*Marek Szajt**

DISPROPORTIONS IN REGIONAL DEVELOPMENT IN THE EUROPEAN UNION AND EXPLOITATION OF INNOVATIVE POTENTIAL

Abstract. Consideration of regional character of given problem is often wrongly omitted during analysis of country policy in area of innovative activity. It is the appropriately oriented regional policy – especially in R&D area – which enables the country to experience a proper increase of innovativeness. In this study, a regional analysis of R&D and innovative activity, based on available resources such as OECD and EUROSTAT, has been presented. Some existing relations and problems associated with strong diversification of examined characteristics on the regional level, has been indicated. In the final part, with the application of regression analysis of spatial data, some real differences in approach to R&D financing in the Europe, has been uncovered.

Key words: R & D activity, innovativity, regional policy.

1. INTRODUCTION

Present-day economic policy is inseparably associated with regional development. It is especially visible in the case of European countries – particularly among old members of the European Union. This policy to a large extent comes out of historical, geographical and economic conditionings. In some countries, which are currently considered as homogeneous communities, some divisions, which originate from a distant history, are observable. For instance, Germany is in fact a federal country, and society of Great Britain consists in reality of four nations – English, Welsh, and much culturally different Scottish and Irish. It is only a compromise, which enables to maintain a relative stabilization in this kind of societies – this compromise should take into account various claims of particular groups. A kind of autonomy attributed to different social groups is also necessary. In this connection, even a comfortable way of governance must take into account a regional policy. It may lead to a sort of competition inside the country – for the European Union and government funds, investors etc. – and finally to an improvement in activity and higher competitiveness in international environment. While analysing European countries with consideration of strong

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division of territories, it is not only the difference between countries, but also the difference between regions, which should be underlined. These differences were present even before the enlargement of the European Union. As we can recall, particular countries joined the European Union in some time intervals, and with various economic systems – not necessarily harmonised with each other. Even today, there are some explicit differences between some regions in Greece or Portugal in comparison with other regions in those two and some other countries. These differences have deepened after an accession of ten countries from the Eastern and Western Europe and after latest incorporation of Romania with Bulgaria into EU structures. Because of that, a formation, which aroused can be hardly considered as a homogenous equivalent of a country.

Regional policy is characterised by several features which are simultaneously considered as advantages in comparison with country level policy. First of all, because of narrower capture of examined issues, a possibility of deeper analysis and more adequate concluding occur. Most often, disaggregation of data, enable to perform more thorough analysis. Secondly, a performance of policy on a smaller territory – usually more uniformly developed – facilitates a proper definition of goals and investigation of opportunities and threats. Even such ordinary issue as personal composition of governing assemblies on the regional level – is usually constructed on the basis of people who come from particular territory, which means a more comprehensive understanding of local needs. Another advantage is associated with emergence of a kind of competition between regions. As far as it is known, competition in conditions of restricted resources determines an improvement in quality. In this case resources – especially obtained from country and international funds (for instance EU funds) – are restricted. Because of that, a kind of fight for winning the funds in various groups and regions occur. The division of funds is performed with the use of various classifications of applications and projects, although the choice depends on government priorities and the quality of applications. Management on the country or regional level is easier with consideration of competence sharing. Efforts to operate on the basis of centralisation failed in every country so far. The usage of regional policy provides also some knowledge about particular regions – thanks to collection of statistical data on the regional level. This information enables – on country level – to indicate some differences between regions, the advantages of particular regions and disadvantages of other areas, technical problems, business, economic and demographic impediments. The possession of such information in relation with data about expenditures associated with precise goals, can facilitate the process of implementation of appropriate activities which must be undertaken with regard to particular administrative entities. Another advantage corresponds with an opportunity to observe some similarities between regions in international or even global perspective. It is extremely difficult to find two similar countries, whereas much easier to distinguish two or

more similar regions. What is more, in Europe a three-stage regional division has been accepted. Each stage or level corresponds with higher level of disaggregation – smaller administrative entities. Most of updated statistical data is available with an appropriate frequency and correspond with NUTS 2 division. In the case of examination of regions similarity, a chosen division is indicated and with regard to comparable categories, a group of objects with similar characteristics can be distinguished. Such activities enable to perform an economic analysis of relations between results and particular actions in area of economic policy. In this study, one of research methods is applied with the use of statistical analysis based on data obtained from regional level of NUTS 2.

