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Contents

| | |
|--|-----|
| Preface | 9 |
| Beata Bal-Domańska: Convergence of Central and Eastern European regions – spatial aspect..... | 11 |
| Barbara Dańska-Borsiak: The determinants of migration outflows from Polish sub-regions in both internal movement and abroad – identification and comparison..... | 22 |
| Anna Golejewska: Rethinking regional competitiveness. The role of productivity..... | 33 |
| Małgorzata Golińska-Pieszyńska: Intellectual capital as an important element of knowledge management..... | 43 |
| Piotr Hajduga: Special economic zones in the Lower Silesia region as a regional development stimulator during the crisis | 56 |
| Petr Hlaváček: Analysis of the development processes of the city of Ústí nad Labem as an example of the social and economic transformation of cities in the Czech Republic..... | 66 |
| Anna Jasińska-Biliczak, Jan Buleca: Participation of economic self-government in the process of the promotion of entrepreneurship – case study of Poland, Germany and Slovakia..... | 78 |
| Małgorzata Karczewska: Diversity of the gross expenditure on R&D in GDP by sources of funds in Poland against the background of the European Union | 89 |
| Artur J. Kożuch, Janusz Sasak, Kamilla Noworól: Target costing and participatory budget in Territorial Self-Government Units..... | 97 |
| Alina Kulczyk-Dynowska: National park as an element fostering the sustainable development of the region – the example of the Tatra municipalities..... | 108 |
| Iwona Ładysz: The regional dimension of economic security in the age of globalisation using the example of the Lower Silesian Voivodship | 118 |
| Krzysztof Malik: Smart specialisation and Key Enabling Technologies in the New Regional Development Policy | 128 |
| Štefan Marsina, Pavol Oravský: Utilization of geothermal energy as a renewable source..... | 141 |
| Anna Mazurek-Kusiak, Julia Wojciechowska-Solis: Noticeability and effectiveness of tourism promotion in Lublin province | 149 |
| Grygorii Monastyrskiyi, Tetyana Monastyrska: Modernization of local self-government in Ukraine..... | 160 |
| Alicja Olejnik: Prospects and frontiers of Multidimensional Panel Spatial Autoregressive Models | 170 |

| | |
|---|-----|
| Pavol Oravský, Štefan Marsina: Infrastructure of energetics and its diversification | 180 |
| Alina Piątyszek-Pych: The cluster development policy in Poland | 190 |
| Zbigniew Piepiora: Occurrence of natural disasters in Africa and international cooperation in the field of counteracting their effects | 200 |
| Renata Pisarek: The importance of passenger air transport and high-speed rail for regional development..... | 210 |
| Małgorzata Rogowska: The quality of public space in the development of urban areas..... | 223 |
| Joanna Szafran: Public-private partnership in Poland and the European Union | 231 |
| Ewelina Szczech: Is there a creative city in Poland? Defining and measuring the concept in Poland | 242 |
| Andrzej Sztando: Twelve rules for the construction of planning documents prepared by self-government units | 252 |
| Maciej Turala: Institutional capacity in Polish communes. Strategic, financial and spatial planning dimension | 264 |
| Alla Vasina: Management of the investment potential of Ukraine's regions in the process of regional structural policy realization | 275 |
| Svitlana Veleshchuk: Strategic development of the region in the context of the branding concept..... | 285 |
| Marcin Bogdański, Wioletta Wierzbicka: Socio-economic potential of Polish voivodship cities..... | 295 |
| Marcelina Zapotoczna, Joanna Cymerman: Application of selected synthetic measures in the assessment of the level of satisfied housing needs in Poland..... | 306 |

