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BUILDING RESILIENCE OF MUNICIPALITIES AND REGIONS INNOVATIVE MANAGEMENT TO SMART SPECIALIZATION

INNOWACYJNE ZARZĄDZANIE JEDNOSTKAMI SAMORZĄDU TERYTORIALNEGO Z UWGLĘDNIENIEM INTELIGENTNEJ SPECJALIZACJI

ABSTRACT

Adaptations to digitalization and climate change of all aspects of society are important issues of innovation management at the local and regional levels. In the European regional policy, the strategy of smart specialization is an effective tool for accelerating innovative development, structural and technological modernization and increasing competitiveness of regions. In this conditions, the developing resilience of municipalities and regions innovative management to smart specialization has a urgent role. Given this, the paper demonstrates: 1) the components of smart specialization in order to achieve municipalities and regions strategy goals; 2) the use of the mechanism of smart specialization to realize the entrepreneurial potential of the regional economy; 3) the introduction of smart specialization for the innovative development of the Ukrainian municipalities based on the European experience; 4) the indicators of building resilience of municipalities and regions innovative management to smart specialization. The composition of institutional support of smart specialization are formulated and practical recommendations on its adaptation by subjects in the form of cluster are given, which will allow to increase the efficiency of regional development management. The innovative added value of the research is to justify the feasibility of integrating smart approach to the formation of agro-energy clusters for the clean energy transition and the reducing carbon dioxide emissions in municipalities and regions.

KEYWORDS: *innovation, strategy management, digitalization of municipalities and regions, smart technologies, climate change, energy efficiency, sustainability development*

STRESZCZENIE

Adaptacja do cyfryzacji i zmian klimatycznych wszystkich aspektów życia społecznego jest ważnym zagadnieniem zarządzania innowacjami na poziomie lokalnym i regionalnym. W europejskiej polityce regionalnej strategia inteligentnej specjalizacji jest skutecznym narzędziem przyspieszania rozwoju innowacyjnego, modernizacji strukturalnej i technologicznej oraz zwiększania konkurencyjności regionów. W tych warunkach rozwój zrównoważenia innowacyjnego zarządzania gminami i regionami do inteligentnej specjalizacji ma priorytetową rolę. Ze względu na to, w pracy przedstawiono: 1) elementy inteligentnej specjalizacji dla realizacji celów strategii gmin i regionów; 2) wykorzystanie mechanizmu inteligentnej specjalizacji do realizacji

potencjału przedsiębiorczego gospodarki regionalnej; 3) wdrożenie programu inteligentnej specjalizacji na rzecz innowacyjnego rozwoju ukraińskich gmin w oparciu o doświadczenia europejskie. Sformułowano skład instytucjonalnego wsparcia inteligentnych specjalizacji oraz zostały podane praktyczne rekomendacje jego adaptacji przez podmioty w formie klastra międzybranżowego, co zwiększy efektywność zarządzania rozwojem regionalnym. Innowacyjna wartość dodana badań polega na uzasadnieniu możliwości zintegrowania inteligentnego podejścia do tworzenia klastrów agroenergetycznych na rzecz przejścia na czystą energię i redukcji emisji dwutlenku węgla w gminach i regionach.

Słowa kluczowe: *innowacje, zarządzanie strategiczne, cyfryzacja gmin i regionów, inteligentne technologie, zmiany klimatu, efektywność energetyczna, zrównoważony rozwój.*

Introduction

In the member states of the European Union, the formulation and implementation of innovation, scientific, technical and industrial policy is carried out within the framework of the concepts of inclusive growth and smart specialisation, using an individual approach to realise the potential of each region in order to achieve the greatest possible synergies for the economy (Brych 2022, p. 142). Particularly in the regional policy of European countries, smart specialisation strategy is an effective tool for accelerating innovative development, structural and technological modernisation and increasing regional competitiveness.

On the path of shaping the sustainability of the innovative management of municipalities and regions to smart specialisation, it is particularly important to identify the components of smart specialisation. When considering the essence of ‚smart‛, there is usually an emphasis on the use of various technologies both in everyday life and in the production, management and shaping of living infrastructure. In this context, *smart specialisation is interpreted as a society that effectively harnesses the potential of digital technologies, internet networks and connected devices to improve people's lives* (Levy 2014).

