SMART SPECIALISATION AND THE INTERNAL POTENTIAL OF REGIONS IN POLAND

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Abstract
The paper aims to verify identified regional smart specialisations in the context of internal potentials of regions in Poland. Regional smart specialisations were examined and compared with development potentials. There are three general topics regarding specialisations: 1) their number, 2) their multidisciplinarity 3) criteria for identification. The identification approach of smart specialisations is multidimensional and multisectoral, so the identified specializations are difficult to classify. In Poland's case there have been 81 regional smart specializations identified. Many of them cover a wide spectrum of sectors. All of them have been classified and examined by statistical methods. Identification of smart specializations should be connected with and dependent on endogenous potentials of regions. The aim was to compare regional strengths and the results of identification proposed in regional innovation strategies (RIS). The role of the new regional policy is to strengthen the competitive industries or branches. However, the identification of smart specializations often aims to strengthen underdeveloped sectors or a new ones, which can be verified in entrepreneurial discovery process in the future.

Key words
Smart specialisations, internal potential, Poland, region

INTRODUCTION AND TERMINOLOGICAL ISSUES

The prevalent view in contemporary regional policy is that territorial development depends on the competitiveness of regions and the possessed skill to make the most effective use of investment funding. Proponents of this kind of solution are rather against the direct supporting of weakly-developed areas, instead speaking up for the installing of conditions whereby development may spread out or diffuse (or trickle down) from areas experiencing growth. What is referred to in this context is the polarisation-diffusion model (*Polska 2030…* 2009). This concept derives from the theory of non-balanced regional development and assumes dynamic develop-

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ment in a given place, with the impacts of this in time spreading out (theoretically by way of diffusion) across the whole area of a region.

In practice, the above does not actually denote non-intervention on behalf of areas that are only more weakly-developed, as is made clear by the active pursuit in Poland of the concept of the Area of Strategic Intervention (*Obszar Strategicznej In-terwencji* or *OSI*), in which the official definition has this as an area requiring outside intervention if full use of development potential is to be made (KSRR 2010). In fact, however, OSIs include both areas experiencing growth and problem areas. The stim-ulation of development and enhancement of investment opportunities in areas at risk of permanent marginalisation is in turn indicated in Poland's 2016 *Strategia na rzecz odpowiedzialnego rozwoju* ("Strategy for Responsible Development").

From the territorial point of view, "winner" regions usually come within one of three categories. Either they are large metropolitan regions, or they are certain kinds of area associated with industry or tourism (Pike et al. 2006). In general, peripheral regions are only developed to a limited extent, lacking strong centres of growth, and therefore needing to seek out the internal potential that may offer them some kind of competitive advantage. This all necessitates a more individualised approach to regions and the effective use of their internal resources. In other words, it denotes alternative development strategies conceptualised regionally and locally.

Technological progress and the ongoing increase in the significance of knowl-edge to the socioeconomic development of states on the Old Continent are shaping new needs where EU regional policy is concerned, not least in regard to the aforesaid, more-individualised approach. As has also been noted, the agent by which development may occur is the activated internal potential of the region, which can exert a favourable influence on the lives of inhabitants, and can permit the more effective utilisation of the area's own investment funding, as well as that coming in from beyond. Assumptions of this kind have been crystallised by way of the concepts of territorial capital (Camagni 2008), endogenous potential (Scott and Storper 2003) and local conditioning and local networking (Fujita at all, 1999).

The "territorial dimension" is one of the fundamental principles of the EU's current (2014-2020) Programming Period, which assumes a departure from the perception of a given territory by reference to its administrative boundaries, with greater attention instead paid to internal potential and resources, as well as barriers to development. Communications from the European Commission stress the major role that local specifics have to play, to the point where this may be denoting a new paradigm in regional development policy (e.g. *Komunikat…* 2010).

In practice, what this amounts to above all is the wise choice of those features specific to a given territory that offer the best opportunities for socioeconomic de-velopment to be achieved. Appropriate mobilisation and use of specific resources therefore represents one of the key conditions underpinning contemporary local

and regional development; and the resources in question may even be termed strategic.

Richard Florida's concept of the "learning region" is in turn founded on a conviction that a matter of key significance for an area's competitiveness is the skill to generate specific and strategic resources (Jewtuchowicz 2005). These are first and foremost skills and knowledge, and what are associated with them are the concepts of regional specialisation and smart regional specialisation.

In the view of M. Dzierżanowski (2014), regional specialisation denotes a dominant sector, or one determining a region's economic potential, the process of definition here entailing comparison of economic structure in a given region under study with those of a country's remaining regions.

A similar meaning is assigned to the concept of the "economic starter", which is a key branch underpinning development in a region (Dziemianowicz et al. 2014). In the most general sense, what is involved here is again the wise choice of a priority sector that can offer the best opportunities for the development of the given region; as naturally followed by the concentration of investment activity within that sector. Such a way of working raises the value for money achieved as public funds are spent. And, while the stimulation of development from the exterior is important, or even crucial; if an appropriate local base is lacking, even large amounts of external financial assistance can end up being wasted (A. Sobala-Gwosdz, 2005).

Similar conclusions were in fact arrived at in analyses pursued under a research programme on Polish society's living conditions – and the associated problems and strategies (Gorzelak 2008). It was noted there that the impact of external factors on local development is mainly dependent on the activeness of the local system in place already, with the existence of a favourable financial and investment-related impulse from the outside still needing to team up with endogenous capital if rational use of the latter is to be made, and tangible outcomes in terms of development achieved.

Smart specialisation is in turn "the filling of a newly-developing market or market niche, as well as a response to defined social needs, that requires the introduction of new technologies, products or services" (Dzierżanowski 2013, p. 7). A key role is here played by innovation, and by cooperation between firms and business institutions, R & D centres and science-and-technology parks. The founder of the "smart specialisation" concept – Dominique Foray – claims that this is a specific process in development policy entailing the making of choices, i.e. the determining of priorities for action based around technologies and knowledge, with a view to funding being concentrated in a small number of economic fields (Foray 2009; Foray et al. 2009). According to Foray, the shaping of appropriate conditions for smart specialisation requires that "space" be prepared to allow for the development of competitiveness. This "space" may actually be scientific-research

backup or innovation, as well as well-developed infrastructure, social capital and cooperation with local and regional-government bodies.

European Commission documents (e.g. *Strategie…* 2014, Polish-language version) describe smart specialisation in terms of the identification of exceptional features and assets present in every country and region. The competitive advantage each region could enjoy is thus emphasised, and the aim is to focus regional partners and resources around a vision of a future that targets full achievement of that advantage. This also means a strengthening of regional innovation systems, a maximisation of flows of knowledge, and the promotion and propagation of benefits arising out of innovations within the entire regional economy.

