) are processes.

Unfortunately, it is very often difficult to combine intended results connected with economic development and processes employed. This may pose a dilemma for persons responsible for economic development management as well as development and improvement of strategies and plans aiming at achieving the conformity between intended results of a product and appropriate and acceptable economic processes.

Strahl treats regional development as a starting point for discussion on economic policy, systemic transformation, regional policy, regional development programming, problem of European integration as well as globalization.¹³ On the other hand, Markowska states that regional development is socio-economic development occurring in a region that is treated as the development of economic potential of a region characterized by sustained improvement in its competitiveness as well as improvement in people’s standard of living. Hence, it is a process of positive quantitative and qualitative changes occurring in a region in the scope of economic, cultural and social activity as well as in the scope of interaction in socio-production sphere and political sphere.¹⁴ Kudłacz defines regional development in alike manner and claims that regional development implies a steady increase in the standard of living of residents and economic potential in a certain territorial unit.¹⁵ The aforementioned definition stems from changes in the following components:

- Economic potential,
- Economic structure,
- Natural environment,
- Infrastructure development,
- Spatial order,
- Inhabitants’ standard of living,
- Land development.

¹²B. Piontek: *Contemporary Determinants* . . . [In Polish] p. 16.

¹³*Regional Development Assessment Methods*. [In Polish] Red. D. Strahl. Wyd. Akademii Ekonomicznej we Wrocławiu, Wrocław 2006, p. 13.

¹⁴M. Markowska: *Regional Development Determinants*. [In Polish] Prace Naukowe Akademii Ekonomicznej we Wrocławiu nr 939. Wrocław 2002, p. 20.

¹⁵T. Kudłacz: *Regional Development Programming*. [In Polish] . . . , p. 15.

The author under discussion stresses that it is too complicated to define the development with the use of more operational expressions. The identification and measurement of regional development should consist in the choice of two or more states of development of the aforementioned components and the identification, description and assessment of qualitative differences between these components made with the use of quantitative criteria and measures of development of particular components. Furthermore, it ought to involve the assessment of the degree to which regional development (i.e. stemming from the development of components under analysis) is advanced.¹⁶

Klasik defines regional development as sustainable development of three elements, namely economic potential of regions, their competitive force and inhabitants' standard of living.¹⁷ It ought to be highlighted that what the author means is sustainable development contributing to the development of the entire national community. In order to expand his definition, Klasik has distinguished the following components of regional development:

- Economic growth and employment,
- Rising prosperity and standard of living,
- Growing investment attractiveness of regions,
- Innovative processes and diversification of economic structure of regions,
- Eco-development and improvement of living conditions in regions,
- Development of social services and human capital,
- Development of identity and regional integration processes.

Therefore, determining the stage of regional development in empirical way consists in the identification and measurement of changes in its components.¹⁸

As stated by Szymła, research into socio-economic development on a regional (local) scale is complicated as each sphere develops not as autarchic¹⁹ element but as integral element of national economy. Every theory of regional development holds that interregional differences exist and are something objective. At the same time, it is assumed a priori that these differences should not exist.²⁰

Blakely defines regional economic development as a process in which local organizations, deriving from self-governments and communities, are involved in stimulating and maintaining business activity and/or employment. The main aim of regional economic development is to create employment opportunities in

¹⁶Ibidem.

¹⁷A. Klasik: Concepts of Regional Development in Poland vs. Regional Differences. Stenographic record from a seminar entitled Regional Development of Poland as an element of European integration. [In Polish] Sejm RP, 22.04.1997, after Regional Development Assessment Methods. [In Polish] . . . , p. 13.

¹⁸Ibidem, p. 14.

¹⁹The sense of the notion "autarchic" derives from the word "autarchy" that refers to economic self-sufficiency of a country or group of countries, and also a situation in which society isolates from others since it believes it is self-sufficient. See: *Dictionary of Polish Language* . . .

²⁰Z. Szymła: *op.cit.*, p. 35.

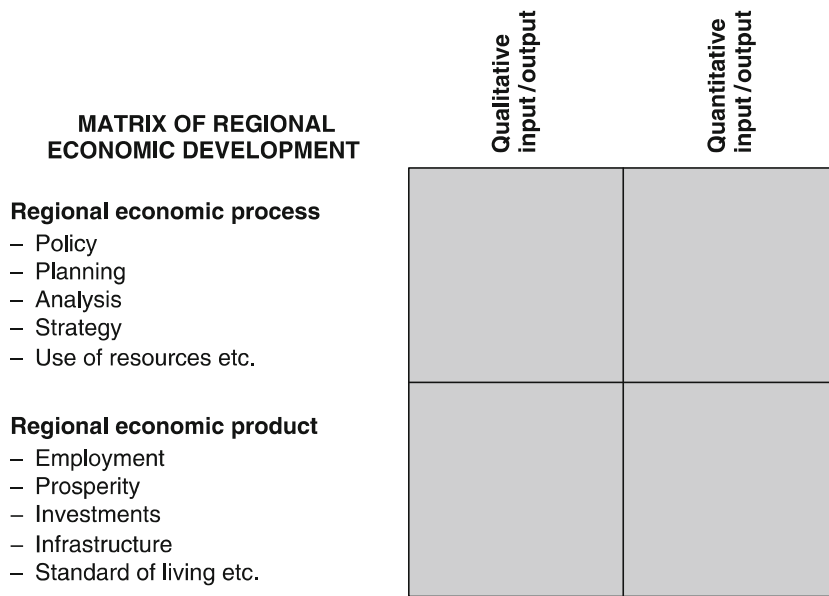


Fig. 1.1 Regional economic development as a matrix of qualitative and quantitative variables as well as development processes and products

Source: R.J. Stimson, R.R. Stough, B.H. Roberts: *Regional Economic Development Analysis and Planning Strategy*. Springer-Verlag, Berlin-Heideberg 2006, p.7

sectors that improve community via existing human, natural and institutional resources.²¹ This definition introduces a new dimension of economic development in which more than labour, capital, prices and production is taken into account. It also covers the mobilization of social capital.

Regional development may be understood as a matrix of results that a product or service may reach for a particular region. Results that stem from acceptable development processes determined by qualitative and quantitative variables (see Fig. 1.1).

Stimson, Stough and Roberts state that regional economic development may be defined as the use of economic processes and resources available in a region, which results in sustainable development of a region and produces intended results. Regional economic development occurs in accordance with values and meets expectations from business, inhabitants as well as people visiting the region.²²

Strahl claims that regional development is a process understood as social and economic transformation taking place in a regional space and resulting from the following three groups of factors: endogenous, exogenous and factors determining endogenous ability to respond to changes in macro environment.²³

²¹E.J. Blakely: *Planning Local Economic Development. Theory and Practice*. Sage Publications, Thousands Oaks, CA 1994, s. XV.