Summaries

| | |
|--|----|
| Beata Bal-Domańska: Konwergencja regionów (NUTS-2) Europy Środkowo-Wschodniej – aspekt przestrzenny | 21 |
| Barbara Dańska-Borsiak: Determinanty krajowych i zagranicznych odpływów migracyjnych z podregionów – identyfikacja i porównanie | 31 |
| Anna Golejewska: Rozważania na temat konkurencyjności regionalnej. Rola produktywności..... | 42 |
| Małgorzata Golińska-Pieszyńska: Kapitał intelektualny jako ważny element zarządzania wiedzą..... | 55 |
| Piotr Hajduga: Specjalne strefy ekonomiczne na Dolnym Śląsku jako stimulator rozwoju regionalnego w dobie kryzysu | 65 |

| | |
|---|-----|
| Petr Hlaváček: Analiza procesów rozwojowych miasta Ústí nad Labem jako przykład społecznych i ekonomicznych transformacji zachodzących w miastach Republiki Czeskiej | 77 |
| Anna Jasińska-Biliczak, Jan Buleca: Partycypacja samorządu gospodarczego w procesie wspierania przedsiębiorczości – analiza przypadku Polski, Niemiec i Słowacji | 87 |
| Małgorzata Karczewska: Zróżnicowanie udziału wydatków na B+R w PKB w Polsce według źródeł finansowania na tle krajów Unii Europejskiej | 96 |
| Artur J. Kożuch, Janusz Sasak, Kamilla Noworól: Rachunek kosztów docelowych a budżet partycypacyjny w JST..... | 107 |
| Alina Kulczyk-Dynowska: Park narodowy jako element wspierający równowagę rozwoju regionu – przykład gmin tatrzańskich | 117 |
| Iwona Ładysz: Regionalny wymiar bezpieczeństwa ekonomicznego w dobie globalizacji na przykładzie województwa dolnośląskiego..... | 127 |
| Krzysztof Malik: Specjalizacje inteligentne i technologie wiodące w Nowej Polityce Rozwoju Regionalnego | 140 |
| Štefan Marsina, Pavol Oravský: Utylizacja energii geotermalnej jako źródła odnawialnego..... | 148 |
| Anna Mazurek-Kusiak, Julia Wojciechowska-Solis: Zauważalność i skuteczność promocji turystyki w województwie lubelskim | 159 |
| Grygorii Monastyrskyi, Tetyana Monastyrska: Modernizacja samorządu lokalnego na Ukrainie | 169 |
| Alicja Olejnik: Perspektywy i ograniczenia panelowego wielowymiarowego autoregresyjnego modelu przestrzennego | 179 |
| Pavol Oravský, Štefan Marsina: Infrastruktura energii elektrycznej i jej dywersyfikacja..... | 189 |
| Alina Piątyszek-Pych: Polityka rozwoju klastrów w Polsce | 199 |
| Zbigniew Piepiora: Występowanie katastrof naturalnych w Afryce i międzynarodowa współpraca w zakresie przeciwdziałania ich skutkom | 209 |
| Renata Pisarek: Znaczenie pasażerskiego transportu lotniczego i kolei dużych prędkości dla rozwoju regionalnego | 222 |
| Małgorzata Rogowska: Jakość przestrzeni publicznej w rozwoju aglomeracji miejskich..... | 230 |
| Joanna Szafran: Partnerstwo publiczno-prywatne w Polsce i w Unii Europejskiej..... | 241 |
| Ewelina Szczech: Czy w Polsce istnieje miasto kreatywne? Próba definicji i pomiaru zjawiska w Polsce | 251 |
| Andrzej Sztando: Dwanaście zasad budowy dokumentów planistycznych jednostek samorządu terytorialnego..... | 263 |
| Maciej Turała: Sprawność instytucjonalna polskich gmin. Wymiar planowania strategicznego, finansowego i przestrzennego | 274 |

| | |
|--|-----|
| Alla Vasina: Zarządzanie potencjałem inwestycyjnym regionów Ukrainy w realizacji regionalnej polityki strukturalnej | 284 |
| Svitlana Veleshchuk: Strategia rozwoju regionu w kontekście koncepcji branding | 294 |
| Marcin Bogdański, Wioletta Wierzbicka: Potencjał społeczno-gospodarczy miast wojewódzkich w Polsce..... | 305 |
| Marcelina Zapotoczna, Joanna Cymerman: Wykorzystanie wybranych miar syntetycznych do oceny zaspokojenia potrzeb mieszkaniowych w Polsce | 316 |