The European Commission has in fact been proposing that smart specialisation be a precondition for the support of investment to strengthen research, technological development and innovation, and to improve access to ICT. With these aims in mind, it is recommended that strategies for smart specialisation be drawn up, with these entailing priority-setting with a view to competitive advantage being gained as regions' strong points in terms of research and innovation are brought together with the needs of business. In line with the 2014-2020 Financial Perspective, strategies taking smart specialisation into account were an *ex ante* precondition if funding from the ERDF and ESF was to be obtained. The determining of specialisations thus assumed major significance when it came to seeking assigned financial resources.

The concept of smart specialisation does not relate solely to the use of internal resources in a defined unit of territorial administration, but can also denote acquisition of skills and familiarity and expertise in given sectors of the economy or fields of activity, with a key element in this being modern scientific and technological solutions. Regional-level smart specialisation represents one response to the financial crisis and breakdown in economic development that have afflicted the EU Member States in recent times. Among the three priorities mentioned in the strategic document from the European Commission (Polish-language version: *Europa…* 2010) are "smart growth", "sustainable growth" and "inclusive growth", with the role assigned to the first of these three being to have regions specialise in particular areas of the economy, in such a way that they are able to compete, or become capable of competing, in the international arena.

Differences of approach to the identification of Polish regions' smart specialisations reflect regional authorities' ways of doing regional policy – by reference to sectors or on many planes at the same time. Under the first approach, a region looks through its economic structure to identify its strongest sectors, and then associates smart specialisations with them. In practice, this most often entails comparisons of levels of employment and/or gross value added in the different PKD Divisions by which the Polish economy is categorised. The second approach is in turn more complex, needing to identify branches enjoying a high innovation po-

tential but remaining weakly developed, and hence in need of stimulation. Under this approach, much weight is attached to the opinions of experts from various different fields, with entrepreneurs also needing to be interviewed for the same reasons. With this approach, specialisations emerging may well encompass many different fields of life, academia and the economy.

The choice of a smart specialisation fora region is based on unique features and internal resources, with account taken of the entrepreneurial tendencies among inhabitants, and activity as regards scientific and academic research in local centres of learning. The European Commission in fact developed a large guide for implementing institutions that offers a set of guidelines concerning the whole process of drawing up national and regional strategies for research and innovation in the interests of achieving smart specialisation. This is the so-called RIS3 Guide (or *Guide on Research and Innovation Strategies for Smart Specialisation*) (Polish-language version, *Przewodnik…* 2012). Unfortunately, however, research carried out in regions reveals that most of them actually make false associations whereby smart specialisations selected are identical to sectors or groups thereof that actually dominate in their economic structure already (Czyżewska and Golejewska 2014).

The work detailed here has thus aimed to achieve a fuller understanding of Poland's smart specialisation structures, as the links between these are regions' internal resources. Ultimately, the work was to answer a question as to whether the regional-level smart specialisations pointed out in strategic documents have any rational justification when it comes to regions' internal resources and research potential.

METHODOLOGY AND STUDY MATERIAL

The available information on regional governments' choices of smart specialisations is typically dispersed and frequently non-comparable. To access it at all, it was necessary to review regional planning documents with their accompanying annexes and appendices. The main source of information in each case was the Regional Innovation Strategy (*Regionalna Strategia Innowacji, RSI*), though analysis also extended to expert opinions and reports, detailed documents related to smart specialisations indicated in *RSI*s, plans for the development of entrepreneurship based on smart specialisations and websites of regional authorities (Table 1)

Among the smart specialisations it is possible to distinguish two general types, i.e. the leading specialisations and the facilitating ones. This division represents key information regarding the approach regional authorities take, as those authorities choosing to draw such a distinction were engaging in a prioritisation process. Moreover, Podlaskie voivodeship came up with the idea of the emerging specialisation, while Opolskie made reference to a potential specialisation. Nevertheless, given the somewhat enigmatic nature of these, they were not taken further account of as the study was elaborated.

Table 1 Smart specialisations by voivodeship

VOIVODESHIP AND SOURCE OF INFORMATION	SMART SPECIALISATION
Dolnośląskie *Ramy Strategiczne Na Rzecz Inteligentnych Specjalizacji Dolnego Śląska*(the Lower Silesian Strategic Framework for Smart Specialisation), dated 2015	The chemicals and pharmaceuticals branch Spatial mobility High-quality food Natural and secondary raw materials Manufacture of machines and appliances and materials processing ICT
Kujawsko-pomorskie Annex No. 5to*RSI WK-P 2014-2020*	Transport, logistics and trade – by water and overland The motor industry, technical means of transport, automation Equipment, moulds and products associated with the manufacture of plastics Cultural heritage, art and creative industries Medicine, medical services, health-resort tourism The best safe food – processing, fertilisers and packaging Bio smart specialisation–natural potential, the environment and power supply Information processing, multimedia, programming, ICT services
Lubelskie Annex No. 11 to the Competition Rules - *Indykatywna lista kodów PKD wpisujących się w Regionalne Inteligentne Specjalizacje Województwa Lubelskiego*	The bioeconomy Medicine and health Low-emission energy ICT and automation
Lubuskie *Obszary Inteligentnych Specjalizacji Województwa Lubuskiego*, 2014	The green economy Health and quality of life Innovative industry Business cooperation and assistance
Łódzkie *Wykaz Regionalnych Inteligentnych Specjalizacji Województwa Łódzkiego oraz wynikających z nich nisz specjalizacyjnych*, 2015	A modern textile and fashion industry (including design) Advanced building materials (including design) Medicine, pharmacy, cosmetics Power supply (including from renewables) Innovative agriculture and food industry ICT

Małopolskie *Inteligentne Specjalizacje Województwa Małopolskiego: Uszczegółowienie obszarów wskazanych w RSI WM 2014-2020*, 2015	Life sciences Sustainable energy ICT Chemicals Electrotechnics and the machine industry Production of metals and metal products, as well as products from non-metal raw materials Creative industries and rest and recreation
Mazowieckie *Regionalna Strategia Innowacji dla Mazowsza do 2020 roku*, 2015	Safe food Smart management systems Modern business services High quality of life
Opolskie See: http://rpo.ocrg.opolskie. pl/aktualnosc-75-specjalizacje_ inteligentne_ wojewodztwa.html	Chemical technologies (sustainable) Sustainable wood and construction technologies Machine and metal industry technologies Power industry technologies Food technologies
Podkarpackie Report on leading branches entitled *Wiodące branże województwa podkarpackiego –inteligentne specjalizacje regionalne*, 2014	Aviation and space Quality of life ICT (facilitating)
Podlaskie *Plan rozwoju przedsiębiorczości w oparciu o inteligentne specjalizacje województwa podlaskiego na lata 2015-2020+ (RIS3)*, 2015	The agricultural and food sector and sectors associated with it in the value chain The metal and machines and industry, boat making and sectors associated with them in the value chain The medical and life-sciences sector and sectors linked with them in the value chain eco-innovation, environmental science and sectors associated with them in the value chain (including renewable energy, resource-efficient construction and efficient processing of wood)
Pomorskie agreement entitled *Porozumienie na rzecz inteligentnej specjalizacji Pomorza*	Offshore and port-logistics technologies Interactive technologies in an information-saturated environment Eco-effective technologies in the production, dispatch, distribution and consumption of energy and fuels and in construction Medical technologies relating to diseases of civilisation and ageing
Śląskie See: https://rpo.slaskie.pl/czytaj/ smarte_specialisatione_kody _pkd_2122014	Energy Medicine ICT