In turn, territories can be called SMART-specialised thanks to the effective management of investments in people (social capital) and IT infrastructure,

which ensure stable growth and improved quality of life. When considering this aspect, three key elements of smart specialisation stand out: technology is a key tool for transforming life and work; human capital and education; dialogue between government and citizens (Nam 2011, p. 283-284, Borysiak 2022a, Brych 2020, Darmorost 2019). Furthermore, in the context of providing technical support for the development and implementation of clean energy transition strategies and plans at Community level, the integration of the environmental component into the smart specialisation framework through the creation of green clusters is an important element of innovative and organisational support for climate change adaptation strategies (Rzeńca 2017, Lupova-Henry 2022, Borysiak 2022c, Lankauskiene 2022, Yegorow 2022).

In contrast, smart specialisation policy in the European Union goes beyond innovation policy and is understood as a process of identifying the competitive advantages, priorities and maximum development of scientific potential in any region, strong or weak, high – or low-tech (Brych 2022, p. 142). The definition of a smart specialisation strategy is set out in European Parliament Regulation 1303/2013: *A smart specialisation strategy encompasses national or regional innovation strategies that prioritise the creation of a competitive advantage by developing and adapting their own strengths in research and business needs to consistently exploit market opportunities and developments, while avoiding duplication and fragmentation of efforts; a smart specialisation strategy may take shape or be integrated into a national or regional strategic research and innovation policy framework.* (Laying down common provisions on the European Regional Development Fund: Regulation (EU) No. 1303/2013 of the European Parliament and of the Council of 17 December 2013, Brych 2021b, p. 58). *The main objective of smart specialisation in the EU is not to stimulate access to Community funds, but to support economic growth and the transformation to a knowledge-based economy, taking into account the societal challenges and conditions specific to EU member states and their regions* (Zalutskyi 2019, p. 5).

In this context, the concept of smart specialisation describes a region's ability to generate new activities by prioritising local concentration and agglomeration of resources. Smart specialisation involves a clear understanding of resource constraints and how they can be used most effectively, an innovative approach to the activities of firms in the region, close interaction within

a ,business-government-society' cluster, openness and flexibility to adaptive change, etc. (Markovych 2016, p. 56-57). Smart specialisation is about identifying the unique functions and assets of each country and region, highlighting each region's competitive advantages and focusing regional partners' attention on a vision of future achievements (Bzhuska 2012, Brych 2022, p. 143). The concept of ,smart specialisation' is a new approach to state support for development processes, primarily at regional level (Foray 2009).

Research Methodology

In view of this, the aim of the article is to examine the features of smart specialisation in Ukraine in line with the strategic objectives of municipalities and regions of the European Union, to develop an algorithm for the use of the smart specialisation mechanism to achieve the entrepreneurial objectives of the potential of the regional economy in the spheres of agriculture and *green* energy on the basis of intersectoral clustering, and to develop recommendations for municipalities and regions for the implementation of programmes to expand the sustainability of the innovation management system for smart specialisation (Artyukhova, Tiutiunyk, Bogacki, Wołowiec, Dluhopolskyi, Kovalenko 2020, p. 7711).

Methods

Smart specialisation involves the continuous creation and development of new technologies, which requires knowledge formation, an appropriate environment and infrastructure for knowledge production and transfer. Because of this, the basis of the methodological approach to the study of building the sustainability of innovative management of municipalities and regions to smart specialisation is a synergistic approach, consisting in building a network of communication between educational and scientific structures, business, authorities, the expert and stakeholder community. An important element of this approach is the process of entrepreneurial discovery, and the active participation of entrepreneurs in the development and implementation of smart specialisation principles is a necessary condition for its realism and effectiveness.

The use of a synergistic approach in the research made it possible to focus on the business sector and the issue of its involvement in the process of creating an algorithm for the use of the smart specialisation mechanism to realise the entrepreneurial potential of the regional economy in the agri-food sector and the ‚green' energy zone on a cross-industry cluster basis. In order to determine the specifics of the implementation of the principles of innovation-based smart specialisation in the municipalities of Ukraine on the example of the Ternopil region, an analysis of the status of the development of smart specialisation principles in the Ternopil region for the period up to 2027 was carried out by creating focus groups.