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SMART SPECIALISATION AND KEY ENABLING TECHNOLOGIES IN THE NEW REGIONAL DEVELOPMENT POLICY

Summary: The process of the creation and implementation of the regional research and innovation strategies for Smart Specialisations (RIS3) and the identification of Key Enabling Technologies (KETs) has a critical meaning for EU regional development acceleration. The identification of Smarts and KETs is recognized as the core of RIS3 and its first order implementation condition. The methodological model for the identification of Smart Specialisations and KETs was the objective of this research. The model (matrix) consists of both knowledge transfer steps and cognitive stages. At each cross-point of the matrix there is an output of analysis. The conjunction of results from each transfer and cognitive steps leads to different levels of regional development priorities, including (finally) Smart Specialisations Areas and Key Enabling Technologies.

Keywords: Smart Specialisation, RIS3, Key Enabling Technology, New Regional Policy.

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1. Introduction

In the upcoming 2014-2020 financial perspective, regional research and innovation strategies for Smart Specialisation (RIS3) and Key Enabling Technologies will play a crucial role in boosting the development in the regions of the European Union.

The objective of this research is to determine the conceptual model for identifying Smarts and KETs as motors of regional development. The identification of Smarts and KETs is recognized as the core of RIS3 and its first order implementation condition. The methodological model for the identification of Smart Specialisations and KETs was the objective of this research. The concept model was tested in the Opolskie region while creating the RIS3 for this region. The methodological model for the identification of Smart Specialisations and KETs is logic-frame based. The data was provided by public statistics and social interviewing tools.

In the real economy, various potentials and development needs, as well as the distinct development trajectories that arise due to them, are based on specific combinations of endogenous growth factors occurring for specific regions. Therefore,

today it is difficult to discuss universal and timeless models of public intervention. A natural phenomenon are changes which nowadays occur in the model of regional development policy, arising from the necessity to adjust this policy to changing environmental conditions of the proximal and distal environment.

2. Theoretical premise for specialisation in regional development policy

The theoretical premise for specialisation in the development policy of the region which are the result of, among others:

- Hirschman's polarization concept,
- centre/periphery concept by J. Friedmann,
- industry clusters by M. Porter,
- business cycle theory explained by J. Schumpeter,
- learning region by R. Florida.

The concept of polarisation by A. Hirschman combines theories of the regional and sectoral polarisations. The essence of economic growth, according to this concept, is the number of sectoral inequalities which occur during the flow of developmental impulses from leading industries to less developed ones. Stagnation in regions – according to A. Hirschman – results from wrong investment decisions and the relatively poor absorption of innovation. The economic development of the country as a whole is inextricably linked with the prior development of one or more growth centres. In the light of Hirschman's theory, the role of the state is supporting development in growth centres and enabling developmental diffusion to spread to neighbouring areas, among others, by providing the proper communication infrastructure [Grosse 2002].

The multidimensionality and spatial aspects of growth were highlighted by J. Friedman, who includes in the analysis of the region, besides economic development factors, also social, psychological and sociological factors. Innovations are located in urban areas – the so-called development centres – where they are distributed through the network of relations to the periphery. Relationships between economic centres (which are heavily concentrated on innovation) and the peripheries, are characterised by authoritarian dependencies towards dominated peripheries in which economic, cultural and political growth is subordinated to the centre. The dominant position of the “centre” over the peripheries is being strengthened, according to Friedman, by the self-driven mechanism of polarisation which is the result of: dominance effects (absorption through the “centre” of periphery growth potential), information effects (information growing potential of the “centre”), psychological effects (positive conditions for innovation absorption), modernisation effects (rapid adaptation of social and institutional structures to changes caused by innovations), linkage effects (process of innovation induction in other areas of the economy), and production effects (increased economies of scale and reduced costs due to internal and external

savings). The purpose of the state, in the light of this concept, is to promote growth in existing centres, as well as promoting the development of new regional development centres [Stackelberg, Hahne 1998].