Świętokrzyskie Annex 1 to *Plan Wykonawczy do RIS3*	Resource-efficient construction (vertical) The metal-casting sector (vertical) Health-resort tourism (vertical) Modern agriculture and food processing (vertical) ICT (horizontal - facilitating) Sustainable energy development (horizontal - facilitating) The fairs and congresses branch (horizontal - facilitating)
Warmińsko-Mazurskie *Badanie potencjału innowacyjnego i rozwojowego przedsiębiorstw funkcjonujących w obszarze inteligentnych specjalizacji wojewodztwa warmińsko-mazurskiego*	Water management The wood and furniture industry High-quality food
Wielkopolskie See: http://iw.org.pl/obszary-inteligentnych-specjalizacji/	Biomaterials and food for the aware consumer (traditional economic specialisation) Interiors of the future (traditional economic specialisation) The industry of tomorrow (traditional economic specialisation) Specialised logistical processes (traditional economic specialisation; quality of life – challenges for the region) ICT-based development (traditional economic specialisation; quality of life – challenges for the region) Modern medical technologies (quality of life – challenges for the region)
Zachodniopomorskie *Wykaz inteligentnych specjalizacjiwojewództwa zachodniopomorskiego (Projekt)*, 2016	Large-scale marine or land construction Advanced metal products Wood and furniture products Environment-friendly packaging Products of chemical and materials engineering Modern food processing Multimodal transport and logistics IT-based products

Source: authors' own elaboration

In the cases of the seven voivodeships of Lubelskie, Małopolskie, Mazowieckie, Opolskie, Śląskie, Warmińsko-Mazurskie and Wielkopolskie, the smart speciali-sations were immediately assigned to the appropriate Sections and Divisions of Poland's official classification of economic activity, or *Polska Klasyfikacja Działalności*(PKD), specifically in line with the categorisations applying in 2007. This

made detailed study of the structure as regards specialisation a real possibility. In contrast, such data were lacking in the cases of the remaining regions, with the result that some analyses were confined to the regions which had determined their PKD Sections and Divisions.

It seems reasonable that voivodships should indeed identify their strongest suits, and then work to ensure that the development of smart specialisations is in line with these. The analysis reported on here allows the concordance between proposed specialisations and regions' economic potentials to be assessed. To do that, the research made use of multidimensional comparative analysis, in the course of a several-stage research procedure. The first such stage involved the assignment of all the smart specialisations to one or other of 10 categories (albeit with sub-categories also identified in two cases), albeit with certain specialisations seen to contain too many aspects to allow them to be assigned to just one category. The categories (and sub-categories) are:

1. Cultural heritage
2. The environment
3. Industrial production

   - Chemicals and plastics
   - The machine, electrical appliances, metal and motor industries
   - Energy and the extractive industries
   - The wood and furniture industry

4. Construction
5. Agriculture
6. ICT
7. Medicine
8. Business services
9. Transport and logistical services

   - Overland transport and logistics
   - Maritime transport and logistics

10. Needs of society and quality of life

In the case of industrial production a further division was used, into the sub-categories involving: a) The machine, electrical appliances, metal and motor industries, b) Energy and the extractive industries, c) Chemicals and plastics, d) The wood and furniture industry, and e) The textile industry. In turn, Transport and logistical services were divided into the sub-categories of: a) Overland transport and logistics, and b) Maritime transport and logistics.

Table 2 Categories of smart specialisation in the voivodeships

Voivodeship	Categories (sub-categories)
Dolnośląskie	chemicals and plastics, maritime transport and logistics, agriculture, the environment, energy and the extractive industries, the machine, electrical appliances, metal and motor industries, ICT
Kujawsko-pomorskie	maritime transport and logistics, the machine, electrical appliances, metal and motor industries, chemicals and plastics, cultural heritage, the environment, medicine, agriculture, energy and the extractive industries, ICT
Lubelskie	the environment, energy and the extractive industries, chemicals and plastics, the wood and furniture industry, medicine, ICT
Lubuskie	the environment, energy and the extractive industries, chemicals and plastics, the wood and furniture industry, agriculture, medicine, needs of society and quality of life, ICT, the machine, electrical appliances, metal and motor industries, business services
Łódzkie	the textile industry, construction, medicine, energy and the extractive industries, agriculture, ICT
Małopolskie	agriculture, medicine, energy and the extractive industries, ICT, chemicals and plastics, the machine, electrical appliances, metal and motor industries, the environment
Mazowieckie	agriculture, ICT, business services, needs of society and quality of life
Opolskie	chemicals and plastics, the wood and furniture industry, construction, the machine, electrical appliances, metal and motor industries, energy and the extractive industries, agriculture
Podkarpackie	the machine, electrical appliances, metal and motor industries, the environment, energy and the extractive industries, agriculture, medicine, ICT
Podlaskie	agriculture, the machine, electrical appliances, metal and motor industries, medicine, the environment, energy and the extractive industries, the wood and furniture industry, construction
Pomorskie	business services, maritime transport and logistics, ICT, energy and the extractive industries, construction, medicine
Śląskie	energy and the extractive industries, medicine, ICT
Świętokrzyskie	construction, the machine, electrical appliances, metal and motor industries, the environment, medicine, agriculture, ICT, energy and the extractive industries, business services
Warmińsko-mazurskie	the environment, the wood and furniture industry, agriculture
Wielkopolskie	agriculture, construction, the machine, electrical appliances, metal and motor industries, maritime transport and logistics, ICT, medicine
Zachodniopo-morskie	the machine, electrical appliances, metal and motor industries, maritime transport and logistics, the wood and furniture industry, the environment, chemicals and plastics, agriculture, ICT

Source: authors' own elaboration

A next stage to the research entailed the selection of diagnostic indicators characterising each category and sub-category (Table 3). These allowed for the assessment and comparison of regions' internal potentials as regards the different categories. As indicators were selected, effort was made to ensure that these first and foremost characterised the potentials of the regions as regards innovation and R & D. However, statistical information of this kind relating to all voivodeships and categories is very much lacking. To avoid cases arising more or less randomly, most data were averaged for the 2010-2015 period.