2. THE ECONOMIC REGIONAL DEVELOPMENT LEVEL

There are some measures of economic development, of which the most popular is change in GDP level in particular periods. This indicator is obtained with the use of chain indices, and sometimes with consideration of conversion rate into convertible currencies in current prices according to purchasing power parity. In this perspective, the dynamics of changes can be analysed in a simple way and freely compared with every area. What is more, in the case of some regions, GDP value is counted in comparison with the number of inhabitants (per capita) – which emphasizes their wealth. With regard for complications associated with collection of regional data, much greater delays, which correspond with collection of statistical information, are expected. Because of that, in the latest data sources, current information is gathered on the basis of for example 2004.

The next diagram presents the GDP per capita compared with European Union average.

Thus the greatest economic potential, can be ascribed to Inner London region, where GDP per capita exceeds three times the average value for the EU. Equally high level of this indicator is noticed in Brussels region in Belgium. The lowest level of wealth is observable in Romanian region of NORD-EST – it comes to 23.6% of EU average. Similar low indicators are visible in Yuzhen Tzentralen region in Bulgaria (25.6%). It is worth to mention that up to ten countries do not achieve the EU average in any region. These are countries which are not divided to a large degree (smaller countries) – Estonia, Cyprus, Lithuania, Latvia, Malta, and Slovenia. However we cannot wrongly assume that small countries are doomed to fail, because Denmark and Luxembourg, which are also small, achieve the level of 251% of the EU average. Among countries with more developed and complex spatial structure, Romania, Bulgaria and Poland do not exceed the EU average. None of Bulgarian regions exceeds the half of EU average, none of Romanian regions exceeds two thirds of EU average and in Poland, only Mazowiecki region slightly exceeds three fourths of EU average.
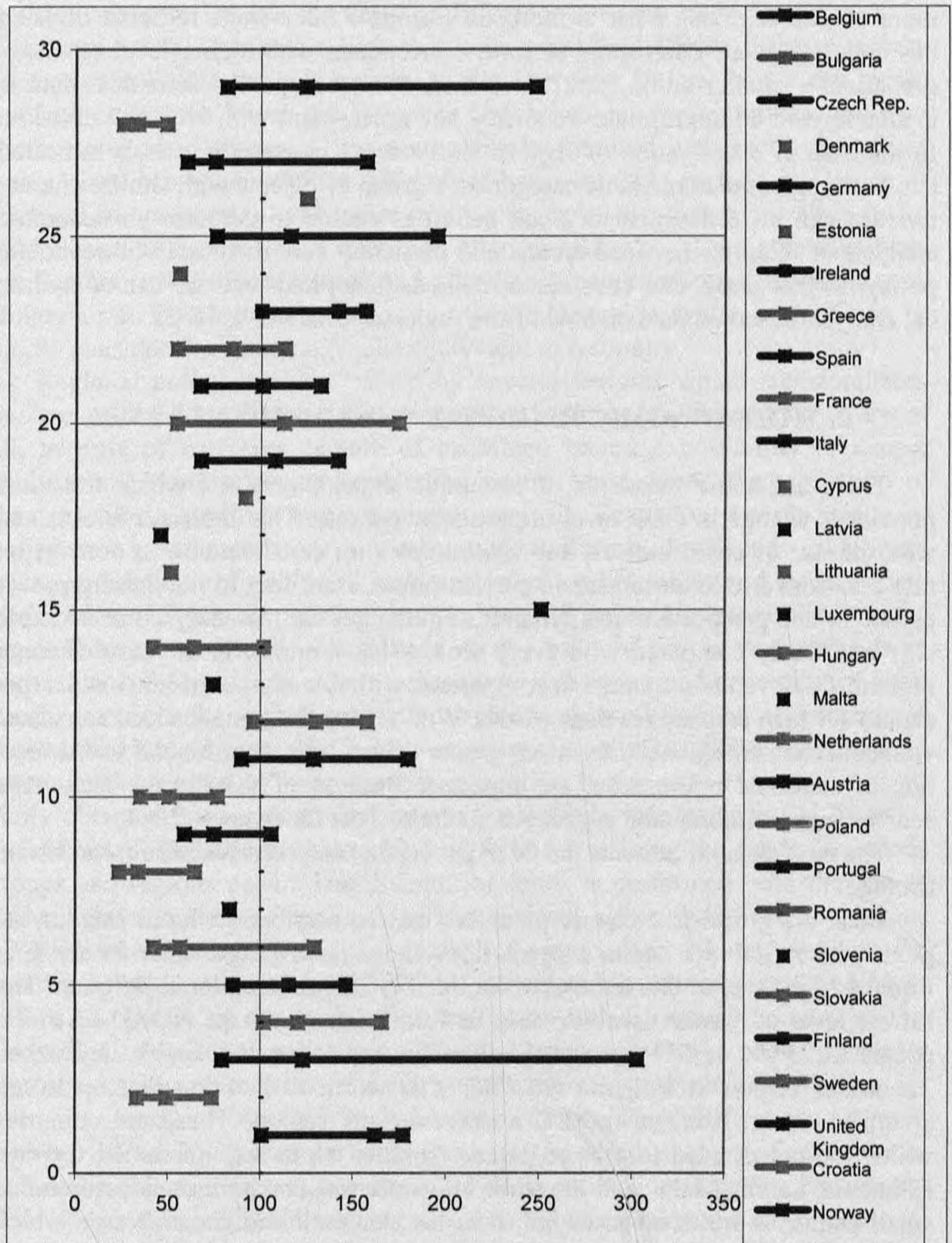
Graph 1. GDP per capita (in PPS) 2004, NUTS 2 level in % of EU-25 average (EU-25 = 100)
S o u r c e: own calculations on the EUROSTAT data basis and EUROSTAT 2005, p. 42.