²²R.J. Stimson, R.R. Stough, B.H. Roberts: *op.cit.*, p. 6.

²³Regional Development Assessment . . . , p. 16.

Endogenous factors are responsible for regional development. This group encompasses factors determining the ability of resources (in particular fields of regional development) to develop. These resources are among other things age structure of population, educational status and qualifications acquired by people inhabiting a region, their entrepreneurship and innovativeness, degree to which local community is integrated in social organizations, participation in regional power, components and resources of natural environment, spatial order, state of pollution, ecological awareness, technical infrastructure and its potential for development, amount of regional budget, structure of regional markets, employing the concept of regional marketing.

Exogenous factors cover changes in macro environment of a region that are either a positive or negative impulse for particular fields of regional development. These factors stem from among other things globalization processes, European integration processes, changing macroeconomic conditions, political changes (e.g. decentralization of a state), changing economic situation, political situation and interregional policy pursued by a state. As an impulse for development, exogenous factors contribute to development and innovative transformation of endogenous factors, as well as create new resources and institutions connected with the location of new devices, technologies and jobs in a region.

Factors determining the ability of a region to respond to changes in macro environment result from different reactions to exogenous chance or danger to regional development. Endogenous regional reaction to changes in macro environment occurring as a result of exogenous factors depends mainly on the following factors:

- Flexibility of economy structure in a region,
- Internal capital potential,
- Activity and openness of regional policy,
- Competence and qualifications of regional and local authorities,
- Activity of community, infrastructure and intellectual resources, etc.

The first and third groups of factors produce centrifugal development, which implies that sources of regional development can be found in internal potential as well as initiative and creativity of regional community. The second group of factors initiates the process of development determined externally, which means that the reason behind regional development are benefits accruing from spatial differentiation of production cost.²⁴

According to Klasik, strategic approach and thinking make it necessary to examine regional development from many dimensions. The environment, economy, space, technical infrastructure and socio-cultural dimension are planes mentioned most often²⁵ (cf. Table 1.1). Each of the aforementioned planes covers a set of

²⁴Ibidem, p. 16.

²⁵A. Klasik, F. Kuźnik: *Strategic Planning for Local and Regional Development*. [In Polish] In: *Functioning of Local Self-governments – Experience and Prospects*. [In Polish] Red. S. Dolata. Wyd. Uniwersytetu Opolskiego, Opole 1998, after M. Markowska: *Regional Development . . .*, p. 24.

Table 1.1 Factors determining regional development in the context of strategic planning

Item number	Regional development dimensions	Factors determining regional development
1.	Socio-cultural	Population and its education, professional qualification, integration of community, living conditions, social institutions and services
2.	Environmental	Natural environment components and resources. State of environmental pollution and devastation, environmental infrastructure, environmental awareness
3.	Infra-technical	Local, regional and supraregional technical infrastructure, organization of infrastructure sectors, infrastructural gap, infrastructural reserves, infrastructural investments
4.	Economic	Economic resources, business activity by trades, sectors, economic functions, local and regional markets, economic base of cities and regions, external benefits, social cost, common goods and facilities, competitiveness of cities and regions
5.	Spatial	Land development, functional-spatial arrangements, spatial availability, spatial order and arrangement, spatial value

Source: Markowska M.: *Regional Development Determinants* [In Polish] . . . , p. 25

factors determining the level of regional development. These factors measure regional development on particular planes, due to which once assessments from each plane have been collected, the state of regional development is presented.

Bagadziński presents the description of factors determining regional development arranged by various aspects of socio-economic activity.²⁶ He assumes that positive phenomena initiated in the course of development processes translate into positive results that are a starting point for further development processes. Such an approach allows to treat them as factors determining another stages of development. The most significant effects, entailed by the development, have been distinguished in each group, namely

1. Economic factors including capital growth, demand growth (also changes in its structure), earnings received by population, profits generated by enterprises, employment, investment outlays, work output and specialization as well as creation of modern management;
2. Social factors including consumption increase and changes in its structure, rate and character of urbanization, changes in regional awareness, promoting entrepreneurial attitudes, improvement in the functioning of self-governments as well as increase in educational status and activity;
3. Technical and technological factors, i.e. development of technical and research base, introduction of technical and product innovations, improvement in

²⁶S.L. Bardziński: *Local Economic Policy during the Period of Systemic Transformation*. [In Polish] UMK, Toruń 1994.

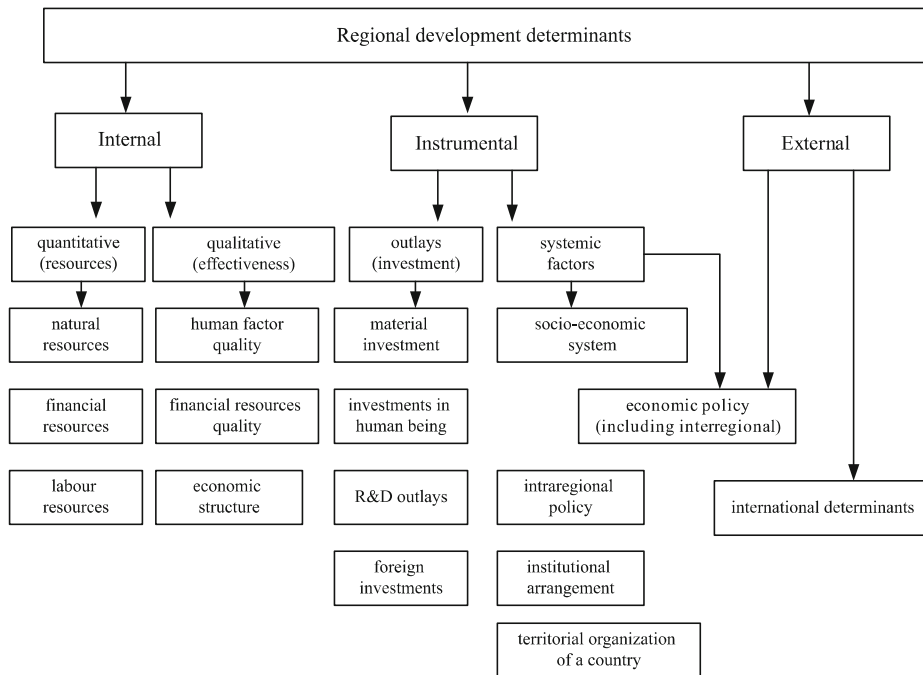


Fig. 1.2 Factors determining the development of regions

Source: J. Kudelko: *op.cit.*, p. 79

- production quality, improvement in technical infrastructure, modernization of material structure of manufacturing apparatus;
4. Environmental factors, namely progress in the environmental protection, rationalization of resources management, implementation of closed cycles;
 5. Political factors, i.e. character of power, competence and rights, way of exercising power, degree to which society accepts authorities.