Table 3 Diagnostic indicators by category of smart specialisation

CATEGORY	INDICATORS
1. **Cultural heritage**	• attendees at theatres and musical venues per 1000 in the population • graduates of arts studies per 1000 graduates in all fields (2015) • participants in artistic/entertainment events per 1000 in the population (2013-2015) • tourists making overnight stays per 1000 in the population • voivodeship budget for culture and protecting cultural heritage (PLN per inhabitant)
2. **The environment**	• total outlays on fixed assets in waste management (outlays on assets serving the protection of the environment expressed in PLN per inhabitant) • graduates in environmental studies per 1000 graduates in all fields (2015) • wastes recycled in thousand tonnes per inhabitant • gaseous air pollutants (excluding CO_2) not emitted thanks to pollutant abatement equipment installed at the most burdensome industrial plants – as a percentage of the pollution generated overall
3. **Industrial production**	**Energy and the extractive industries** • share of overall production of electricity accounted for by renewables • GVA in Section B [in million PLN] (2010-2014) • energy savings per inhabitant in PLN **The machine, electrical appliances, metal and motor industries** • trend for sold industrial output in Divisions of the economy C24, C25, C27, C28 and C29 (2011-2015) • share of total employment accounted for by Divisions C24, C25, C27, C28 and C29 (2010-2014) • percentage of all industrial enterprises (manufacturing metal products, machines and appliances) introducing product or process innovations (2013-2015)

3. **Industrial** **production**	**Chemicals and plastics** • trend for sold industrial output in Divisions C20 and C22 (2011-2015) • number of entities in the national economy entered on the REGON register in Divisions C20 and C22 and as a share of all businesses • share of total employment accounted for by Divisions C20 and C21 (2010-2014) **The wood and furniture industry** • trend for sold economic output in Division C16 (2011-2015) • graduates of forestry studies per 1000 graduates in all fields (2015) • m³/ha harvest of merchantable wood per 100 ha of forest • percentage of national consumption of fibre board and chipboard (2015) • overall outlays on forestry ['000 PLN] (2014-2015) (*Leśnictwo, Statistics Poland*) **The textile industry** • trend for sold industrial output in Divisions C14 and C15 (2011-2015) • number of entities in the national economy entered on the REGON register in Divisions C14 and C15 and as a share of all businesses • share of total employment accounted for by Division of the economy C14 (2010-2014)
4. **Construction**	• output in construction and assembly – sales in PLN per inhabitant • graduates of studies relating to architecture and building per 1000 graduates in all fields (2015) • numbers of fast-growth enterprises in construction (2010-2014) (Selected indices of entrepreneurship in the years 2010-2014, from GUS – *Statistics Poland*) • investment outlays in Section F ['000 PLN] (2015)
5. **Agriculture**	• percentage of the country's commercial output from farming • graduates of agricultural studies per 1000 graduates in all fields (2015) • number of tractors of over 60kW per ha of farmland (2016) • index of the quality of productive agricultural space = *JRPP*) (2010) • internal outlays on R & D activity as regards the agricultural sciences (2015)
6. **ICT**	• share of all enterprises having their own website • graduates in teleinformatic technology studies per 1000 graduates in all fields (2015) • employment in Section J of the economy per 1000 people in work • mean number of ICT enterprises (2010-2014) (Selected indices of entrepreneurship in the years 2010-2014, from GUS – *Statistics Poland*) • investment outlays [in '000 PLN] in Section J of the economy (2015)

7. **Medicine**	• doctors enjoying the right to practice per 10,000 in the population • graduates of medical studies per 1000 graduates in all fields • medical doctorates underway per 1000 doctoral studies in all fields • Combined value [in '000 PLN] of projects for the adaptation, modernisation and purchase of medical equipment implemented under the Regional Operational Programmes for 2007-2013 (Report from *NIK* – Poland's Supreme Audit Office)
8. **Business services**	• number of conference halls with appropriate infrastructure (2009, 2013) • graduates in business and administration per 1000 graduates in all fields (2015) • jobs in divisions of the economy M69-M74 per 1000 people in work (2010-2014)
9. **Transport services and Logistics**	**Overland transport and logistics** • graduates of studies involving transport services per 1000 graduates in all fields (2015) • employment in divisions of the economy H49 and H52 (2010-2014) • percentage share of carriage of loads by road, by place of dispatch [%] (2010) • number of fast-growing enterprises in transport and warehousing (2010-2014) (selected indicators of entrepreneurship for 2010-2014, GUS-*Statistics Poland*) **Maritime transport and logistics** • international trade by sea recorded at ports (transit in thousands of tonnes) • % of total employment in a voivodeship accounted for by the maritime economy (2010-2013) • % share of the value of total fixed assets in a voivodeship accounted for by the maritime economy (2010-2013) • % share of all investment outlays in a voivodeship accounted for by outlays on the maritime economy
10. **Needs of society and quality of life**	• share of households with access to broadband internet (2011-2015) • share of residential buildings connected to technical infrastructure (in 2015) • people in households on social welfare per 10,000 in the population • graduates of studies involving social welfare and social services per 1000 graduates in all fields(in 2015) • internal outlays on R & D in the field of the social sciences (in 2015)

Source: authors' own elaboration

Calculations then made use of the following formula (Pluta, 1977):

1. First, the standardisation of variables was achieved using the formulae:

   a) Stimulant: $\quad\quad y'_s = \dfrac{y_{ij}}{\max y_{ij}}, \quad\quad j' \in S, j = 1,2,\ldots,n$

   b) Destimulant: $\quad y'_D = \dfrac{\min y_{ij}}{y_{ij}}, \quad\quad j' \in D, j = 1,2,\ldots,m$

2. Then a summary index was calculated, as normalised using the formula:

$$S_i^n = \frac{\sum_j^n y'_s + \sum_{j=1}^m y'_D}{n+m}$$

   where:
   S is the normalised summary index
   y' is the value of the stimulant (S) or destimulant (D)
   y_{ij} is the value of variable Y for unit i (j of units)
   n is a stimulant
   m is a destimulant
   $n+m$ is the number of stimulants and destimulants

3. The process continued with the adoption of threshold values serving to indicate specialisations in line with the region's potential for specialisation as regards the categories defined:

$$W_S = \max S_i^n - \sigma$$

   where:
   W_S is the threshold value for the category
   $\max S_i^n$ is the normalised summary index
   σ is the standard deviation for the obtained S index values in the given category

   Results were also compared with the mean values for the S index in the given categories in order to point to any high-potential specialisations.