Apart from above-mentioned Denmark and Luxembourg, Sweden is the only country where income in all regions is higher than the European Union average (on average it is 120.3% of EU average). Not surprisingly, the fastest growth is visible in the regions of countries newly accepted. Romanian Bucaresti-Ilfov obtained an annual growth of GDP per capita of more than 10%. Nearly the same growth occurs in two other Romanian regions and Estonia, Lithuania and Latvia.

The first ten of the regions with highest growth opportunities encompasses also mazowieckie voivodeships and Greek Attiki. Among regions of countries, which are the older EU members, only Irish regions indicate the growth of more than 8 % annually. Generally speaking, countries of the old EU are characterised by annual GDP per capita growth equal to 4.15%, while new EU members note the annual growth of 6.45%. Most of the French and German regions and all of Italian regions experience the lower GDP growth than EU average. Similarly, if countries from the ten recently incorporated EU members are considered – Cyprus and Malta experience GDP growth which indicates a kind of backward movement of their economies. The difference, even if large, do not guarantee that outsiders will quickly catch up with leaders. The problem is even greater if we take into consideration that the French Guyana or Italian Sicily are the most slowly developing regions. While analysing the relationships between the income per capita and the speed of economic growth, a statistically significant negative correlation has been observed (Pearson's correlation indicator equal to 0.24). Regions with high level of GDP slow down, whereas regions with low level of GDP try to accelerate their economies in order to catch up with wealthier neighbours. Various levels of wealth can be also observed in particular countries. Netherlands are the least diversified country – regional diversification equal to 16.4%. The most diversified countries are situated to the south of Poland – Czech Republic (40.5%) and Slovakia (52.7%). Obviously, the governance in such diversified economies is very difficult. Disproportions between particular regions are significant also in other countries. In Great Britain the most wealthy region experiences the GDP per capita equal to 3.8 times GDP of the least wealthy region. The triple difference is observed in the case of Slovakia, France and Belgium as well. The way to a growth is also unequal in particular regions within the same country. For instance, in Greece, Sterea Hellada region experiences the growth equal to 1.5% annually, whereas Attiki region comes to 8.4% growth annually. Similar differences, however slightly smaller, can be observed in Czech Republic, Portugal and in Hungary.

3. HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY IN REGIONS

As a measure of research potential it is not the number of people employed in R&D sector, but the Human Resources In Science and Technology (HRST) which becomes more useful and more often implemented because of greater significance. This measure can be explained as "everyone who has successfully completed post-secondary education (or is working in an associated S&T occupation); at its narrowest it covers only those with at least university-level qualifications in natural sciences or engineering (or working in an associated S&T occupation)"(OECD 1995, p. 8).