According to Kudelko, analyzing the notion of “regions’ development”, one should remember that regions are not isolated socio-economic entities but are strongly connected with their environment and refer to the character of their internal determinants. This means that regional development is determined by the following three factors: internal determinants of a region, external environment determinants as well as influence of public authorities and various economic and social institutions. Hence, the author has presented the division of factors into internal, instrumental and external (Fig. 1.2).²⁷

Internal factors are connected with the right use of region’s economic potential and social potential. These are also factors resulting indirectly from socio-economic situation of a region, its internal determinants and the use of socio-economic potential.

²⁷J. Kudelko: *Level of Socio-economic Development of Polish Voivodships*. [In Polish] Zeszyty Naukowe Akademii Ekonomicznej w Krakowie nr 651. Kraków 2004, pp. 78–81.

Instrumental factors encompass actions influencing the shape and use of quantitative and qualitative factors distinguished. In fact, development outlays play a crucial role among instrumental factors as they indirectly contribute to enriching socio-economic potential of a region.

External factors are not affected by a particular region and do not depend on economic situation of regions or the effectiveness of regional policy pursued in these regions (cf. Fig. 1.2).

Markowska emphasizes that in the era of globalization, local and regional development are processes that practically cannot be isolated. They occur inside a country but on two different planes, and the border is determined by the degree to which development processes are complex and synergic effect possible to reach. Factors determining the development of a region on a local scale may be investigated in the context of functional assets namely

1. Factors influencing the level of assets of resources determining the possibilities and easiness of receiving all the necessary production factors (natural resources, personnel, production traditions, objects, land and infrastructural development standards);
2. Factors influencing the level assets of demand (market absorption, availability of external markets, demand structure);
3. Factors determining the attractiveness of arrangement to potential inhabitants and institutions (spatial development state, access to services, natural environment state, social security, etc.).²⁸

The idea of sustainable growth is strictly connected with the notion of “regional development”. The first mentioned concept was introduced with the degradation of the environment, demographic expansion and growing disproportion in socio-economic development occurring in particular sides of the world as well as depleting natural resources. With the development of this concept, it was more and more evident that there was a need for change in the hitherto existing idea of world development (the idea shaped in accordance with economic theory and development).²⁹ In one of first definitions formulated in the 3rd Section of United Nations Environment Programme (UNEP) in 1975, sustainable development was described as inevitable and desired economic development that would not disturb human environment profoundly and irreversibly, that would not result in biosphere degradation and combine natural and economic laws with culture.³⁰

²⁸M. Markowska: *Regional Development . . .*, pp. 25–26.

²⁹Por. J. Korol: *op.cit.*, p. 23; M. Kistowski: *Model of Sustainable Development and Environmental Protection in Poland and Strategies toward Development of Voivodships*. [In Polish] Bogucki, Wyd. Naukowe Uniwersytetu Gdańskiego, Gdańsk–Poznań 2003, p. 15.

³⁰Cf. M. Sej-Kolasa, A. Zielińska: Comparative Analysis of Communes in Dolnośląskie Voivodship on the basis of Selected Indicators Showing Sustainable Development. [In Polish] In: *Taxonomy 9. Data Classification and Analysis. Theory and Applicatopns*. [In Polish] Red. K. Jajuga, M. Walesiak. Akademia Ekonomiczna we Wrocławiu, Wrocław 2002, p. 12; S. Kozłowski: Is the Transformation of Polish Economy Aimed at Sustainable Development. [In Polish] In: *Mechanisms and Determinants of Eco-development*. [In Polish] Vol. I. Wyd. Politechniki Białostockiej, Białystok 1996, p. 97.

The definition of sustainable development, quoted the most often, comes from the report of Bruntland Commission *Our Common Future*.³¹ The Commission has placed concepts of sustainable development and future in international programme and defined it as the development that satisfies the needs of present generations without putting future generation at risk of losses so that they could meet their needs as well. This development is not a permanent state of harmony but rather a process of change during which resource exploitation, trends in investments and technological development as well as institutional change are in accordance with future and present needs.³² The aforementioned definition refers to a particular type of further and future development of society aware of the fact that this development is connected with the exploitation of resources and hence resources should be managed in such a way so that future generations could use them as well.³³

The statement issued by Bruntland Commission was criticized by some as it did not take a major difference between development and growth into account. Development is very often equated with growth and these notions are used interchangeably, which is a mistake as they are not synonyms. For instance, Kozłowski and Hill state that development is the attainment of certain social and economic goals that may require stabilization, growth, reduction, change in quality or even the exclusion of existing elements. At the same time, achievement of goals may require the creation of new elements. It should be noticed that in each of the aforementioned cases, development, occurring via certain changes, is supposed to lead to progress reflected mainly in improvement in common interests of communities involved in this process.³⁴

Better results achieved by a region do not necessarily have to result from economic growth (usually described as GDP per capita growth or gross regional product per capita growth), and lack of growth does not entail that development has not occurred. Nevertheless, followers of sustainable development believe that it is vital to state that a need for economic progress goes hand in hand with development though such development should minimize costs (economic, social and environmental) and maximize profits. This is a compromise and, at the same time, a challenge.

Jacobs believes that sustainable development allows to provide all the members of a particular community with basic environmental, social and economics services

³¹Bruntland Commission: *Our Common Future*. World Commission on Environment and Development, New York 1987.

³²R.J. Stimson, R.R. Stough, B.H. Roberts: *op.cit.*, p. 43.

³³H.N. van Lier: Land Use Planning in Perspective of Sustainability. An Introduction. In: Sustainable Land Use Planning, ISOMUL Developments in Landscape Management and Urban Planning. Red. A.J. de Buck, C.R. Jurgens, Jaarsma, H.N. van Lier. Elsevier, Amsterdam 1994, pp. 1–12.

³⁴J. Kozłowski, G. Hill: *Towards Planning for Sustainable Development. A Guide for UET Method*. Aldershot, England 1993, p. 4.

and does not threaten the implementation of natural, created and social systems on which providing the services depends.³⁵ Pearce et al suggest that sustainability implies that the environment should be protected in such conditions and to such extent so that its capabilities (capability of the environment to fulfill various functions) could be maintained for a long time and at a level sufficient to provide future generations with opportunity to take advantage of the environment to a comparable degree.³⁶

According to Maastricht Treaty on European Union from 1992 (article 2), sustainable development is believed to improve the quality of life as long as this life is capable of supporting the ecosystems. The 5th European Community Environment Programme (from 1993) called for treating sustainable development as harmonized development of economic activity that did not cause inflation and respected the environment. Local Governments for Sustainability (ICLEI) perceive sustainable development as constant economic and social development harmless to national resources on which the quality of human activity and further development depend.