From the standpoint of the analysis on theoretical conditions of the specialisation based development concept, the learning region theory by R. Florida also plays an important part, which assumes that the primary role in the development of the regions is (product, process, organisational, and marketing) innovation. A driving force for development is permanent innovation and the region's adaptability to the market environment being changed. Intervention actions should focus on the development of science, the R&D sector, the improvement of human resources, and the dissemination of high technology [Florida 2000]. According to this concept, an institutional solution in this field are regional centres of innovation, science and technology parks and technology transfer agencies of the spin-off and spin-out type.

It should be emphasized that polarisation-based development concepts indicate that innovation and entrepreneurship are the key growth factors, referring to J. Schumpeter's theory of real business cycles, according to which technological innovations allow production of the same or better quality goods at lower costs than those offered by competitors, by which they become a driving force for the economy, causing acceleration in the economy development growth phase [Chądzyński, Nowakowska, Przygodzki 2007].

On the other hand, M. Porter's *industry clusters theory* is based on the assumption of the so-called location paradox – local production is sold globally [Porter 1990]. A co-location of businesses, contractors, service providers, research institutions, government, and business environment entities that are linked together vertically or horizontally, generates certain positive external benefits which are reflected as benefits for all stakeholders of the industry cluster. The source of benefits from clusters as a factor in the development is both the co-operation and competition of enterprises.

Analysis of modern development concepts suggests that public intervention aimed at supporting selected industries (specialisation and concentration of resources) is an important factor in the development of the region, notably through:

- support for entrepreneurship and inhabitants' creativity leading to the development of innovative products and processes,
- creation of growth centres and subsidiary support poles,
- development of transport and communication infrastructure,
- adjustment of the education level and scope to regional needs,
- development of horizontal and vertical linkages between technology and organisation, including cluster development.

In the last two decades crucial changes have taken place in regional (spatial) economics and policy. The new theoretical approaches (paradigms) have become: *new economic geography* [Fujita, Krugman, Venables 2001], *place based policy* [Barca 2009], *social network economics* [Castells 2007].

3. European Union development policy for innovation

Besides the indicated theoretical premise, the dissemination of the specialisation-based development policy concept is in particular influenced by the current global and regional economic situations, manifested in a prolonged phase of economic recession, energy crisis, and by the crisis in public finances and political life in the European Union member states. The innovation and entrepreneurship based development policy concept, focused on specific areas of specialisation, becomes the driving force for development by achieving sustainable competitive advantages of countries and regions. The *Strategy for Smart, sustainable and inclusive growth. Europe 2020* points to the need for concerted action among Member States in the field of recovery from crisis, and for the implementation of reforms addressing the challenges at global and regional level, including the ageing of the population and the increasing need for the efficient use of non-renewable resources. To meet the challenges of growth, three basic and intercomplementary priorities were proposed in the document: (1) Smart growth based on the creation and use of knowledge and innovation; (2) sustainable growth understood as the pursuit of a low carbon economy, resource-efficient and competitive at the same time, and (3) inclusive growth indicating support for the economy, characterised by a high and stable level of employment, ensuring economic, social and territorial cohesion. An assessment of the progress in the implementation of the “*Europe 2020*” Strategy will be possible through the designation of five development objectives, all of which have to be achieved by the European Union by 2020 [Europe..., 2010]. Their implementation will be possible due to seven flagship initiatives undertaken at European, as well as national and regional levels (Table 1).

Table 1. Priorities, development goals and flagship initiatives of the “Europe 2020” Strategy

| Strategic priorities | Development goals | Flagship initiatives |
|----------------------|--|--|
| Smart growth | TARGET 2: To improve conditions for research and development (3% of EU GDP for R&D investments) TARGET 4: Increasing the educational attainment level | Innovation Union Digital Agenda for Europe An Agenda for new skills and jobs An industrial policy for the globalisation era |
| Sustainable growth | TARGET 3: Reducing overall greenhouse gas emissions by 20% | A resource-efficient Europe Youth mobility |
| Inclusive growth | TARGET 1: Achieving a 75% employment rate for the population aged 20-64 TARGET 5: Promoting social inclusion | European platform against poverty and social exclusion |

Source: own study based on *Europe 2020. A strategy for Smart, sustainable and inclusive growth*, Ministry of Economy, Warsaw 2010, pp. 4-9.