Table 1

The worst and the best regions in EU in HRST (% of active population)

HRST as a percentage of active population (the worst regions)	%	HRST as a percentage of active population (the best regions)	%
Centro (PT)	12.9	be10 Région de Bruxelles-Capitale/ Brussels Hoofdstedelijk Gewest (BE)	
Norte (PT)	13.1		50.1
Alentejo (PT)	13.4	Noord-Holland (NL)	50.2
Nord-Est (RO)	13.4	Île de France (FR)	50.3
Região Autónoma da Madeira (PT)	13.9	Zürich (CH)	50.7
Região Autónoma dos Açores (PT)	14.0	Praha (CZ)	51.4
Ionia Nisia (GR)	14.1	Inner London (UK)	53.3
Sterea Ellada (GR)	14.4	Utrecht (NL)	54.1
Sud-Vest Oltenia (RO)	14.4	Stockholm (SE)	54.3
Algarve (PT)	14.5	Prov. Brabant Wallon(BE)	55.8
Sud-Muntenia (RO)	14.5	Oslo og Akershus (NL)	57.1

S o u r c e: own calculations on the EUROSTAT data basis.

In this area a considerable differences are visible in particular countries and regions. In the territories most oriented on development of innovative society, HRST consists of more than a half of people employed. Such regions are presented in the table below and correspond with Oslo, Wallon region, or Stockholm. On the other hand, there are regions with employment lower than 15% – mainly Portuguese, Romanian and Greek regions occupy the 25 last places. In Greece, only Attiki region have an HRST employment equal to 34.3% of economically active population. With regard to this measure the strongest region in Portugal – Lisboa has an indicator of 2.5%. In Portugal, only 16.8% of economically active population can be included in HRST – it is less than in Romania, which as a new EU member is considered to be economically underdeveloped.

Average indicator for Romania comes to 18%, and in Bucaresti region comes to 36.6%. Also in these countries the strongest diversification of HRST indicator occurs. In Portugal, Romania and Slovakia exceeds 30%, in Czech Republic and Greece 26%, in other European countries do not exceeds 20%, and in Poland, Switzerland and Italy even 10%. However, there is a difference between various groups of particular countries. In Poland, HRST consists of 25% of economically active population, in Switzerland is close to 45% and in Italy comes to 30%. The highest values of this measure can be observed – except of above-mentioned Switzerland – in Nordic countries and in Germany, Luxembourg, Belgium and Netherlands. The highest dynamics of growth in this indicator can be noticed in Austrian, Greek, Spanish and Portuguese regions – more than 5% annually. Moreover, similar indicators are observed in Border, Midland and Western from Ireland and in Lubelskie in Poland. Lithuania and Estonia experience the greatest decrease in indicator's value – more than 2% annually. This decrease in fact is associated with 20th and 21th century change, because in recent years, a growth is observable.

4. CREATION OF INNOVATIVITY IN REGIONS

Within the process of permanent economic development that is often identified with economic growth, innovativeness can be distinguished as one determinant of that growth. The way of identifying this term is to a large extent difficult. However, in order to simplify we can assume that innovativeness is an ability to implement and absorb certain changes regarded as innovations. These abilities are ascribed to a given enterprise, area or society. Obviously, the character of innovations should be indicated – we can talk about inventions or about innovations. From the macroeconomic or mezoeconomic analysis point of view, we rather take into consideration innovations, which are classified as a complete novelty in a given area – in the case of research description – in the given region. Therefore, we can assume, that regions where creative and absorptive capabilities are well developed, is innovative. However, a different problem associated with definition of creative and innovative capabilities appears. In this study we assume, that these capabilities are represented by abilities of a given region (regarded as spatial entity) to implement innovations (described as reported patents). A much more difficult impediment to be overcome is to understand innovative absorptivity considered as an ability to absorb science and technical knowledge from external sources (measured as a number of patent applications from a given area created by non-residents). What is obvious, in order to measure the innovative absorptivity, a set of data from WIPO (World Intellectual Property Organization) is essential. However, concerning the way of presentation and data col-