Sustainability may also be defined as continuation without reduction and hence sustainable community or region may be considered as looking for and improving economic, environmental and social qualities of a particular area in such a way so that members of this community could live in a healthy, creative and pleasure way. Development can be understood as improving or leading to a more advanced state. Therefore, sustainable development may be perceived as development improving the economy but not weakening the environment or society.

There are several factors contributing to sustainable development, namely capability to create and absorb innovations, improve human capital and knowledge, professional organization of human resources and creation of effective structural arrangements of human and material resources of a region allowing the commercialization of regional product.³⁷

Sustainable development is also very often called long-lasting development or eco-development. It is a concept of permanent use of capital or resource. It defines permanence in economic terms, i.e. as maintaining the natural capital.³⁸ Natural capital is the entire natural environment that is a resource of production means such as soil, air, forests and water, thanks to which goods and services provided can be

³⁵M. Jacobs: *The Green Economy: Environment, Sustainable Development, and the Politics of the Future*. Pluto Press, London 1991.

³⁶D. Pearce, A. Markandya, E.B. Barbier: *Blueprint for a Green Economy*. Earthscan, London 1989.

³⁷M. Sobocińska: *Using Marketing in Regional Development – Selected Issues*. [In Polish] In: *Marketing and Activity of Regions*. [In Polish] Red. J. Karwowski. Uniwersytet Szczeciński, Szczecin 2006, p. 60.

³⁸J. Śleszyński: *Introduction to Issues relating to Sustainable Development Indicators*. [In Polish] In: *Markets and Regulation. Poland at the close of 1990's*. [In Polish] Materiały z konferencji Wydziału Nauk Ekonomicznych Uniwersytetu Warszawskiego. WNEUW, Warszawa 1998, p. 359.

recycled or not recycled and launched or not on the market. It should be stressed that methods for acting should allow to marinate natural resources or at least do not reduce benefits accruing from these resources.³⁹

Piontek defines sustainable development as continued improvement in the quality of life of present and future generations via shaping the right proportions in using three types of capital, namely economic, human and natural capital.⁴⁰

Gil and Śleszyński also mention three elements of sustainable development, i.e. economic, social and environmental. Economic element makes one aspire to economic growth that leads to real prosperity and enables him/her to avoid short-sighted policy resulting in long-term impoverishment. Societies must optimize income stream and at the same time maintain basic resources of their capital as well as optimize social and environmental costs connected with the production and distribution of goods. Social element refers to satisfying fundamental needs by members of a society and providing equal opportunities for development. Finally, environmental element implies that natural goods and services should be used in such a way so that, on the one hand, complex ecosystem relationships are not disturbed, and on the other hand, the contribution that goods and services have made to human prosperity is not lessened.⁴¹

The above discussion on the notion of “regional development” allows to draw certain general conclusions. In fact, regional development refers to a certain space (territorial unit) and may be treated not only in terms of a product but also from the perspective of a process and hence it is vital to analyze it in a temporal dimension. Regional development is determined by many factors both qualitative and quantitative in nature. Furthermore, it cannot be analyzed in isolation from the concept of sustainable development. Thus, the examination and assessment of regional development are extremely complex tasks.

1.2 Data Monitoring for Regional Development Assessment

Proper and reliable assessment of regional development cannot be made without access to extensive source of diverse yet comparable information items. Any flaws or gaps in this scope hinder the assessment and limit the possibilities of carrying it out in a comprehensive and objective way.⁴² The examination of a current situation

³⁹S. Gil, J. Śleszyński: *Lasting Economic Prosperity Indicators*. [In Polish] In: *Economist*. [In Polish] Warszawa 2000, pp. 608–609.

⁴⁰B. Piontek: *Determinants of Socio-economic Development in Contemporary Economy*. [In Polish] In: *Economy and Environment no 1(27)*. [In Polish] Fundacja Ekonomistów Środowiska i Zasobów Naturalnych, Białystok 2005, p. 25.

⁴¹Cf. S. Gil, J. Śleszyński: *op.cit.*, pp. 608–609; J. Śleszyński: *op.cit.*, p. 362.

⁴²The notion “assessment” is understood as determination of the value and importance of something (*Popular Dictionary of Polish Language*. [In Polish] Red. B. Dunaj. Wyd. Wilga, Warszawa 2000), which in the context of regional development assessment entails a diagnosis of region’s state. Regional development assessment understood in such a way is in accordance with the majority of publications concerning this subject matter (e.g. *Regional Development . . .*, p. 34 et al).

in a region, possibility of predicting the future course of phenomena via the projection of historical data, dynamic analyses or interregional comparison are plausible only thanks to proper resources of databases.⁴³

In this context, regional monitoring is of profound importance.⁴⁴ “Regional monitoring” is understood as a process of consistent collection of reliable information concerning a region in order to observe changes occurring in this region. It is about both quantitative information (that enables one to identify the level at which an explicitly defined measure is achieved) and qualitative information. In other words, regional monitoring consists in a long-term or permanent observation of certain phenomena occurring in particular dimensions of regional development (cf. Table 1.1) that allows to get to know their response to certain actions. As a result of these observations, certain information pieces regarding the state of a region are collected (database). Such information is used, among other things, by local authorities for decision-making.⁴⁵ Understood in such a way, monitoring is a key element in programming and managing of regional development (taken sustainable development principles into account).⁴⁶ Programming and managing of regional development are impossible without the support from information collected and complemented during the process of monitoring.

The system of regional monitoring should be analyzed on the following planes:

- Institutional – organizational,
- Information – functional.

Institutional – organizational structure of monitoring system consists of the following units: statistical offices, statistical service of local government and government administration, and other units obliged to register changes occurring in a region.

The main unit dealing with the collection of statistical information, that may be used for assessing the regional development, is Central Statistical Office (GUS), i.e. one of central bodies of public administration obliged to make data widely available in the light of legal regulations (Public Statistics Act and Statistical Research

⁴³To find more consult the following sources: M. Obrębalski: *Urban audit – Attempt to Measure the Standard of Living in Selected European Cities*. [In Polish] Prace Naukowe Akademii Ekonomicznej we Wrocławiu nr 979. Wrocław 2003, p. 448; M. Markowska: *Databases of Regions as an Element Supporting Regional Management*. [In Polish] Prace Naukowe Akademii Ekonomicznej we Wrocławiu nr 979. Wrocław 2003, pp. 102–03.