The last stage in the study involved the verification of values for the summary index in each of the categories or sub-categories, by setting them against the corresponding smart specialisation in the region selected. Where index values are high, it may be accepted that internal resources confirm the significance or relevance of the proposed specialisation. In the opposite case, a region's smart specialisation fails to find support or justification in the internal potential it actually possesses. That said, the multi-aspect nature of certain specialisations did hinder their full appraisal, hence the assumption adopted that at least one feature attesting to the high internal potential of a region should be deemed to confirm the justification for that specialisation to be selected.

RESEARCH RESULTS

The structure of smart specialisations in the regions

The regional authorities at voivodeship level identified a very broad set of smart specialisations (Fig. 1). The numbers per region were in the range from 3 (in Podkarpackie, Śląskie and Warmińsko-Mazurskie voivodeships) to 8 (in the cases of Kujawsko-Pomorskie and Zachodniopomorskie). These kinds of differences in numbers of specialisations help determine thrusts to development, as well as influencing scope when it comes to branches of the economy encompassed by innovation policy within the Regional Innovation Strategy framework. However, the very definition of smart specialisation implies that this should relate to, and draw on, unique features of a region, with competitive advantage being successfully shaped in this way. This leaves proposals for a large number of specialisations looking like unfocused activity, and hence an approach that misses the point and risks being characterised by ineffectiveness.
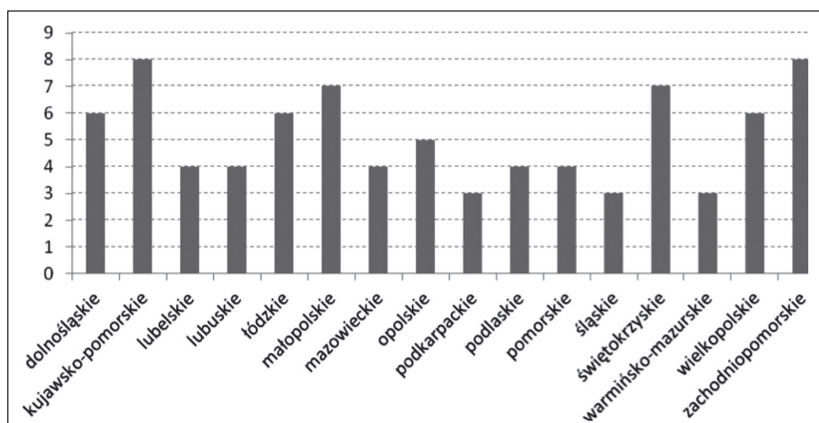

Figure 1
Numbers of smart specialisations by voivodeship, 2016

Taken together, the voivodeships have proposed 81 smart specialisations, including 67 that are leading ones and 15 that are facilitating. In terms of their categorisation, these first and foremost represents industry (36% of the total), with agriculture in second place (on 14%), followed by ICT (12%) and the environment (11%). Where the industrial sector is concerned it is specialisations in the energy and extractive industries sector that dominate, as well as the machine, electrical appliances, metal and motor industries.

In the seven regions in which the authorities assigned their specialisations to relevant sections and divisions of the PKD classification, a smart specialisation was on average associated with 3 PKD Sections and over 7.5 Divisions of that classifica-

tion system. Only in the case of three specialisations in Małopolskie voivodship was just a single PKD Section involved in each.
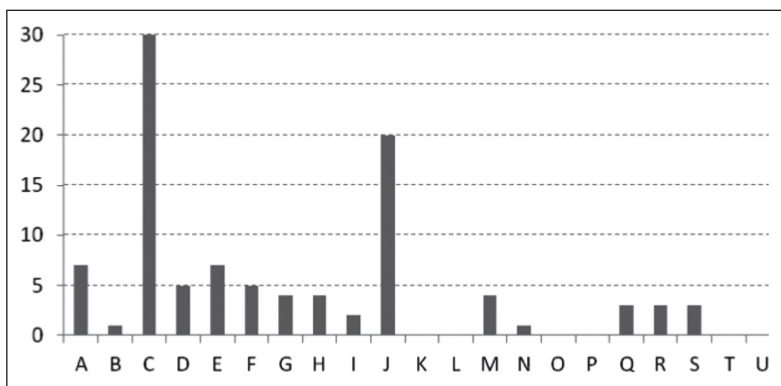

Figure 2
Number of Sections in the smart specialisations of Lubelskie, Małopolskie, Mazowieckie, Opolskie, Śląskie, Warmińsko-Mazurskie and Wielkopolskie voivodeships

Analysis of the numbers of Sections assigned to smart specialisations points to the clear dominance of manufacturing, which is present in over 90% of the specialisations. That Section is followed by ICT, which ought presumably to be an inherent internal feature of all smart specialisations. The remaining Sections are only represented to a very limited extent.
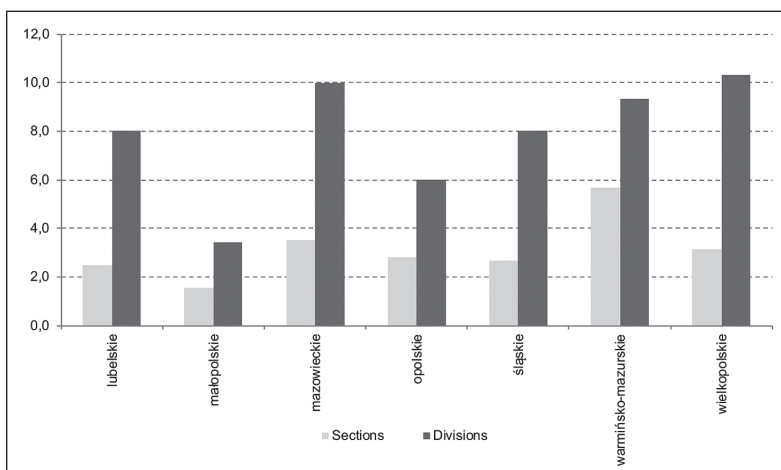

Figure 3
Mean numbers of Sections and Divisions of the PKD classification coinciding with a single smart specialisation in one of the selected voivodships (a Section or Division could be assigned repeatedly to different specialisations in a region).

Considerable differentiation was to be noted in terms of numbers of PKD Sections and Divisions per smart specialisation. In Małopolskie voivodeship, for example, one specialisation relates to less than two Sections on average, leading to a general assertion that the specialisations in this region are genuinely concentrated in given sectors of the economy. In contrast, in Warmińsko-Mazurskie voivodeshop, each specialisation has around 6 PKD Sections assigned to it on average. These would then seem to be multidisciplinary proposed specialisations. That said, it is hard to be sure which solution is more suitable or appropriate, given that smart specialisations may really differ in their nature; and while attention might be focused on a precisely-defined economic activity, the sectors of the economy associated with it need to be taken account of. Nevertheless, at least where the broad treatment of smart specialisations is concerned, there would seem to be a need for these to relate to only a relatively small number of PKD Sections, even if the number of Divisions within these might actually be quite large.