The European Commission underlines that the key for the *Smart growth* priority implementation, that is, the development of an economy based on knowledge, including innovation, is to determine, the so-called Smart Specialisations. Under this priority, at the level of undertaken actions, the most important factor for growth based on specialisation, is to be the flagship initiative entitled *Innovation Union*.

It should be emphasized that there is a strong connection between the priorities, goals and flagship initiatives of *Europe 2020* and the financial funds supporting them – thematic goals of EU funds [*Amended proposal...*].

According to the principles, each region should have a regional *research and innovation strategy for Smart Specialisation, RIS3*. Regional research and innovation strategy will be part of a complex system for programming development in Poland and in the region, in terms of innovation and knowledge transfer. According to the Guidelines of *Poland's Development Management System, the key documents, based on which the regional development, in terms of innovative and knowledge transfer is being implemented, are* [Poland's Development... 2009]:

- *Long-Term National Development Strategy – LTNDS (Poland 2030 – Third Wave of Modernity)* – defining major trends, challenges and Poland's development concepts up to the year 2030,
- *National Development Strategy 2020. Active society, competitive economy and efficient state*, which defines strategic national development goals until 2020,
- Nine integrated strategies, including *Strategy for Innovation and Efficiency of the Economy*, aimed to achieve the medium-term objectives in specific areas.

The main document, taking into account the innovation and knowledge transfer area is the *Strategy for Innovation and Efficiency of the Economy*, the main objective of which is to target Poland's actions, so the knowledge and co-operation based economy will be highly competitive (innovative and efficient) [*Resolution no. 7... 2013*]. The *Strategy identifies a number of factors that have an influence on boosting the process of change in the economy competing by the use of innovation*. In the document there is presented a list of the necessary changes relating to financial and regulatory environment. The document also specifies the direction of activities, necessary for the efficient use of resources, including knowledge, labour and natural resources. The significance of internationalisation of the economy in Poland was also highlighted, both in terms of products as well as the solutions developed in the R&D area.

The most important instruments in the R&D sector development policy and commercialisation of innovative solutions are the *National/Regional Research and Innovation Strategies for Smart Specialisation (RIS3)*. They are integrated local economic transformation programs, designed to achieve five major objectives:

1. Targeting support under the policy, key national/regional investments, challenges and needs to achieve knowledge based development.
2. Using strengths, competitive advantages and perfection potential in each country/region.

3. Supporting technological and practical innovation, and aiming to stimulate private sector investments.

4. Total involvement of partners and encouraging innovation and experimentation.

5. The strategies are based on facts and cover proper monitoring and evaluation systems [*Fact Sheet of the EC...*].

There is work undergoing on the development of the cohesion policy 2014-2020, which will be a basic tool for transferring the *Innovation Union* initiative and the concept of Smart Specialisation into practical actions by various support instruments. Member States were required by the European Commission to develop a (national and regional) strategy for Smart Specialisation which will be the basis for the new financial perspective 2014-2020. Putting an emphasis on the support of national and regional specialisations, the efficient use of EU funds, as well as the condition of co-ordination and synergy between the initiatives taken at EU, national and regional levels should be improved. During the identification of the development potentials, it is particularly important to define the methodology for selecting priority areas for support (Smart Specialisations) and the process of public hearings. In the new financial perspective, the European Commission proposed that Smart Specialisation has to become an integral part of the *ex-ante* conditionality. Identifying specialisation in the country and regions should be performed according to the bottom-up approach, with the participation of key partners in the field of innovation (in co-operation among entrepreneurs, universities and R&D centres), which are the most aware of development needs in the region. Certain specialisations at national and regional level will be regularly updated [*Industry Technology Foresight... 2012*].

4. Specialisation as a cognitive and knowledge transfer process in the region – methodological matrix identifying *Smart Specialisations*

In paper works on *Regional Innovation Strategy for the Opolskie Voivodeship until 2020* various methods and research tools were used in a novel, depending on the development stage of the work (Table 2).