⁴⁴“Monitoring” is understood here as a system involving long-term or recurrent observation of a certain type made with reference to phenomena of specific type or response to these phenomena (*Dictionary of Foreign Words*. Red. I. Kamińska-Szmaja. Wyd. Europa, Warszawa 2001). The notion is defined similarly by *Popular Dictionary*. . . : constant observation, taking continuous and systematic measurements.

⁴⁵Cf. M. Obrębalski: *Public Statistics as a Means for Supporting Local Authorities in Decision-making*. [In Polish] In: *Strategic Decisions in Regional Economy*. [In Polish] Red. R. Krupski, E. Tyszkiewicz. I-BIS, Wrocław 1996, pp. 204–31.

⁴⁶W. Toczyński: *System for Monitoring Sustainable Development in Northern Poland*. [In Polish] In: *Sustainable Development – Polish and European Experience*. [In Polish] Red. S. Czaja. Biblioteka “Ekonomia i Środowisko” nr 23. Nowa Ruda 2005.

Programme announced every year). Access to data is at present relatively easy as it is published on websites of Central Statistical Office in the form of Regional Database (BDR).⁴⁷

Regional database, functioning since 1995, is the largest arranged set of information about socio-economic, demographic and social situation as well as the environment made available on the Internet in Poland. On the main website, one may browse a list of information available as well as its catalogue which is presented in the form of features (indicators) describing the units of territorial division in Poland and consists of many items arranged by fields. The number of items is different in consecutive years and depends on the scope of research conducted and gradual extension of database. So far, GUS has collected about 1,800 features in the following categories:

- territorial division (surface area of a county, number of villages and towns),
- Local self-government (councilors by sex, age, occupational group),
- Population (population state and natural movement, migrations for permanent residence),
- Surface area and use of arable land (farmlands, other arable land and wastelands),
- Transport and communications (county, local and city roads, post offices, telephone subscribers),
- State of the environment and environmental protection (municipal sewage treatment plants, air pollution emission, industrial waste, natural and landscape protection, greens),
- Communal economy (water system, sewage system, gas mains in cities, power industry, public transport routes),
- Trade (shops, market places),
- Tourism (tourist accommodation, accommodation places by categories),
- Pre-school education (number of institutions, places, children, teachers),
- Education (number of institutions, departments, pupils/students, teachers, graduates),
- Health protection and social security (hospitals, health care in spas, clinics, pharmacies, health service, crèches, social security institutions),
- Culture and art (libraries, cinemas, theaters),
- REGON, i.e. National Economy Register (units registered in sectors and sections of EKD,⁴⁸ i.e. European Classification of Business Activity),
- Income and expenditure in the district budget (income and expenditure in the district budget by sources and purposes).

The above information refers to voivodships, counties and communes as subjects in the system of social and administrative organization of a country, as

⁴⁷The address of Regional Database website is as follows: <http://www.stat.gov.pl/bdr/>.

⁴⁸European Classification of Business Activity (Polish EKD) has been carried out on the basis of the project carried out by Statistical Bureau of European Community EUROSTAT. It has a subject character and is a systematized set consisting of types of socio-economic activities in national economy.

well as regions and sub regions that are elements of Nomenklatura Jednostek Terytorialnych do Celów Statystycznych (NTS).⁴⁹ NTS divides Poland into hierarchically related territorial units at five levels. Three levels are regional whereas the remaining two – local ones. Regional level includes:

1. level 1 – the area of a region (on May 1, 2004, 6 regions were outlined each of which included from two to four voivodships),
2. level 2 – voivodships,
3. level 3 – sub regions (groups of counties).

Local level encompasses level 4 (counties) and level 5 (communes). Levels 2, 4 and 5 are in keeping with the system of identifiers and nomenclature of units of administrative division that is a part of National Register of Official Territorial Division of a Country (TERYT).

A Polish voivodship meets the following two criteria established in the delimitation of EU regions: region is the largest unit in the administrative division of a country (administrative criterion) and has elective authorities, legal subjectivity and its own budget (political criterion). It is also in compliance with the definition of a region accepted by the Assembly of European Regions that puts an emphasis on political criterion (region is a territorial unit that occupies a position directly below central government and has its own political representatives elected).⁵⁰

NTS nomenclature has been worked out on the basis of European Nomenclature of Territorial Units for Statistics (NUTS) that is in operation in EU Member States. It is used for collecting and harmonizing data on regional statistics of Member States as well as making it available. Furthermore, the nomenclature in question is also employed while shaping the regional policy in EU Member States and essential for analyzing the degree to which regions have developed socio-economically, paying special attention to the assessment of regional diversity and working out regional development programmes.⁵¹

NUTS distinguishes the following categories⁵²:

⁴⁹NTS description has been presented, among other things, on the website: *Nomenklatura NTS*. GUS, http://www.stat.gov.pl/bdrpl/slowniki.nts_info (accessed October 9, 2007).

⁵⁰T. Borys, P. Rogala et al.: Final Report on Work carried out: Devising the Implementation Model of Sustainable Development at the level of Voivodships as a part of Regional Database. [In Polish] Regionalny Ośrodek Ekorozwoju Fundacji Karkonoskiej, Jelenia Góra–Warszawa 2003, pkt 2.1.1 (the text is also available on the Internet: http://mos.gov.pl/2materialy_informacyjne/raporty_opracowania/synteza1.pdf).

⁵¹See: Regulation (EC) NO 1059/2003 of the European Parliament and of the Council (dated May 26, 2003) on the establishment of common classification of territorial units for statistics (NUTS). DzU L 154 dated June 21, 2003, p. 1.

⁵²To find more about NUTS consult the following sources: J. Żebrowska-Cielek: *Nomenclature of Territorial Units for Statistics*. [In Polish] PARR, Warszawa 2001, available on the Internet: <http://eupolicy-jeanmonnet.sggw.waw.pl/publikacja/5.3.pdf> (accessed August 7, 2007); M. Rozkrut: *Investigation of Economic Development of Polish Counties in the context of Division into Territorial Units NUTS 1*. [In Polish] In: *Taxonomy 13. Data Classification and Analysis, Theory and Applications*. [In Polish] Red. K. Jajuga, M. Walesiak. Prace Akademii Ekonomicznej we Wrocławiu nr 1126. Wrocław 2006, pp. 343–344; *Division of Poland into Statistical Units NUTS*, <http://www.zyrdow.pl/ue,podzial> (accessed August 8, 2007).