An analysis of the diagnostic indicators by categories of smart specialisation

The **Cultural heritage** category includes two specialisations, i.e. *cultural heritage, art and creative industries* in the case of Kujawsko-Pomorskie voivodship, and *creative industries and rest and recreation* in Małopolskie. A look at the summary index for this category reveals that the first region's value is just a little above average. The threshold adopted does not permit its being qualified as a leading region where cultural heritage is concerned. This is to say that there are regions (Małopolskie, Mazowieckie, Pomorskie and Zachodniopomorskie voivodeships) more attractive from this point of view, also possessing good infrastructure and various features of value from the point of view of tourism that typically work to further raise the level of cultural attractiveness. However, it is clear from this that the index value in the case of Małopolskie voivodeship does indeed justify the choice of this category by the regional authorities there.

Conceptually, smart specialisation attaches great importance to **The environment** *(or pro-environmental activity)*, hence a lack of surprise that this category is put forward by as many as 10 among Poland's 16 voivodeships. However, the summary index in this case was founded upon concrete achievements concerning, for example, waste management, pollutant emissions and the training of personnel in the environmental protection field. When all that was taken account of only two voivodeships – Dolnośląskie and Małopolskie – were found to be achieving values above the threshold, with only the first of the two actually putting forward a smart specialisation associated with natural resources. Furthermore, it needs to be stressed that a specialisation entitled *Natural and secondary raw materials* relates, not only to environment-friendly activity, but also to renewable resources and the extractive industries. Regions that have above-average index values were in turn found to include Wielkopolskie andŚląskie voivodeships, but neither of these selected specialisations of relevance to this category. Rather, environmental

protection and natural resources were taken account of in the smart specialisations put forward by Lubuskie, Podkarpackie, Świętokrzyskie and Warmińsko-Mazurskie voivodeships, in all of which the values for the index in fact tended to be low. In the last three regions in particular, it is clear that highly valuable natural features are present, and that these should be simultaneously protected and put to use. However, this does not mean that they fit the smart specialisation model. The choices here may reflect the way in which authorities see smart specialisations as ways of improving the situation in neglected sectors of the economy, as opposed to providing further support for already-dynamic branches.

The category of **Industrial production** is represented in every region, and is made up of several sub-categories. In the case of the sub-category involving **Energy and the extractive industries**, clearly pre-eminent values for the summary index are obtained for Śląskie voivodeship, which was in fact the only one to exceed the threshold set. Beyond that, it is possible to speak of strong potential in the cases of Kujawsko-Pomorskie, Podlaskie, Warmińsko-Mazurskie and Zachodniopomorskie voivodships, in each of which the index takes on above-average values. The sub-category under discussion was present in no fewer than 13 specialisations identified and proposed by 12 regions – leaving this as the second most-often indicated category/sub-category.

The second sub-category of **The machine, electrical appliances, metal and motor industries** is associated with more limited differences in values for the summary index. A specialisation linked with this sub-category was indicated by 10 voivodeships in 12 specialisations. The indicator in turn confirms the significance of this specialisation in the case of Lubuskie, Opolskie and Śląskie voivodeships (the regions of Lublin, Opole and Silesia). A high potential is also displayed by Dolnośląskie voivodship (Lower Silesia), while in the remaining regions the values assumed by the indicator fail to confirm qualification of this sub-category as a key branch. It should however be stressed that it is in regard to this group of industries that differences in the values obtained for the indicator analysed are most limited. Generalising, it may thus be said a specialisation in this sub-category on the part ofa region fails to find much justification.

When it comes to the **Chemicals and plastics** sub-category, a high value for the index is achieved by 6 voivodeships, i.e. Kujawsko-Pomorskie, Łódzkie, Mazowieckie, Podkarpackie, Śląskie and Wielkopolskie. However, in only the first region is a smart specialisation associated with this industrial sector pointed to. In turn, in the sub-category of **The wood and furniture industry**, the threshold value is exceeded by four regions, i.e. Małopolskie, Mazowieckie, Warmińsko-Mazurskie and Wielkopolskie. The result of the analysis confirms the correct nature of the specialisation as identified in Warmińsko-Mazurskie voivodeship. In remaining voivodeships, no specialisation associated with this industrial sector is indicated. The results of analysis of the index for **the textile industry** overlap with the iden-

tified specialisation selected in Łódź voivodeship, i.e. *a modern textile and fashion industry*.

In the **Construction** category, values for the summary index exceeding the threshold are to be noted in the three voivodeships of Małopolskie, Mazowieckie and Śląskie. In turn, above-average values attesting to high potential characterise Dolnośląskie, Pomorskie, Świętokrzyskie, Wielkopolskie and Zachodniopomorskie voivodeships. Nevertheless, it was only in Świętokrzyskie, Wielkopolskie and Pomorskie voivodeships that smart specialisations in this category were proposed. Among other voivodeships with analogous specialisations that lack confirmation in terms of values for the index we find Łódzkie, Opolskie and Podlaskie. In turn, among the three voivodeships shown by the index to have developed construction to the highest level, not a single specialisation associated with this sector was identified and put forward.

The analysis of smart specialisations in the category of **Agriculture** poses certain difficulties arising out of conflicting or contradictory assumptions. On the one hand, regions point to the need for "safe", "high-quality" and "healthy" food, or "food for the aware consumer"; while on the other they see opportunities as lying in the development of "modern agriculture and food processing", which in turn suggests a focus on the intensive production of food achieved using industrial methods. The synthetic index in this category first and foremost takes account of the R & D potential for agriculture, as well as the quality of natural conditions suitable for developing this sector. This was the means by which we sought to identify regions possessing features that may actually support smart specialisations associated with farming. Among voivodeships with major potential to take advantage of this are Mazowieckie, Wielkopolskie and Lubelskie. Beyond that, it is possible to indicate Dolnośląskie, Kujawsko-Pomorskie and Warmińsko-Mazurskie voivodeships as places in which the summary index takes on above-average values. That said, it needs to be stressed that almost all of the voivodeships (except Śląskie) indicated diverse specialisations linking up with this category. Thus, in the remaining voivodeships the selection of smart specialisations associated with agriculture is a source of some reservations.

A category of fundamental importance to all innovation is of course **ICT**. This was identified a distinct category of smart specialisation, though sometimes co-occurring with other categories (e.g. in the *Innovative industry* proposal from Lubuskie voivodeship). In the regional documents identifying smart specialisations that were subject to analysis, ICT gains frequent mention as an indispensable component. Nevertheless, in Lubelskie (Lublin) voivodeship, as well as the neighbouring Podkarpackie, a specialisation associated with ICT is described rather as facilitating or supplementing (cf. Table 1), while in remaining voivodeships specialisations arrived at in this category are considered to have a full role on a par with other specialisations.