In turn, the combination of dialectical approach to the knowledge of the components of smart specialisation and the methods of induction, deduction for the justification of the use of the mechanism of smart specialisation for the realisation of the entrepreneurial potential of the regional economy based on cross-industry clustering became the basis for the development of recommendations for municipalities and regions for building their resilience to smart specialisation based on interdisciplinary clusters.

RESULTS

Today, municipalities and regions, creating a system of innovative governance, need to build their resilience in the transition to smart specialisation in order to gain competitive advantages. The basis of smart specialisation is an entrepreneurial discovery that demonstrates what a municipality or region does (will do) best in terms of socio-economic development and innovation (Wołowiec, Myroshnychenko, Vakulenko, Bogacki, SWiśniewska, Kolosok, Yunger, 2022, p. 8407).

Components of European smart specialisation

In general, the definition of the components of European smart specialisation sets a single paradigm for a pan-European strategy for smart, sustainable, climate-neutral and inclusive growth and a standard set of tools to stimulate private sector investment and innovation activity in the form of reduced taxation and research credit. In addition, the general trend is towards large multi-stakeholder digital platforms and a focus on digitisation of business processes. With this in mind, the European Commission has identified five possible directions for shaping smart specialisation strategies in the areas of innovation and growth:

- renewal of traditional industries through the search for new market niches;
- modernisation through the adaptation and dissemination of new technologies;
- technological diversification into related activities;
- development of new economic activities through radical technological changes and innovative breakthroughs;
- exploitation of new forms of innovation, namely open, social, service and consumer-driven innovation (Smart specialization, European Commission; Brych 2022, p. 143-144; Cohesion Policy 2014-2020 2014, National/Regional Innovation strategies for smart specialisation /RIS3/).

Implementing the strategic development vector of European integration, Ukraine has started intensive adaptation to European best practices, in particular in the transformation of regional development and spatial management. The Cabinet of Ministers of Ukraine approved the State Strategy of Regional Development for 2021-2027 and the methodology for developing, monitoring and grading the effectiveness of regional development strategies and action plans for their implementation. In November 2018. The Cabinet of Ministers of Ukraine adopted a decision on the application of the smart specialisation approach in strategic planning for regional development and added relevant additions to the *Procedure for the elaboration of regional development strategies and action plans for their implementation, as well as monitoring and*

grading of the effectiveness of the implementation of the specified regional strategies and action plans (On Approval of the Procedure for the Elaboration of the State Strategy of Regional Development of Ukraine and Action Plan for its Implementation, as well as on Monitoring and Grading of the Effectiveness of the Implementation of the Specified Strategies and Action Plan in 2015; On Approval of the State Strategy of Regional Development for 2021-2027, 2020). According to the new edition of this document, *at least one strategic objective of the regional strategy is defined on the basis of smart specialisation and provides for innovative development of priority economic activities of the region, raising the level of competitiveness of the region* (Brych 2021, p. 60). Throughout 2019, the process of drafting regional strategies and action plans based on smart specialisation was conducted in all regions of Ukraine (Brych 2021b, p. 60).

At the same time, in contrast to European trends, in Ukraine the priorities and tasks of smart specialisation of regions do not sufficiently reflect the directions of their transformation to ensure sustainable innovative development. In EU countries, a shift from Smart Specialisation Strategy (S3) to Smart Specialisation Strategy for Sustainability (S4) has been announced, together with a corresponding redistribution of financial and economic resources for sustainable and inclusive activities. Thus, in the EU, more than 90% of smart specialisation strategies are directly aimed at overcoming climate challenges. The innovative component of the priorities is mostly realised through comprehensive digitalisation, the introduction of IT-technologies and products in the defined priority actions, while in Ukraine, the targeted development of IT technologies in smart specialisation priorities is defined only in 5 regional strategies (Shevchenko 2021, p. 6).