1. NUTS I – the largest unit inhabited by from 3 to 7 million people, corresponds to, e.g. States of Germany and to level 1 in the aforementioned NTS nomenclature;
2. NUTS II – enabling to present socio-economic issues in a region-country arrangement in a comprehensive way, corresponding to, e.g. French or Spanish regions inhabited by from 800,000 to 3 million citizens and to level 2 (voivodships) in NTS nomenclature;
3. NUTS III – areas that are too small to conduct comprehensive regional analyses (from 150,000 to 800,000 inhabitants), correspond to, e.g. French departments or German counties and to level 3 in NTS (groups of counties);
4. NUTS IV – category defined only in certain countries, e.g. British counties, corresponding to level 4 in NUTS (counties);
5. NUTS V – basic units, i.e. communes (level 5 in NTS).

Figure 1.3 shows the map of Poland with units corresponding to NUTS I, i.e. to level 1 NTS (numbers refer to the number of inhabitants). The following regions have been marked on the map:

- region I (central) covering Mazowieckie and Łódzkie voivodships,
- region II (southern) with Małopolskie and Śląskie voivodships,
- region III (eastern) covering Podlaskie, Lubelskie, Podkarpackie and Świętokrzyskie voivodships,
- region IV (north-western) encompassing Wielkopolskie, Lubuskie and Zachodniopomorskie voivodships,
- region V (south-western) covering Dolnośląskie and Opolskie voivodships,
- region VI (northern) encompassing Pomorskie, Kujawsko-Pomorskie and Warmińsko-Mazurskie voivodships.

Regional Database, organized in accordance with the aforementioned NTS nomenclature, provides users with a permanent and friendly access to current statistical information as well as enables them to make multidimensional statistical analyses in regional and local arrangements. Apart from RD, statistical office has also established demographic database referring to many aspects of population mobility which presents (in a free of charge and partly paid form) indicators that, once selected carefully, may reflect the potential of a region in the context of, among other things, human capital quality.⁵³

From a number of publications presenting the description of regions in a numerical form, one may also mention statistical yearbooks and bulletins⁵⁴ as

⁵³Base is available on the Internet on the following website: <http://www.stat.gov.pl/demografia/index.html>.

⁵⁴Central Statistical Office publishes among other things the following yearbooks: Small Statistical Yearbook of Poland, Demographic Yearbook, Statistical Yearbook of Voivodships, Statistical Yearbook of Industry, Statistical Yearbook of Agriculture and Rural Areas, Statistical Yearbook of the Republic of Poland [All the above in Polish]. Data useful in regional monitoring is also presented in various types of bulletins, journals and collective studies published by Central Statistical Office such as e.g. Information on socio-economic situation in the country; Information on socio-economic situation of Voivodships; Polish Counties etc. [All the above in Polish]. Complete list of GUS (Central Statistical Office) publications has been presented on the following website: http://www.stat.gov.pl/gus/zws_PLK_HTML.htm.



Fig. 1.3 Division of Poland into NUTS regions

Source: own elaboration based on J. Zimny, J. Sokołowski, R. Kozłowski: *NUTS – another partition of Poland?* [In Polish] Instytut Studiów nad Rodziną UKSW, <http://www.isnr.uksw.edu.pl/aktual/2005/nutsy.htm> (accessed August 8, 2007)

well as other papers⁵⁵ providing him/her with information on socio-economic situation of voivodships (paid data on labour market, remuneration, pensions and retirement pensions, housing construction, economic entities, industrial production and construction, financial results of enterprises, agriculture, income and expenditure made by local self-government units). Furthermore, Regional Statistics Center (Polish CSR),⁵⁶ functioning since 1994, is developing the methodology of regional research. Internet Panorama of Cities, Communes and Regions functions as a part

⁵⁵Monographs published by The Gdańsk Institute for Market Economics to, among other things, *Developmental Success of Polish Voivodships*. [In Polish] Red. T. Kalinowski. IBnGR, Gdańsk 2006.

⁵⁶More information concerning the activity of the Center is presented on the following website: <http://www.ae.poznan.pl/pages/i/1/1208.php>.

of CSR and is aimed at supporting the local democracy, mainly in local self-governments, in terms of information.

Discussing the sources of data used for regional development assessment, one should also mention InfoBase system that has been developed by Acxiom corporation.⁵⁷ It is an integrated system of databases made up of the following sources: Regional Database of Central Statistical Office (GUS), Data from General Census 2002, PESEL MSWIA and Acxiom bases based on Polish questionnaire on products and services. Particular data sets describe different units, namely persons, buildings, statistical regions, communes. Table 1.2 shows general information concerning the level of data aggregation, its source and scope.

Database of EU Member States regions, i.e. Eurostat Regio (a part of New-Cronos base) is a useful source of information that may be employed in the system of regional monitoring. Eurostat, functioning since 1972, deals with making statistical forecasts and analyses mainly with reference to the European Union. They are of major importance to decisions made by community authorities who cope with coordinating and monitoring of work carried out by statistical offices in order to standardize the research methods used and consolidate national statistics in Member States.⁵⁸

The quality of regional monitoring system depends on information-functional structure of available sources. Unfortunately, due to a diversity of tasks accomplished by institutions and organizations, data collected by them is not always cohesive. Hence, while making spatial-temporal analysis, a researcher very often comes across information barrier resulting from the lack of comparable statistical data. This fact hinders, or at best makes it difficult to assess the state of a region accurately, due to which it is not possible to identify a problem and, as a consequence, take measures that would provide harmonious and sustainable

Table 1.2 Organization of InfoBase system

Aggregation level	Data source	Information scope
Commune	Regional Data Bank GUS; General Census 2002	Urbanization, infrastructure, development of areas (migrations, investments), education
Statistical regions (400 households)	Operational data GUS, Acxiom base	Population size and density, lifestyle patterns
Building	PESEL base	Type of building, structure of age and sex of persons registered
Individual characteristics of consumer/household	Acxiom base	Age, sex, place of residence

Source: Infobase, Acxiom, <http://www.acxiom.pl/CustomerInformation/Infobase/index.html> (accessed October 17, 2007)

⁵⁷Website of the corporation: <http://www.acxiom.pl/>.

⁵⁸Regional Development Assessment . . . , p. 49.

development. The quality of research subjects covered, possibility of making comparison and effectiveness of scientific analyses depend on the quality of sources. Sources should be reliable, stable and comprehensive.⁵⁹ These postulates ought to be taken into account while shaping the system of regional monitoring. Information needs of this system result from the analysis of major processes in social, environmental (natural-cultural) and economic systems, having adopted sector, integrated and spatial perspectives.