In practice, the greatest potential as regards **ICT** is shown by Mazowiecki voivodeship, with this presumably reflecting the way that large firms in this sector have located in Warsaw. Lower values for the index, though ones that still exceed the average, characterise Dolnośląskie, Pomorskie, Śląskie and Wielkopolskie voivodeships. Specialisations associated with this category were in turn indicated by 13 regions (i.e. all the voivodeships except Opolskie, Podlaskie and Warmińsko-Mazurskie). However, it is *only* in the case of Mazowieckie voivodeship that a selection gaining confirmation in the analysed indices may be referred to.

ICT is important for the innovative development of all sectors of the economy, hence a justification for it to be developed in all regions. However, ICT as a separate smart specialisation should be offered equal treatment with other specialisations, hence only appearing in those regions where the required conditioning is present. A different thing is the treatment of ICT as an integral component of all other specialisations.

There is marked differentiation to the result for the ***Medicine*** category. It proved possible to identify 11 smart specialisations associated with this category, in 11 voivodeships. Regions standing out against the others in this regard are Łódzkie and Podlaskie voivodeships. In the case of the latter, the emphasis is on the so-called "*silver economy*", not only associated with medicine, treatment and care of the elderly, but also integrating the production of health foods.

Services rendered to businesses are assuming ever-greater significance, in the contexts of *business-to-business* (B2B), *offshoring, business process outsourcing* (BPO) and so on. Where this category is concerned it is possible to note links with results obtained for the ICT category, given that business services make use of modern technologies and are often provided long-distance away, being mainly located in large centres where qualified personnel concentrate. Thus, while values for the summary index are found to be above-average in seven voivodeships, it is only in Mazowieckie that the threshold is passed. In Lubuskie, the need for this type of service to develop for example reflects the location close to the German border, while in Świętokrzyskie it can be linked with the activity of the Kielce Trade Fairs.

In the case of ***Transport services and Logistics***, threshold values were only calculated for overland transport. Maritime transport was a matter for just three voivodeships, so a classification for this sub-category served no purpose. Where overland transport is concerned, the threshold values for the summary index are exceeded in Mazowieckie, Pomorskie and Zachodniopomorskie voivodeships – a circumstance that can be linked to the major economic potential of the capital city and the Tri-City, as well as a border location and heavy traffic in the coastal zone. However, as the transport sector is a *sine qua non* condition for the proper functioning and development of any region, the selection of transport services as a smart specialisation looks dubious.

Needs of society and quality of life was a smart specialisation category applying to Mazowieckie and Lubuskie voivodeships. However, it needs to be stressed that "quality of life" as a notion is variously understood. In Wielkopolskie voivodeship, for example, it is considered to link up with the development of ICT, medical services and transport services. This leaves qualification of a given specialisation to this category as a task fraught with difficulty.

Table 3 Results of the multidimensional analysis by category

Name	Cultural heritage	The environment	Energy and the extractive industries	The machine, electrical appliances, metal and motor industries	Chemicals and plastics	The wood and furniture industry	The textile industry	Construction	Agriculture	ICT	Medicine	Business services	Overland transport and logistics	Maritime transport and logistics	Needs of society and quality of life
Dolnośląskie	0.56	0.69	0.23	0.73	0.55	0.45	0.36	0.59	0.45	0.57	0.42	0.68	0.33	n.d.	0.59
Kujawsko-Pomorskie	0.56	0.44	0.43	0.63	0.65	0.33	0.50	0.38	0.49	0.37	0.52	0.47	0.36	n.d.	0.67
Lubelskie	0.31	0.44	0.12	0.62	0.35	0.54	0.46	0.36	0.69	0.30	0.65	0.39	0.42	n.d.	0.65
Lubuskie	0.54	0.11	0.23	0.77	0.54	0.46	0.47	0.35	0.23	0.33	0.26	0.43	0.26	n.d.	0.48
Łódzkie	0.56	0.40	0.20	0.60	0.67	0.38	0.95	0.40	0.41	0.41	0.85	0.64	0.32	n.d.	0.59
Małopolskie	0.61	0.57	0.19	0.69	0.55	0.63	0.49	0.65	0.42	0.42	0.58	0.73	0.33	n.d.	0.67
Mazowieckie	0.64	0.36	0.09	0.54	0.60	0.70	0.46	0.74	0.81	0.92	0.55	0.96	0.80	n.d.	0.78
Opolskie	0.32	0.32	0.19	0.84	0.51	0.28	0.32	0.34	0.30	0.38	0.38	0.31	0.20	n.d.	0.47
Podkarpackie	0.31	0.24	0.17	0.66	0.58	0.49	0.38	0.45	0.30	0.39	0.36	0.43	0.22	n.d.	0.60
Podlaskie	0.54	0.36	0.41	0.66	0.50	0.49	0.50	0.42	0.38	0.37	0.72	0.39	0.19	n.d.	0.57
Pomorskie	0.74	0.45	0.25	0.62	0.56	0.44	0.46	0.52	0.30	0.48	0.61	0.68	0.70	0.97	0.76
Śląskie	0.54	0.53	0.69	0.76	0.62	0.43	0.46	0.66	0.24	0.51	0.54	0.70	0.54	n.d.	0.87
Świętokrzyskie	0.30	0.28	0.25	0.60	0.52	0.34	0.33	0.56	0.26	0.34	0.46	0.39	0.16	n.d.	0.52
Warmińsko-Mazurskie	0.46	0.27	0.41	0.58	0.29	0.67	0.36	0.48	0.58	0.34	0.20	0.44	0.17	0.04	0.57
Wielkopolskie	0.49	0.52	0.15	0.69	0.61	0.76	0.49	0.55	0.79	0.43	0.58	0.61	0.47	n.d.	0.70
Zachodniopomorskie	0.65	0.43	0.27	0.65	0.50	0.58	0.28	0.55	0.33	0.39	0.59	0.58	0.64	0.73	0.75
Mean	0.51	0.40	0.27	0.67	0.54	0.50	0.45	0.50	0.44	0.43	0.52	0.55	0.38	0.58	0.64
standard deviation	0.13	0.14	0.15	0.08	0.10	0.14	0.15	0.12	0.19	0.15	0.17	0.17	0.20	0.48	0.11
Ws (threshold value)	0.60	0.55	0.54	0.76	0.57	0.62	0.80	0.61	0.62	0.78	0.68	0.79	0.60	0.49	0.76
Difference between y max and y min	0.44	0.58	0.60	0.29	0.38	0.48	0.67	0.40	0.58	0.62	0.65	0.65	0.63	0.93	0.41

☐ above-average S   ☐ below-average S   ☐ above the Wsthreshold value

Source: authors' own elaboration

CONCLUSIONS

Smart specialisation is a new concept and one of the tools forming part of EU regional development policy. It above all involves a wise choice of priority sector offering the best opportunities for development of a given region and for the concentration of activity within it. This kind of scheme works to raise the level of effectiveness with which public money is spent. The choice of smart specialisation is to arise out of analysis of a region's strong points and its greatest potentials, with the result being innovation and development founded upon knowledge, as supported by investment in the private sector.