Given the importance of the transition of municipalities and regions to smart specialisation, we will consider the specifics of the implementation of smart specialisation principles based on innovation in municipalities of Ukraine on the example of the Ternopil region. The analysis of the state of development of smart specialisation principles of the Ternopil region for the period until 2027 was carried out by specially formed focus groups, which included representatives of authorities (state administration, local governments), entrepreneurs, scientists, representatives of public organisations, agricultural producers and experts from EU countries in the field of creation and operation

of innovative infrastructure identified a list of activities that are the basis of future smart specialisation of the Ternopil region. At the same time, the area of smart specialisation should be: agriculture; food industry; mechanical engineering (Strategy of development of Ternopil region for 2021-2027 and Action plan for its implementation for 2021-2023, p. 141).

Based on the results of the study, the priorities of smart specialisation in the Ternopil region are: production of electric lighting equipment; deep processing of milk; production of niche and organic products (Ternopil Region Development Strategy 2021-2027 and Action Plan for its implementation 2021-2023: 141; Brych 2021b: 60). Tasks of smart specialisation: clustering, cooperation in areas of smart specialisation, including the creation of fruit and berry clusters and a lighting cluster; introduction of IT products into the socio-economic infrastructure, including the creation of new startups and companies and their development in a startup incubator; development of innovative activities in smart industries, including the organisation of marketing research on the possibilities of shaping and functioning of regional industry markets (Ternopil Region Development Strategy 2021-2027 and Action Plan for its implementation 2021-2023, p. 141). At the same time, given the need to develop preventive, mitigation and adaptation measures to climate change, a promising direction is the green development of entrepreneurial potential (Borysiak 2022b, Brych 2021a). In particular, in the context of energy decarbonisation, the development of entrepreneurship in the area of renewable energy is of particular importance.

The developed Strategy for the Development of the Ternopil Region for 2021-2027 states that the strategic goal is to increase the competitiveness of the region, while the operational goal is to implement regional smart specialisation. One of the possible ways to increase the level of competitiveness of the Ternopil region is the implementation of an innovative smart specialisation approach, consisting in the transformation of economic sectors and the realisation of the latest scientific potential through effective cooperation of government, business, science and society. The programme *Increasing the competitiveness of the region* includes 5 components, including 1 – based on smart specialisation, which are implemented through 17 directions comprising 42 relevant projects. Each of the directions deals with a separate aspect

that is critical for sustainable economic development (Strategy for the development of the Ternopil region for 2021-2027 and Action Plan for its implementation for 2021-2023: 284).

Under conditions of climate change, an innovative solution for the implementation of municipal and regional development strategies based on smart specialisation is the introduction of climate-neutral and energy-saving technologies. In the context of providing technical support for the development and implementation of clean energy transition strategies and plans at the level of municipalities and regions, it is particularly important to develop a mechanism for the creation of cross-industry clusters based on agricultural and energy companies.

Taking into account the favourable conditions for the development of agriculture in the Ternopil region, an algorithm for the formation of an agro-energy cluster was developed. In this context, the production and conversion to processing of agro-biodiesel is both a way to neutralise the negative impact on the climate (cultivation of photosynthesising crops) and an alternative source of energy (biofuel).

It should be noted that the hallmark of the creation of an agro-energy cluster is to ensure a closed cycle of consumption of energy resources (primary and secondary energy) and, as a result, to achieve a zero carbon footprint in activities to mitigate climate change. In such a chain, we propose to distinguish the actors of primary energy generation and supply (agro-enterprises as producers of biomass – energy crops), conversion of primary energy into secondary energy (biofuel enterprises and *green* thermal energy enterprises), supply and operation of secondary energy (distribution stations, energy service companies) directly consumers (households, transport sector) (Borysiak, Wołowiec, Gliszczyński, Brych, Dluhopolskyi 2022, p. 11449).

Maximising the environmental effect (decarbonisation of the environment) and minimising energy consumption costs

At the same time, in this chain we distinguish energy service companies as intermediaries in ensuring that the costs of maintaining a *green* energy transmission chain are optimised through the introduction of climate-neutral and energy-efficient technologies. The coordinating role of the operation of the agro-energy cluster is played by local government units on a smart governance basis. The innovation of the construction of such a chain lies in the observance of the principle of climate neutrality at all stages of the energy transition, which consists in placing at the core of the management model for the provision of *green* energy services such an optimising effect as maximising the ecological effect (decarbonisation of the environment) and minimising the costs of energy consumption (Borysiak, Skowron, Brych, Manzhula, Dluhopolskyi, Sak-Skowron, Wołowiec 2022, p. 7841).