In the literature on the subject, attention is paid to the fact that information-functional structure of regional monitoring system should allow, among other things, the analysis of increase in the number of new jobs, development of new markets, launching new production and new types of services, improvement in management effectiveness, technological progress, improvement in professional qualifications of the employed, and improvement in relations among economic entities as well as between inhabitants and the environment. All the aforementioned elements are of major importance while pursuing regional strategy. They reflect socio-economic phenomena occurring in a region and consequently are a point of reference in the assessment of results of actions taken in a region, i.e. successes and failures.⁶⁰

1.3 Regional Development Indicators

It is vital to indicate areas that require observation and select appropriate indicators so that the monitoring is effective.⁶¹ Apart from measuring the degree to which objectives have been fulfilled and keeping trace of changes in factors determining this process, these indicators are also used for mobilizing the participants in control process in the scope of programming and to carry out actions as well as adjust the behavior to management goals identified.

Construing the system of indicators, it is necessary to specify the criteria to be met by them. On the basis of experience gained while creating systems of indicators for the UN and OECD, the following three criteria can be mentioned⁶²:

- Usefulness to a certain policy,
- Analytical and perceptual clarity for all the participants in monitoring system,
- “Technical” feasibility, possibility of taking measurement in particular.

⁵⁹M. Markowska: *Databases . . .* [In Polish], p. 107.

⁶⁰L. Wojtasiewicz: *Strategy for Voivodship Development. Socio-economic Aspects.* [In Polish] In: *Spatial Information in Regional Economy.* [In Polish] Instytut Geodezji i Kartografii, Warszawa 1999, pp. 89–101.

⁶¹Indicator is understood as a measure determining the level of occurrence of a certain phenomenon and at the same time defining the degree to which objectives established have been achieved.

⁶²GUS (Central Statistical Office) website, http://www.stat.gov.pl/gus/opis_wskaznikow_2891_PLK_WAI.htm (accessed September 15, 2007).

On the basis of the above criteria, one can prepare a detailed set of features by which regional development indicators should be characterized. These indicators should:

- Present a representative view of the system observed and conditions of environment,
- Show tendencies,
- Provide a well-founded basis for responding to occurring changes,
- Be related to systems recognized internationally, provide basis for making international, national and regional comparisons,
- Allow the assessment and interpretation of indicator value also via referring to standard values,
- Refer to functioning socio-economic models (development and control), decision-making models, models for forecasting and informing,
- Be based on available information that is well proven and of recognized quality,
- Have a comprehensible construction, and results of measurement should be relatively easy to interpret,
- Be updated.

The role of indicators in the assessment of regional development, factors determining it and its results is extremely crucial as it enables one to compare countries and regions. Without such a comparability, indicators lose their importance because they make it impossible to make relative references and assess changes as well as their rate.

Formulating the system of indicators, one should remember that it ought to be adjusted to the role and needs identified by particular groups of users, as well as types of problems faced in a certain region. For instance, in order to create a system for informing politicians and wide social circles, that would allow to make comparisons on a national scale and international scale, one can draw on the aggregation of detailed indicators. By doing so, one obtains so-called synthetic measures⁶³ used for decision-making. One may also use a method involving the selection of key indicators from all existing ones. However, they must be relevant to the group of objectives and problems that a particular indicator is supposed to reflect. Construing the system of indicators aimed at informing a wider community, one should pay attention to the fact that it should exert a profound influence in terms of social engineering. Indicators should reflect the reality and be weighed (as far as the scope and expressions are concerned) in such a way so that knowledge could be acquired

⁶³K. Nermend: *A Synthetic Measure of Sea Environment Pollution*. "Polish Journal of Environmental Studies" 2005, Vol. 14, No 4b; D. Strahl: *Using Classification Methods for Identifying the Level of Regional Development*. [In Polish] Prace Akademii Ekonomicznej we Wrocławiu nr 979. Wrocław 2003, pp. 76–83; W. Tarczyński: *Discriminatory Analysis on the Stock Exchange*. [In Polish] "Przegląd Statystyczny" 1996, R. XLIII, z. 1–2; *idem: Capital Markets*. Vol. I. WNT, Warszawa 1997, p. 266; M. Oparło: *Regional Development Measures*. [In Polish] PWE, Warszawa 1972.

easily and make particular users act. Figure 1.4 shows a general hierarchy of the system of indicators adjusted to particular groups of receivers.

It is very hard to specify indicators characterizing regional development as it is determined by many different factors at different levels (corresponding to, e.g. NTS system). Some factors are common, while the others can be found and exert influence only in certain places and at certain moments. Many authors claim that regional development is determined by the location of a given region, resources and natural environment conditions, rank and character of agriculture, demographic situation and unemployment rate, occupational composition and qualifications gained by labor force, effectiveness of rural institutions (including the activity of self-governments and local authorities in communes), property relationship and capital endowment, activity of rural community, structure of economy, infrastructure state.⁶⁴

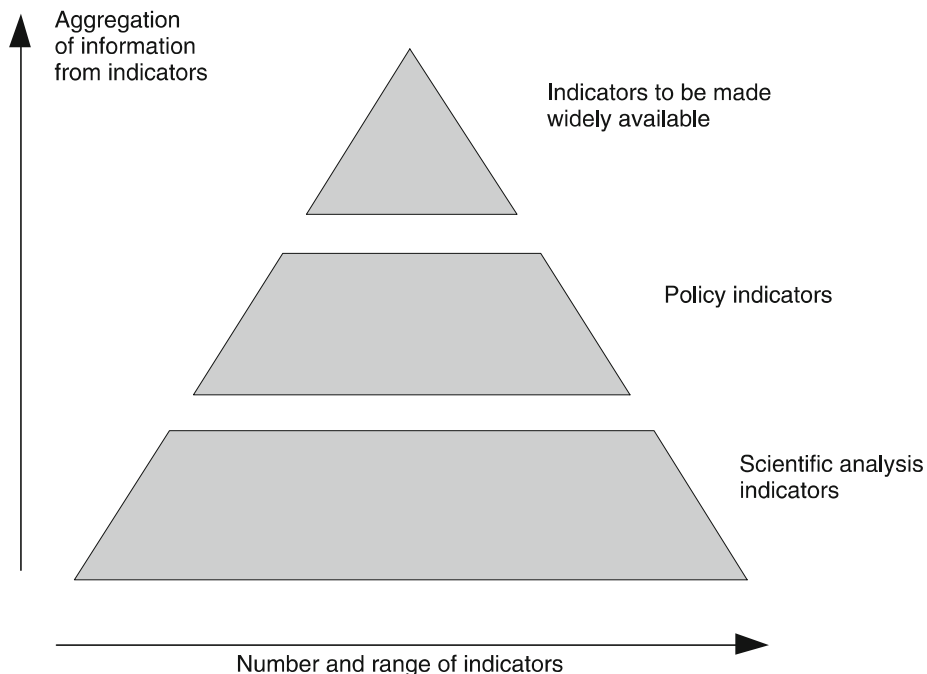


Fig. 1.4 Aggregation of indicators depending on the way they are used

Source: elaboration based on R. Coenen, H. Paschen: *Untersuchung zu einem integrativen Konzept nachhaltiger Entwicklung: Bestandsaufnahme, Problemanalyse, Weiterentwicklung*. Institut für Technikfolgenabschätzung und Systemanalyse, Karlsruhe 1999, p. 4