lection, many values and indicators presented by this institution have changed within last years. On the regional level, this way of measurement is impossible. Some other characteristics that intermingle emerge – for instance HRST (Human Resources for Science and Technology). We will come back to these indicators, however it is worth to mention that on the one hand they describe the creative abilities (we will deepen this issue in the following sections), and on the other hand, they show absorptive abilities. Assuming, that youngsters and well-educated people are the most susceptible to novelties group of people, HRST measure is a kind of descriptive indicator (although it is a simplification) of absorptive abilities of a given area. What is more, a multiplier effect is worth to be mentioned here. If we assume a large creative potential present in well-educated society – reflected in high level of education – and good orientation in novelties and market needs – as an effect of large involvement in research – we can also assume, that innovative society (society with high level of HRST indicator can be regarded as innovative) is innovative from both demand and supply side of analysis. First of all, the society is creating a certain amount of innovations which are afterwards implemented in manufacturing and directed into the market. Obviously, usually the creators, authors and people connected with them are the first users. A suitable channel of information and promotion in connection with high consciousness of potential customers (it concerns especially goods of common usage) brings about an increase in demand for a given good. Increase in demand generates an increase in manufacturers' income – to some degree also a rise in authors' income – and allocation of new funds on additional research and improvements. Obviously in the case of market success, we have to do with diffusion into other markets and even higher benefits obtained as economies of scale and economies of scope. Above-mentioned multiplier effect is associated with the part of income of group of people engaged in R&D activity. This income is allocated to purchase of products created through this activity or services associated with modern and improved products. In extreme situations, we can observe consumers, who are strongly interested in technical novelties (gadgeteers) which is an effect of too large involvement in work instead of leisure time. In connection with this relation, remaining leisure time is exploited in an optimal way, which is facilitated by various inventions, which have been created recently. Therefore a paradoxical situation occurs, in which an initiator/manufacturer becomes a prisoner of his own idea and the main user/consumer.

While analysing a government policy – in apparent isolation from the economy – we can observe many activities, which aim at increase in innovative potential – often in an indirect form. Knowing that artificial creation of new workplaces in R&D sector is unprofitable, a better solution is to "supply" the market with new consumers or potential innovators. The best way to do it is to increase the level of education. Therefore, we can observe activities of different

countries directed into development of qualifications of particular societies. However
a kind of bias is visible – an increasing pressure is put into education of potential inventors – through promotion of exact sciences and specialties. Most of initiators, researchers and technical service employees originate from this area. The amount of students who are studying in technical universities and schools depends on abilities and market demand, especially in free market economies. Many schools in the world are nowadays so elastic, that facing market demand, they modify their study schedules, or even create new specialties. Market needs in this area are fulfilled however with a certain delay. In the case of long-term policy performed in particular countries, there exist some movements, which are designed for prevention from potential human resources shortages. For instance German offer composed for countries from Eastern and Western Europe consists of proposition of employing 20 000 IT workers. Denmark is willing to employ Polish nurses. An appropriate labour market opinion poll in connection with comprehensive analysis of demand for given goods, may lead to measurable benefits, which come out from a suitable regional policy in the area of education and employment. It is worth to mention here some issues, which correspond with specialization.

Benefits derived from specialization were observed many years ago. It has already been proved by many economists that narrow specialization usually corresponds with an increase in services quality and production efficiency. Similar relation is observable on the regional level. Efforts taken to implement a kind of regional autarchy in most cases have proved to be missed. On the other hand, the promotion of narrow regional specialization has lead to a very good outcome. For instance, regions with highly developed agricultural processing culture (Champagne, Bordeaux, Cognac) – exploit their brand which apparently is a well-known brand, in order to form consumers in a way suitable for manufacturer's preferences. It is much easier to sell the worst quality sparkling wine from Champagne than even the best cognac from this region. In association with this, an advanced level of specialization is visible in development of particular industries. It is in government and local authorities' interests to bound particular industry organisations (or enterprises) with research sphere and high-level education sector. Thanks to an appropriate policy, school graduates can be employed in the nearest surroundings of the school, which offers education programs in response to the market needs. What is more, thanks to this kind of activity budget expenditures for education are exploited directly in the same place – outflow of intellectual capital (brain drain) is restricted. Similar experience from Finland or Sweden proves that this is the best solution. Additionally, underinvested employees of higher education sector, who are people with a great recognition of technical issues associated with their research, often form spin-off enterprises. The activity of this kind of enterprises usually brings about many