Figure 1 builds a model for the formation of a smart specialisation mechanism for the realisation of the entrepreneurial potential of the regional economy in the agrarian and ‚green' energy spheres, based on cross-industry clustering. In order to optimise the costs and improve the efficiency of the work of the participants of such a cluster, the functioning of:

- sectoral smart management centres (may be at the level of one enterprise or a group of enterprises in an industry), which are responsible for monitoring the economic and environmental efficiency of production, use of energy resources (agricultural smart management centre; bio-processing (bioenergy, food) smart management centre, ‚green' energy (electricity/thermal energy) smart management centre, consumer smart management centre (domestic, transport, industrial);
- inter-industry intelligent interaction centres, which are responsible for optimising risk factors in the transfer of energy resources;
- intelligent energy service centres, which are responsible for supporting energy-saving decision-making at industry (business unit) level and the introduction of climate-neutral technologies into the energy chain;

- smart reverse logistics centre, which is responsible for processing waste (reverse logistics) from the main activities of energy consumers (e.g. use of waste heat from transport activities, operation of household appliances for energy and water heating).

The basis for shaping the mechanism of urban and regional agro-energy cluster management on the basis of smart specialisation is the specificity of the operation of smart technologies, which makes it possible to ensure the optimisation of the complex decision-making process and multi-channel interaction of all participants in the ,green' energy transmission chain. In particular, the transition to the introduction of low-temperature thermal solutions in the central heating system involves the conversion of buildings and the introduction of energy-saving technologies.

Fig. 1. *Model for shaping a municipal and regional agro-energy cluster management mechanism based on smart specialisation*
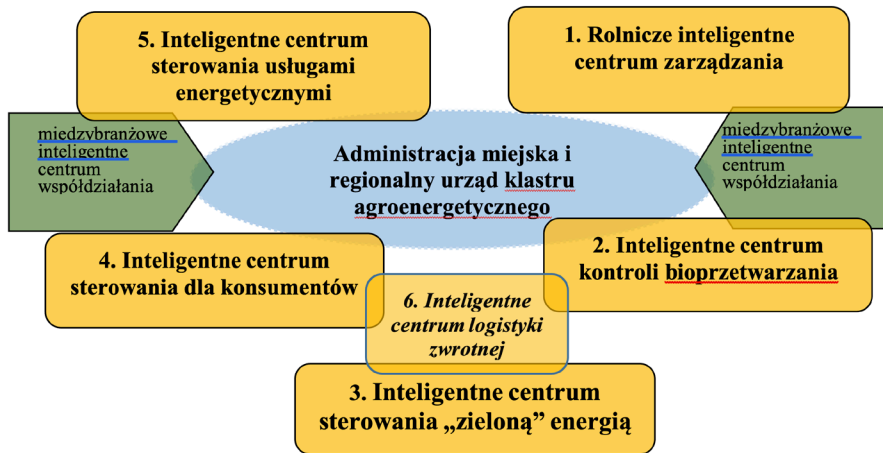
Source: own elaboration

The establishment of the agro-energy cluster and its subsequent activities are based on the organisational and technical tasks of the transition to clean energy and carbon reduction, which include negotiations between the parties, business meetings, consulting, providing advisory services , discussing business

processes, holding seminars and round tables between partners, involving new partners in the work of the association, agricultural and other support services that directly affect all participants (Wołowiec, Kolosok, Vasylieva, Artyukhov, Skowron, Dluhopolskyi, Sergiienko 2022, p. 8857).

Conclusions

Extending the sustainability of innovative municipal and regional governance to smart specialisation is to take into account the importance of using the main postulates of the smart specialisation mechanism to realise the innovation potential of the regional economy. Smart specialisation involves different approaches to the main actors in this process:

- for investors – an investment map of potential projects;
- for researchers – the direction of applied research and education process that the market needs;
- for business – meeting the need for innovation and skilled personnel, the possibility of cooperation and expansion of the value creation chain;
- for authorities – inclusiveness, legitimacy and support for community decision-making (Dameniia 2020).