⁶⁴Cf. T. Kudłacz, M. Grzebyk: *Diversity of Communes with reference to Socio-economic Development Level in Rzeszowski Region*. [In Polish] *Zeszyty Naukowe Akademii Ekonomicznej w Krakowie* nr 588. Kraków 2002, p. 89; K. Duczowska-Małysz: *Development of Rural Areas. Report*. [In Polish] MRiGŻ, Warszawa 1996, pp. 22–33; J.J. Parysek: *Local Economy Fundamentals*. [In Polish] UAM, Poznań 1997, pp. 73–120.

All the indicators taken into account in regional development analysis can be divided into the following groups:

- Demographic variables,
- Socio-economic variables,
- Environmental variables,
- Variables characterizing the degree to which socio-economic infrastructure has developed.

The group of demographic variables is of major importance as regions function in certain social, political and economic environment and hence their assessment should take demographic situation into consideration. The quality and quantity of human resources in a region as well as their inflow and outflow have a profound influence on regional development. It does matter if a region encourages new settlers to arrive and settle or rather to leave and if the structure of settlers' age is important in the context of formulating the strategy of regional development. Strategies implemented in areas inhabited by elderly people and in regions where people of working age live should be different as both groups have different expectations and requirements. Among the group of demographic variables, the following may included: birth rate, population density, number of women for every 100 men, population of pre-working age for every 100 inhabitants of working age, population of working age for every 100 of population, population of post-working age for every 100 inhabitants of working age, total of married couples for every 100 persons, total population influx for every 1,000 persons, total population outflow for every 1,000 persons. Selecting the indicators from this group, one should bear in mind the fact that in order to asses demographic situation of a region, it is necessary to employ many indicators as each of them individually may distort the real situation. For instance, birth rate may be negative (which is unfavorable) even when the number of births is large in a region (which is particularly favorable to a region).

Socio-economic indicators characterizing a given region form another group of variables of major importance. In the literature, one may come across the following indicators: industrial production sold per capita, personal income tax for every 1,000 of population, county investment income for every 1,000 of population, other county income for every 1,000 of population, special subsidies and grants for every 1,000 of population, total per capita income, total personal income per capita, total expenditure on education and upbringing for every 1,000 of population, total expenditure on health service for every 1,000 inhabitants, total expenditure on public safety and fire safety for every 1,000 of population, total per capita expenditure, number of firms for every 1,000 of population, number of firms in public sector to total of firms in per cent, number of firms in private sector to total of firms in per cent, surface area of arable land to surface area of a county in per cent, surface area of forests and wooded land to surface area of a region in per cent, total of working population for every 100 of population of working age, number of working women to total of working population in per cent, unemployed registered for every 100 inhabitants of working age, unemployed who have not worked yet, higher

education institutions graduates to total of unemployed in per cent, unemployed women who have not worked yet, higher education institutions graduates to total of unemployed graduates who have not worked yet (in per cent), average gross monthly remuneration.

The group of socio-economic indicators is of profound importance to the research on regional development as these indicators provide information concerning human resources in a region. For example, indicator referring to the number of people of working age (from the group of demographic variables) has a whole different sense in comparison with indicators showing the total number of employed for every 100 of population of working age, number of working women to the total of employed in per cent, unemployed registered for every 100 inhabitants of working age or number of firms for every 1,000 of population. The quality and activity of human resources as well as economic background area of a region form the basis for initiatives and investments planned as well as strategic decisions.

Environmental variables form another group that include the following indicators: sewage channeled for every 100 inhabitants, sewage purified in municipal sewage treatment plants to sewage channeled in per cent, population served by sewage treatment plants in per cent, sewage channeled for every 100 firms, sewage purified in industrial sewage treatment plants to sewage channeled in per cent, emission of particulate pollutants for every 100 firms, emission of gaseous pollutants for every 100 firms, particulate pollutants blocked or neutralized to pollutants emitted in percent, gaseous pollutants blocked or neutralized to pollutants emitted in percent.

The aforementioned indicators inform about environmental conditions in which inhabitants of a particular region live. These indicators are important for at least two reasons. First of all, they reflect the influence that the environment has on an inhabitant and hence make conclusions about his/her condition and willingness to stay in a region. Secondly, they reflect the attitude of regional authorities toward creating as good environmental conditions in the area that comes within their jurisdiction as possible.

The last group of indicators used for regional development analysis are variables referring to the degree to which socio-economic infrastructure has developed. These variables form a basis for assessing regional infrastructure with the use of such indicators as among other things length of water supply system for every 100 km, length of sewage system for every 100 km, number of flats per one occupant, average floor surface of a flat per one occupant, county hard surface roads for every 100 km², improved county hard surface roads for every 100 km². It was legitimate to employ these indicators as they not only describe the conditions offered by a region to its inhabitants but are also a valuable source of information for potential investors.

Indicators employed in regional analyses enable one to assess the state of a region and level of regional development as well as to compare regions. Certain standards, that should be met by regions so that they do not diverge from the others unfavourably, are shaped thanks to indicators under consideration.

Summing up the discussion on indicators that can be taken into account in regional research, it is worth presenting a set of indicators that are used most often and referred to in European interregional comparisons, namely⁶⁵

- GDP, GDP per capita, GDP dynamics,
- Regional unemployment rate (total, by sexes, among population up to 25 years old),
- Economic activity of population, employed, employment (by sex and age, in economic sectors),
- Population migrations, birth rate, population density,
- Structure of households, agricultural production,
- Wages and salaries in industry,
- Transport infrastructure, transport system, railway system and others,
- Science and technology (patents, doctorates, R&D outlays, employment in high-tech sector, share in education),
- Health service, mortality, doctors, hospital beds,
- Water system, communal waste stockpile, afforestation rate,
- City statistics.

In practice, various sets of indicators are used for regional analysis depending on the research purpose and methods employed in the research (to which the next chapter is devoted).

⁶⁵T. Borys, P. Rogala et al: *op.cit.*