The implementation of strategic and operational goals embedded in a matrix of development challenges should be focused on specific areas of development in the region – Smart Specialisations. According to European Commission documents, Smart Specialisations are identified, unique features and assets, highlighting the competitive advantages of the region and accumulating regional partners and resources around the vision of future-oriented achievements. Regional specialisations, including Smart Specialisations, are based on endogenous potentials and are used for competitive position improvement of the region, taking into account sustainability. Actions taken to identify regional specialisations, including Smart Specialisations, were focused

on determining the exceptional features and assets of the region, the opportunities for competitive advantages, focusing regional partners and the resources around the vision and development challenges [*Fact Sheet of the EC...*].

Table 2. Methods and tools during the stages of work on RIS OV2020

| Methods and tools | Stages of the work on RIS OV2020 | | | | | | |
|---|----------------------------------|-----------------------------|---|---------------------------|---------------------------------------|---|-------------------------------|
| | Diagnosis | Foresight (futures studies) | Identification of regional Specialisations, including Smart Specialisations | Strategic analysis (SWOT) | Identification of vertical challenges | Identification of horizontal challenges | Strategic goal identification |
| Content analysis (<i>Textual analysis</i>) | X | X | X | | | | |
| Branch analyses | X | | X | | X | | X |
| Research on existing sources | X | | X | | | X | |
| Time series / Trend forecasting (<i>Time series/trend forecasting</i>) | | X | X | | | | |
| of experts | X | X | X | | | | X |
| Stakeholder consultations | X | X | X | X | X | X | X |
| Delphi Method | | X | | | X | X | X |
| Creative imaging | | | X | | | | |
| Impact assessment | | X | X | | X | | |
| PEST analysis (Political, Economic, Socio-cultural, and Technological analyses) | X | | | X | | | |
| Logical diagram | | | X | X | X | X | X |
| Environmental scanning | | X | X | | | | |
| Vision development | | X | | | | | |
| Future workshops | | X | X | | | | X |

Source: *Regional Innovation Strategy for the Opolskie Voivodeship until 2020* (under the academic auspices of: Krzysztof Malik). Draft for public hearing, Managing Authority of the Opolskie Voivodeship, Opole, 10 April 2013.

In order to identify the region's development specialisations, including Smart Specialisations, the original method of logical matrix based on the criteria for the evaluation of the knowledge transfer and cognitive process was adopted (Table 3). The regional specialisation identification process, including Smart Specialisation, shall be analysed via regional knowledge transfer, referring to its individual phases, that is production, use and dissemination of innovative solutions. Knowledge transfer is one of the elements of knowledge management, and it covers a set of processes which facilitate (1) creation, (2) dissemination, and (3) the use of knowledge (technology)

at every stage of development management. On the basis of the knowledge transfer process consisting of three phases, a matrix based model for research and analysis, allowing the identification of regional specialisations, including Smart Specialisations was developed (Table 3). Simultaneously, for the identification of Smart Specialisations, it was assumed that they occur if a specific technology or its product is present in each of the three phases of the regional knowledge transfer. Therefore Smart Specialisations are present in the studied region if, simultaneously, specific innovations are or become:

1. the object of the research study in the regional R&D sector (centres, laboratories, and universities located in the region),
2. the subject matter of the pilot implementation projects in an enterprise located in the region,
3. the subject of the sale and purchase transaction on the regional and transregional market.

Smart Specialisations appear when innovations go through all the three stages of transferring knowledge: from R&D, usage in production and finally extending within the regional and trans-regional market.

KET's are technologies enabling growth within one or many of the smart specialisations (intra and inter KET's), e.g. plant production and fuel production technologies, engine and power transmission systems technologies.

A methodological matrix contains products of the two parallel transfer processes of knowledge and expertise, each of which goes through three levels of the analysis. Therefore, the developed methodological matrix consists of nine fields. Each field of the matrix is the result of research and corresponds to the scope of the regional specialisation' identification. The cognitive process is aimed to determine a short list of technology groups which were a significant validity measure for the conducted research on existing sources, quantitative and qualitative (expert) studies. The matrix of the logical conjunction of results on the knowledge transfer and cognitive process leads to the identification of the Smart Specialisations (Table 3).