benefits for everybody (excluding very high level of risk associated with these businesses). Such enterprises can run their business on the basis of all universities equipment (often with the use of buildings and rooms) – which is regulated by appropriate agreements and enables more efficient exploitation of such equipment (or buildings) and simultaneously a faster depreciation (which in reality is a way of obtaining funds for modernization of technological research equipment). This is by the way necessary in the face of rapidly increasing technical development. A second aspect is associated with full exploitation of abilities and knowledge of research workers employed in education system, which is often impossible if only university is engaged. There are many other advantages of this activity, such as researchers' contact with practical life and creating innovations for market needs and consistent with consumers' requirements. This leads to construction of real innovations, not those designed to put them on the shelf. This experience is directly transferred into knowledge – to a large extent practical – passed on to students during lecture hours. Simultaneously, we create educated personnel, create consumers and if some suitable entities are noticed – we perform recruitment process. It is worth to indicate some advantages of spin-off entities from the business sector point of view. As far as large enterprises are considered, usually they create their own research departments; however, they are not responsible for all possible aspects necessary in research. This is the case because the costs of running of some of the largest departments would be unacceptable. As far as smaller enterprises are concerned, the cost of maintaining departments or sections responsible for research usually exceeds enterprise capabilities. A suitable solution for both kinds of enterprises is to take advantage of experience of external entities and outsource some of the technically complicated activities to expert enterprises. Obviously in the case of very complex projects, a possibility of creating consortium occurs. In the long-run some of them turn into technological clusters that usually operate in a given region and work in a concrete industrial sector.

Unfortunately, the ideas and solutions presented above are not so easy to implement. In reality, this is local government, who has the most important role to play. Incentives designed in order to facilitate cooperation between R&D sphere and industry should originate from governing parties. These incentives should be associated with facilitation of establishment and operation of such companies. From the cooperation point of view, except of possible amenities and allowances, legal regulations of cooperation between higher education system and enterprise sector should be implemented (which is not the case in Poland). In addition, possibilities of obtaining funds from external sources by universities should be regulated. Some of facilities and government efforts should be meant for help in procedures associated with intellectual property protection and trade of this property.

5. THE GDP AND GERD – THE TEST OF INDICATION
ON REGIONAL LEVEL THE SIMILARITIES AND DIFFERENCES

Initial research has revealed some divergence between previous assumptions and reality. It was assumed that relation between GDP and GERD (Gross Domestic Expenditure on R&D) is logistic (Szajt 2006, p. 235). Expenditures on R&D are increasing rapidly up to a point, where the dynamics become steadier and finally it sets on the given level. In association with early stage of the examined process in global environment, it was assumed, that it increases exponentially during this stage.
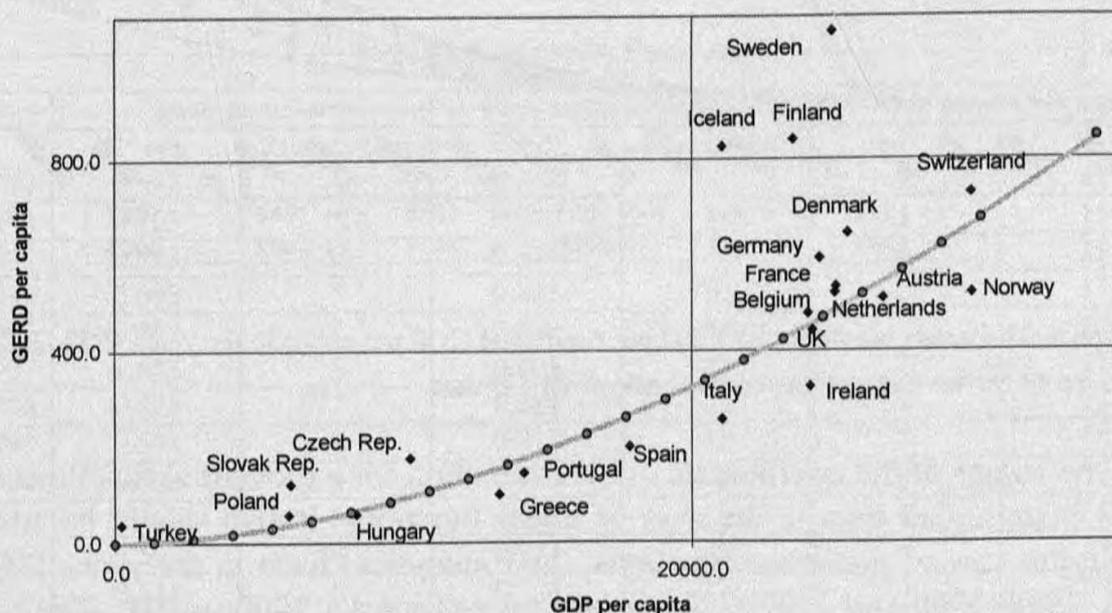
Graph 2. Outlays on R&D per capita and GDP per capita in 2002 in some OECD countries
(PPP in USD at 1995 prices)
S o u r c e: own calculations on the basis of OECD data.