The choice of smart specialisations is a complex process that need not denote a final choice. Rather it is a learning and discovery process for entrepreneurs, given that the specialisations selected reflect the present situation in part only, with a great deal of importance attached to the vision vis-à-vis development. The forecasting of development and *de novo* establishing of development priorities is a risky matter in the circumstances of dynamic socioeconomic change and rapid technological progress.

The analysis presented here reveals very varied approaches to smart specialisation on the part of regional authorities. Some are conservative in the way they identify their strong suits, while others are willing to take a more courageous stance to the shaping of their futures.

Analysis of the synthetic indices for the different categories or sub-categories sustains the idea that some regions' selection of smart specialisations were not associated with their strong points at all, but rather in fact with areas of neglect or at best weak development. In such cases, the proposals for specialisation were more about wish fulfilment than reality.

In line with the assumptions made *a priori*, a specialisation selected appropriately must be included in at least one category or sub-category with a value that passes the threshold (W_s). Compiled below (Table 5) are the smart specialisations selected in line with voivodeships' potentials. Also offered is an indication of the categories (or sub-categories) in which the index values exceed the threshold one, but no specialisation has been associated with them. These are potentially areas for which appropriate smart specialisations might be proposed.

Table 4 Appropriately selected smart specialisations and categories (sub-categories) associated with them in which the threshold value for the W_s index is exceeded; as well as potential categories (with W_s passing the threshold value) to which no specialisation has been attributed.

VOIVODESHIP	APPROPRIATELY-SELECTED SMART SPECIALISATION AND ITS CATEGORY[1]	POTENTIAL CATEGORY WITH HIGH W_s VALUE
Dolnośląskie	*Natural and secondary raw materials* – **The Environment**	Lacking
Kujawsko-pomorskie	*Tools, forms and products of plastic* – **Chemicals and plastics**; *Best safe food – processing, fertilisers, packaging* – **Chemicals and plastics**	Lacking
Lubelskie	*Biomanagement* – **Agriculture**	lacking
Lubuskie	*Innovative industry* – **The machine, electrical appliances, metal and motor industries**	Lacking
Łódzkie	*Modern textile industry and fashion (including design)* – **The textile industry** *Medicines, pharmacy and cosmetics* – **Medicine**	**Chemicals and plastics**
Małopolskie	*Creative industries and rest and recreation* – **Cultural heritage; The environment**	**The wood and furniture industry; Construction**
Mazowieckie	*Safe food* – **Agriculture** *smart management systems* – **ICT** *Modern business services* – **Business services** *High quality of life* – **Needs of society and quality of life**	**Cultural heritage Chemicals and plastics The wood and furniture industry Construction Overland transport and logistics**
Opolskie	*Technologies of the machine and metals industries* – **The machine, electrical appliance, metal and motor industries**	Lacking
Podkarpackie	Lacking	**Chemicals and plastics**
Podlaskie	*The medical sector, life sciences and the sectors associated with them in the value chain* – **Medicine**	Lacking

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1   A specialisation could be represented by several categories. The compilation confines itself to those categories for which the Ws value exceeds the threshold.

Pomorskie	*Offshore and port/logistic technologies –* **Maritime transport and logistics**	Cultural heritage; Overland transport and logistics
Śląskie	Power supply – **Energy and the extractive industries**	The machine, electrical appliance, metal and motor industries Chemicals and plastics Construction Needs of society and quality of life
Świętokrzyskie	Lacking	Lacking
Warmińsko-mazurskie	*Wood and furniture industry –* **The wood and furniture industry**	Lacking
Wielkopolskie	*Biomaterials and food for the aware consumer –* **Agriculture**	Chemicals and plastics The wood and furniture industry
Zachodniopomorskie	*Large-scale maritime and land construction –* **Maritime transport and logistics** *Multimodal transport and logistics –* **Maritime transport and logistics**	Overland transport and logistics Cultural heritage

Source: authors' own elaboration

Certain reservations are aroused by the specialisations taking in to many sectors of the economy, since the very definition of specialisation denotes that this should relate to a narrow group of economic activities somehow distinguishing the region when set against other territorial units. Furthermore, the research here shows that the choice of a large number of specialisations does not find its justification in regions' real potentials. A choice is therefore indicated, and this in close relation with a given region's economic potential, there being in this way a maximum of 2-4 smart specialisations in each.

An interesting example is Mazowieckie voivodeship, in which all of the smart specialisations selected can be assessed as correct or appropriate. This is a reflection of the economic strength of the Warsaw metropolitan area and the role played by Poland's capital city in both administration and business. In turn, in the case of Świętokrzyskie voivodeship, where the level of development of all sectors of the economy is at best "average", it is hard to point to any smart specialisation which could be specific to that region.

To sum up, the concept of smart specialisation is interpreted differently from one region to another. Hence the hard-to-justify selection of certain specialisations, with some not gaining confirmation in terms of regions' internal potential. A further problem is that certain voivodeships have selected too many such

specialisations. Also noteworthy is certain regions' selection of ICT as a separate specialisation, given that the latter would seem to be an integral, inherent part of all specialisations, in line with the very concept.
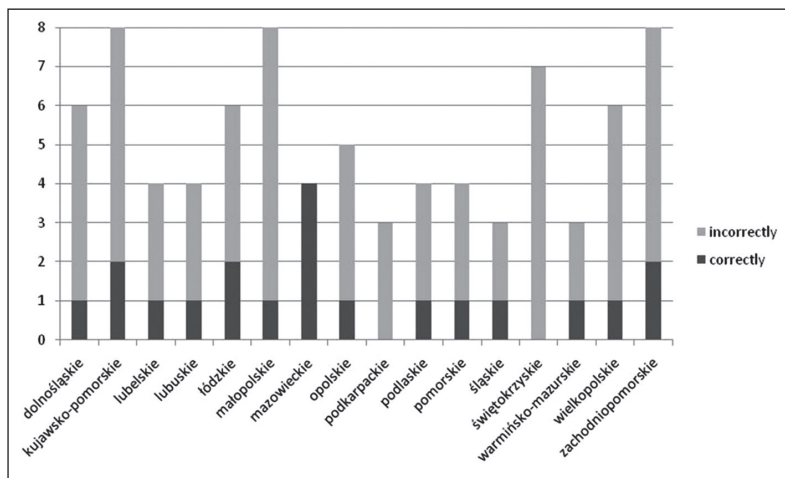

Figure 4
Number of smart specialisations selected

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