According to this identification methodology, besides Smart Specialisation, other ranges of specialisation were distinguished at regional level: potential Smart Specialisations and the lack of regional specialisation (Table 4).

In cases where technology meets three criteria (which means it is present in all stages of regional knowledge transfer), it is considered as Smart Specialisation. In cases of meeting two criteria, they are identified as a potential Smart Specialisation. Fulfilling one of the criteria classifies technology to regional specialisation (production or use). In cases where the performed analysis indicates that the technology available in the region is not present in any of the regional knowledge transfer phases, then regional specialisation does not occur.

Table 3. Regional Specialisation identification matrix model, including Smarts and KETs (view of the process)

| Phases of the process | Definitional criteria (^conjunction) | | | | | | |
|--|--|---|--|---|--|---|--|
| knowledge transfer cognitive | Production- Creation of potential innovations in R&D sector | ^ | Use- Transmission of R&D products to be spread in the economy | ^ | Dissemination- Creation of trans- regional competitive advantages | = | Regional Specialisations |
| Foresight and other regional research (existing sources) | Involved resources based on knowledge (R&D) that can be used for innovation | ^ | Production processes and structures | ^ | Trans-regional sales and distribution channels | = | Logical conjunction by areas of the economy |
| Quantitative research | Identifying indicators for this phase by the PCA section | ^ | Identifying indicators for this phase by the PCA section | ^ | Identifying indicators for this phase by the PCA section | = | Logical conjunction by the PCA section |
| Quantitative and expert research study | Identification of technology (detailed listing of sections and areas) | ^ | Identification of technology (detailed listing of sections and areas) | ^ | Identification of technology (detailed listing of sections and areas) | = | Logical conjunction by groups of the technology |
| Cartesian product rankings of RSI priorities | Regional Specialisation areas ranked by the production phase | ^ | Regional Specialisation areas ranked by the use phase | ^ | Regional Specialisation areas ranked by the dissemination phase | = | Logical sum of regional Specialisations = Smart Specialisation and Key Enabling Tech |

Source: *Regional Innovation Strategy for the Opolskie Voivodeship until 2020* (under the academic auspices of: Krzysztof Malik). Draft for public hearing, Managing Authority of the Opolskie Voivodeship, Opole, 10 April 2013.

Table 4. Simplified model identifying regional specialisation, including Smart Specialisation (view of the process)

| | R&B phase | Use phase | Dissemination phase | Degree of compliance with the criteria |
|--------------------------------------|-----------|-----------|---------------------|---|
| Technologies enable in the region | + | + | + | Regional KETs in Smart Specialisation area |
| | + | - | + | Regional KETs in potential Smart Specialisation area |
| | + | + | - | |
| | - | + | + | |
| | + | - | - | Lack of Specialisation |
| - | - | - | | |

Source: own study.

5. Methodology model verification, Smarts and KETs of the Opolskie Region

Based on the adopted methodology for the identification of regional specialisations, including Smart Specialisations, certain results were obtained for the Opolskie Voivodship.

In order to determine Key Enabling Technologies available in the region which condition the development of identified areas, and thus to ensure the dynamic development of the region, corresponding activities – technology groups – were assigned to the key development areas.

The synthetic research approach allowed analysing the structure of knowledge and technology transfers that are used in the production of goods and services in the region. The adopted methodology for assessment, according to the stages of knowledge transferring and cognitive processes, allowed for identification of Key Enabling Technology groups, including Smart Specialisations (Table 5).

Table 5. Smart Specialisation and Key Enabling Technologies in the Opolskie Voivodship

| | Groups of technologies, products, and processes within development areas | Key Enabling Technologies |
|------------------------------------|---|--|
| A. Smart Specialisations | Chemical technologies (sustainable) | Polymer, plastic and rubber technologies |
| | | Organic chemical technologies |
| | | Cleaning products technologies |
| | Sustainable construction and wood technologies | Low-energy building technologies |
| | | Cement and concrete technologies |
| | | Wood technologies |
| | Machine and metal industry technologies | Propulsion systems technologies |
| | | Design and manufacturing technologies for machinery and equipment |
| | | Metal processing technologies |
| | Energy industry technologies (including RES) | Fuel production technologies |
| | | Engine and motor technologies |
| | | High voltage technologies |
| Agricultural and food technologies | Plant production technologies | |
| | Food production and processing technologies, in particular, milk processing | |
| B. Potential Smart Specialisations | Life and environmental science (ELS) | Health care products |
| | | Spatially integrated regional tourism product |
| | | The process of organising environmentally friendly intermodal transport system |