Graph 2 suggests that the expenditure on the R&D activity increases much more slowly in less wealthy countries than in the richer ones. Exceeding a certain wealth point results in an automatic increase in expenditure on the investigated sector. At the beginning of the 90s this increase was much more dynamic than now as it even exceeded the rate of growth of wealth. The current slowdown can be explained by the present recession all over the world. The recession also affected the R&D sector.

From the above charts it follows that these functions look similar in different periods of time, especially in the case of the linear functions. After an of the fit the analytical form of the proposed functions based on the coefficient of determination, the opinion presented above is confirmed.
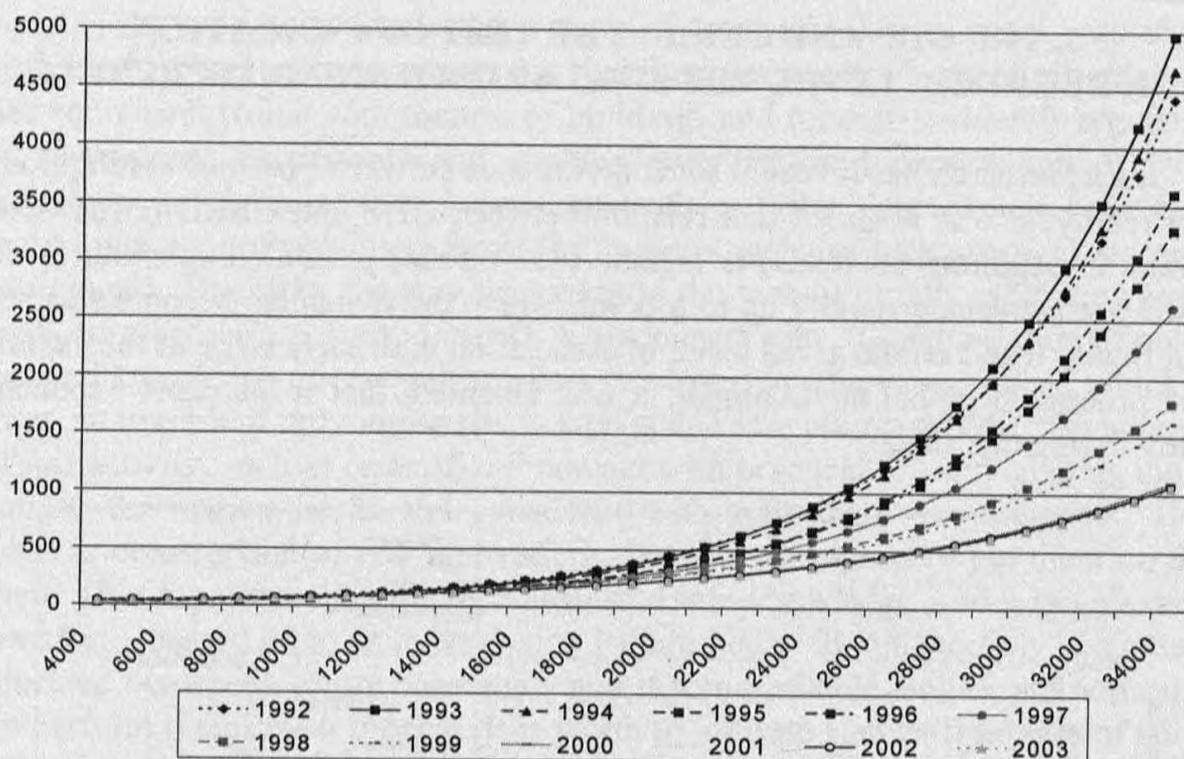
Graph 3. The trends of outlays on R&D per capita and GDP per capita in the years 1992–2003
S o u r c e: own calculations on the basis of OECD data.