A smart specialisation strategy is a tool for the development of the country's sectors through innovation. The selection of areas of application of the smart specialisation strategy is made by consensus of experts representing science, education, business, industry at the territorial level (Brych 2022, p. 144).

According to the developed and approved Development Strategy of the Ternopil region for the period up to 2027, it is envisaged to concentrate efforts and financial resources on three strategic objectives, one of which is defined by an operational objective based on smart specialisation. The first indicates the need to lay the foundations for the development of human capital and envisages improving health and extending the active life span of people, increasing the adaptability of the population to the needs of the economy and the non-productive sector, and creating comfortable and safe living conditions for the population. The second focuses on increasing the competitiveness of the

region and envisages stimulating the development of small and medium-sized enterprises, the region's tourism industry, attracting investment, improving energy efficiency in all sectors of the economy, and envisages supporting and developing industries identified on the basis of smart specialisation. The third – contains a number of tasks and activities aimed at the development of rural areas, which will be ensured by increasing the employment of the rural population, increasing the level of production efficiency in agriculture and developing the infrastructure of rural areas.

In this context, the proposed agroenergy cluster model on the basis of the Ternopil region can be proposed and easily replicated in other territories under the following conditions: selection of suitable qualified partners to provide support for the project; selection of a reliable cluster participant that has the infrastructure for value-added creation and processing of participants' products; attraction of original ideas for initiating innovative products and technologies of cluster activities. Partnership in an agroenergy cluster creates opportunities for the development of direct relationships between farmers and representatives of the energy sector on the basis of mutually beneficial joint activities. This approach minimises the financial outlay at the start-up stage, which is important because it provides an opportunity for a wider range of willing parties to enter the business (Brych 2021b, p. 62).

The priority directions of the agro-energy cluster model should be the establishment of a cluster model of *Government-Business-Science-Education* interaction. In order to achieve this goal, scientists from the Western Ukrainian National University justified and developed the Programme for Supporting Innovation in Areas of Smart Specialisation in the Ternopil Region for 2020-2023, which aims to implement innovative approaches to capacity building of the regional economy within the framework of smart, sustainable and comprehensive development, based on the Smart Specialisation Strategy. In the programme for supporting innovation in areas of smart specialisation in the Ternopil region for 2020-2023, the regional priorities for innovation activities are of the following types:

- development of new energy transmission technologies, introduction of energy-saving, resource-efficient technologies, development of alternative energy sources;

- mastering new technologies of high-tech development of transport system, armament and military equipment;
- development of new technologies for the production of materials, their processing and combining, creation of a nanomaterials and nanotechnology industry;
- technological renewal and development of the agro-industrial complex;
- introduction of new technologies and equipment for high quality medical care, treatment, pharmaceuticals;
- widespread use of cleaner production and environmental technologies;
- development of modern information and communication technologies, robotics.

The above-mentioned points of the Programme of innovation support in the areas of smart specialisations in the Ternopil region for 2020-2023 should be implemented by creating a regional innovation cluster in the form of a network of university innovation centres and science parks, local centres and spaces for creative innovation, accelerators and industry startups, business – incubators and innovation project offices; opening an innovation support centre in the areas of smart specialisations; implementing a model of innovation management and investment development of sub-regions and communities based on smart specialisations (Brych 2022, p. 144-147).

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Strategia Rozwoju obwodu tarnopolskiego na lata 2021-2027 oraz Plan Działań na rzecz jej realizacji na lata 2021-2023.

W sprawie zatwierdzenia Państwowej Strategii Rozwoju Regionalnego na lata 2021-2027, Uchwała Gabinetu Ministrów Ukrainy z dnia 5 sierpnia 2020 r. nr 695.

W sprawie zatwierdzenia procedury opracowywania Państwowej Strategii Rozwoju Regionalnego Ukrainy i planu działań na rzecz jej realizacji, a także monitorowania i oceny skuteczności realizacji wspomnianych Strategii i planu działań, Uchwała Rady Ministrów Ministrów Ukrainy z dnia 11 listopada 2015 r. nr 931 (zmieniona zgodnie z uchwałą KM nr 959 z dnia 14.11.2018 r.).

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