Source: *Regional Innovation Strategy for the Opolskie Voivodship until 2020* (under the academic auspices of: Krzysztof Malik). Draft for public hearing, Managing Authority of the Opolskie Voivodship, Opole, 10 April 2013.

It should be emphasized that the adopted division into groups of key technologies is contractual in nature. Regional KETs listed in the subgroups should not be solely and exclusively identified with a single group of Smart Specialisations. Specific technologies often integrate business activity areas and development areas of the region. Thus, the use and popularisation of the KETs becomes an impulse for the development of the region (synergetic effect). The list of Smart Specialisations and Key Enabling Technologies is not closed. Groups of priority technologies for the development of the Opolskie region, identified by this method are (based on the criteria listed in Tables 3 and 4):

- A.** A group of Regional Key Enabling Technologies within Smart Specialisations (polymers, plastics and rubber, organic chemicals, cleaning detergents, low-energy construction, cement and concrete, wood, propulsion systems, design and production of machinery and equipment, metal engineering, production of fuels, engines and motors, high voltage production, plant production, milk processing).
- B.** A group of Regional Key Enabling Technologies within potential Smart Specialisations (products for healthcare and physiotherapy, spatially integrated regional tourism products, organizational process of environmentally friendly intermodal transportation system).

6. Final conclusions

The proposed methodology for identifying regional Smart Specialisations and Key Enabling Technologies ensures:

- 1) the economic robustness of the regional assets identified due to the presence of permanent vertical and horizontal linkages (technological transfer);
- 2) the possibility of obtaining permanent competitive advantages in the sustainable development of the region;
- 3) a more objective way of identifying existing and potential specialisations of regional development, including Smart Specialisation and KETs;
- 4) the implementation of RIS3 via supporting regional Key Enabling Technologies;
- 5) the possibility of the continuous monitoring of a group of KETs according to the criteria of specialisation in order to verify the identified set of Smart Specialisation;
- 6) a base for evaluation system of RIS3 e.g. by a set of indicators relating technology products and results to the public expenditure on developing these technologies [Malik 2011].

Furthermore, the identification of Smart Specialisations, according to the double helix method of cognition and knowledge transfer processes, encourages the development of the governance system for research, innovation and technologies at regional and supra-regional level.

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SPECJALIZACJE INTELIGENTNE I TECHNOLOGIE WIODĄCE W NOWEJ POLITYCE ROZWOJU REGIONALNEGO

Streszczenie: Proces powstawania i wdrażania regionalnych strategii badań i innowacji dla specjalizacji inteligentnych (RIS3) oraz identyfikacja regionalnych technologii wiodących (KET's) mają obecnie duże znaczenie dla przyspieszania rozwoju regionów Unii Europejskiej. Identyfikacja specjalizacji i regionalnych technologii wiodących jest uznawana za integralną część strategii proinnowacyjnych oraz warunek konieczny ich skutecznego i efektywnego wdrażania w perspektywie 2014-2020. Celem pracy było opracowanie modelu metodologicznego identyfikacji specjalizacji inteligentnych i regionalnych technologii wiodących. Zaprezentowano model identyfikacji specjalizacji i technologii regionalnych w formie macierzowej, zawierający zidentyfikowane specjalizacje (grupy technologii) według etapów transferu wiedzy oraz poziomów poznawczych. Efekty badań wpisano w polach przecinania się wskazanych kryteriów analizy. Koniunkcja rezultatów na każdym polu transferu wiedzy i etapie poznawczym doprowadziła ostatecznie do identyfikacji specjalizacji inteligentnych i technologii wiodących w wymiarze badanego regionu.

Słowa kluczowe: specjalizacje inteligentne, RIS3, wiodące technologie, Nowa Polityka Regionalna.