The values of the coefficients of determination for exponential functions are in all cases higher than in the case of linear functions. It also should be added that in the case of the linear functions, their analytical form in the years 1995–1996, 1998–2000 and 2002–2003 is improper (Osińska 2000, p. 80). The conclusions from the above calculations would suggest that the expenditure in some countries was lower than the average determined by the regression line. However, this presentation does not take into account the capabilities of individual countries connected with the wealth of their societies and their R&D policies.

The research conducted for particular countries and regions in division on NUTS 1 and NUTS 2 level indicate that there exist many differences in policies concerning R&D. The relation between GDP and GERD on the national level becomes flattened year by year. In the case of regions, the situation is slightly different. With regard to NUTS 2 level, the greatest slenderness has been observed in 1998, than in 2001 and 2003, and the smallest in 2000. According to NUTS 2 division the slenderest relation was observed in 2000, whether the greatest flattening in 2001. Therefore it can be indicated, that R&D policy, and especially concerning financing methods, depends not only on GDP, but also on many other factors. What is more, some differences in mutual relationships between GDP and GERD have been indicated, especially in the case of various regions of the same country, or in observations of different years conducted in

one region. This volatility in the last ten years has been oscillating between 30% in Nordic regions up to 100% in Portuguese regions. It should be underlined that the policy is very stable in those countries in which the relation of GDP and GERD has been set between 2.3% (in France), and 24 % (in Slovakia). On the basis of this information it can also be assumed, that the country to a certain degree is distributing a large part of funds among particular regions. Because o that, it influences the internal, regional policy without disturbing the external perception of national activity. Internal problems cause a kind of mutual balancing and they can offset each other.

Table 2

Fit of the similar functions

Year	Linear Functions		Exponential Functions		Critical Value of Runs Test	
	R^2 adj.	Run number	R^2 adj.	Run number	S_1	S_2
1992	0.692	12	0.740	12	7	17
1993	0.723	12	0.770	9	5	15
1994	0.733	9	0.834	11	6	15
1995	0.698	5	0.811	10	7	17
1996	0.719	7	0.870	13	7	17
1997	0.683	8	0.805	15	7	17
1998	0.624	7	0.784	13	7	17
1999	0.671	7	0.815	11	8	18
2000	0.608	6	0.772	12	7	17
2001	0.567	8	0.762	12	7	17/18
2002	0.587	6	0.773	10	7	17
2003	0.611	6	0.778	12	7	17/18

S o u r c e: own calculations.

6. CONCLUSION

While analysing presented statistical data and their mutual relationships, some significant conclusions can be made. Innovation policy plays a very important role in economies of particular countries and regions. On the regional level, it is formed and determined by economical, geographical and political patterns. In many cases it is the level of regional development and specialisation, which determines the bias on R&D or other activity. The differences between innovativeness of regions within the same country or the same geographical area can be very distinct. The employment policy associated with science, and financial policy with regard to organisation of the funds for R&D activity seemed to be the most influential and meaningful factors that create innovative development of regions, and are directly linked with economic development of those regions. In many cases, despite of great involvement of particular regions in innovative activity, the results are unsatisfactory because of differ-

ent assumptions in comparison with national strategic guidelines, or existing histori-
cal impediments, which hamper the development phenomena. The only policy,
which enables to obtain the highest – in terms of efficiency – possible values of
indicators of innovativeness development, is based on application of comprehensive
innovative national policy coherent with realisation of strategic targets determined
by regions.

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DYSPROPORCJE W ROZWOJU REGIONALNYM W UNII EUROPEJSKIEJ
A POTENCJAŁ INNOWACYJNY I JEGO WYKORZYSTANIE

Analizując politykę państw w zakresie działalności innowacyjnej często – błędnie pomija się
uwzględnienie charakteru regionalnego wskazanego problemu. To właśnie odpowiednio ukierun-
kowana polityka regionalna – zwłaszcza w obszarze działalności B+R umożliwia właściwy rozwój
innowacyjności państwa. W pracy, korzystając z dostępnych źródeł danych – OECD i EURO-
STAT – przedstawiono analizę regionalną działalności B+R i innowacyjności. Wskazano istnieją-
ce zależności i problemy wynikające z silnego zróżnicowania badanych cech na poziomie regio-
nalnym. W części końcowej – wykorzystując analizę regresji dla danych przestrzennych, wskaza-
no na rzeczywiste różnice w podejściu do polityki finansowania działalności B+R.

Słowa kluczowe: działalność B+R, innowacyjność, polityka regionalna.