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Priority Areas of Poland's Development in Line with EU Policy (Smart Specializations) – Poland's Food Security and Climate Change

ABSTRACT

Objective: The purpose of this article is to determine whether the problem of climate change has been included in the smart specialization programs as one that significantly determines the food security of a given region.

Methodology: For this purpose an analysis of provincial programs/strategies for the development was made. The programs indicate areas of importance for the region (the desk research method was used, which is a research method involving the analysis of available data).

Value Added: The starting point for the considerations taken in the article is the Strategy for smart and sustainable development, which sets out the objectives and priorities of the European Union for the years between 2010 and 2020 [EC, 2010]. In response to the above mentioned strategies, the Ministry of Development in Poland has distinguished National Smart Specializations (KIS) [Internet source A], their idea is to identify key sectors for the socio-economic development of the country and their financial support from EU funds (Smart Development Operational Program - POIR). The five sectors of smart specialization include agri-food, forestry and environmental bio-economy, which emphasize the importance of increasing the country's food security and improving food quality. Regional Innovation Strategies (RSI) are the response to KIS. They distinguish the smart specializations of the region, and their assumptions and goals are to be appropriate for the characteristics of the region.

One of the biggest challenges of today is the climate change, which significantly affects the productivity of the agricultural industry. The European Commission in the White Paper and in its subsequent regulations emphasized the need to support local, regional, national and EU activities which will increase readiness and ability to respond to the effects of climate change (EC, 2013). Is it true that in connection with the above, the issue of adaptation of climate change to agricultural, as one of the important elements conditioning food security of the country, was taken into account when creating the concept of smart specializations? They do not decisively affect adaptation activities in the country, individual regions and industries, but in principle they are intended to raise important and current issues for the development of the country, and climate change and its consequences are undoubtedly such an issue.

Recommendations: The analysis of Most Voivodeship Development Strategies carried out shows lack the appropriate form. The scientific language and extensive documentation make it difficult to complete tasks, fail to reach the right recipient, and promote excessive bureaucracy. This is probably not conducive to the development of innovation, but only drives bureaucracy and generates unnecessary costs.

Key words: climate change, food security, EU policy

JEL codes: O2 Development Planning and Policy; O1 Economic Development

Previous Background about Sustainable development, climate change and water protection requirements

The UN goals for a sustainable development (2015) cover a broad spectrum of social demands. For the purpose of this paper, there is one which deals

with better awareness about natural resources (water, oceans, forest, land degradation, desertification) and its proper management, new sources of energy supplies, infrastructure for sustainable consumption, production, economic growth and development such as to protect the environment. These goals, requires the necessary institutional framework to be carry out successfully. Recent experience (2000-2015) shows that institutions matter for dealing with systemic risks which otherwise spill over throughout the whole system. Sustainable development requires an institutional framework strong enough to get its goals through.

Climate change

The report issued by the WMO (World meteorology organization, 2010) set a pessimistic tone to the XVI Conference on Climate Change held in Cancun, Mexico, the same year. The report indicated that in 2010, the emissions of dioxide of carbon had been the highest ever on record, even though the global economy growth was not at its full speed. This fact confirmed the trend, which indicates that while in the previous 10,000 years the level of emissions was stable, in the last 250 years, it had increased by 38%. Therefore, it seems that human behaviour has something to explain about it. It is feasible to assume that climate change will not be solved without some important cost unless both actions and policies are implemented.

Market solutions, will be too slow to provide a long term solution because the main benefit of the trade mechanism with green bonds does not get first to those who reduce emissions, but to those who trade its value. Environment like any common good has not got price, because nobody can claim property right on it. So, market needs complementary public policies.-

Protocol agreements concerning environment protection work as long as governments wants it to do so. However, government also has limitations which is a constraint to get the best of all instrument available to deal with climate change (Kyoto Protocol, 1997).

On the real side, regular massive flooding pattern, changes in weather temperatures, rising sea levels, seem to be the first cost of the climate change due to human intervention. These social costs must be reduced by applying proper policies, which should include support for new sources of energy, tax exemption for those who get reduction on emissions, tax incentives to support clean technologies, and alternative technologies for agriculture activities.-

The real problem to make sure there is a net gain, is to get a reliable measures to compare marginal benefits (economic growth), with marginal cost (further contamination), of carbon dioxide emissions. This gain of course, depends upon benefit going higher faster than costs do. But, to get such outcome, a careful evaluation of the best alternatives is a necessary previous condition.

Water as a scarce resource

Water for human consumption has already become a scarce resource. It will become a tough competition for other alternative uses arising from increasing demand due to higher population. An average person needs around 200 hundred litres of water daily, but to produce different kind of good such as an hamburger; 24 litres are required, a lettuce – 60 litres, tomatoes - 88 litres, apples - 332 litres, wheat bread - 616 litres, and rice – 1612 litres. (www.treehugger.com).

The list goes on and the issue is clear enough to look out for efficient policies. Less than 1% of all water available on earth is suitable for human consumption. Underground sources of water are not huge enough to count it as the reserve of last resort.

Agricultural and mining activities, whose productive process is water intensive, will have to compete for water between each other. Thus, there is a real possibility that severe conflicts might arise because of lack of water.

From the economics point of view, water scarcity means it should get a higher price, which in the near future may get into the consumer bills. While

in the last 40 years, mankind have been worried about oil prices, in the next 50 years or so, it will have to be worried about water prices.

Besides, water is considered a common good (the tragedy of commons), which means that there is no restriction about its use, and the risk of over exploitation is real. The solution requires assigning property rights coupled with an institutional framework, suitable for its protection and reasonable uses. Whether to protect water means a price increase for both private and public users, all should be more cautious about the way they use this resource.

But water preservation is not just a market or policy issue. Government regulations also are important. At the same time, it is also a government responsibility to foster effective actions to deal with it.

There are agricultural sectors which have water scarcity while at the same time have a higher water demand because of mining and energy sectors investments, along with higher human consumption. The implications go beyond supply and demand. Actually, mining investments in particular have to be based upon on desalinization process and water recycling, which increases mining production costs. Those agricultural products are highly water intensive and represent a very high production cost in areas with water scarcity. Thus, tomatoes (3237m³w/acre) and onions (2670m³w /acre) production, requires a lot of more water than lettuce (1668m³/acre) and carrot (1214 m³/acre). This implies, a different approach to production options.

On the supply side, there is also a lack of an efficient management model of water allocation. Therefore, a better water management model is also required. There are already some alternatives available, such as WEAP (water evaluation and planning), Hansen (1992), SAWP (state wide agricultural production) Gallucio (2005), and a combination of both the Econ-WEAP model implemented in California, Forni (2010).

These models deal with the improvement of decision processes concerning the use of water in agricultural activities, taking into account optimization criteria based on economics variables to allocate water. The case of the Econ-WEAP approach for example, provides water supply simulation

to cope with water demand preferences in each area, taking into account any specific year and its characteristics to build up a model for optimization and maximization of profits, taking social cost into account.

However, wiser use of water is not a matter of just better institutions or government policies, business practices or social responsibility criteria. It is also a matter of improving awareness about the importance of protecting water.

The adaptation to climate change: Policy options for Poland's regional economies

Plant production as an example of a solution for adaptation to climate change in agriculture: international evidence

Plant production is essential for human existence and the growing population and changing environment require the search for new solutions to improve food production. For this, biological progress is needed, and thus the creation of new varieties of arable, environmentally friendly, more fertile and of better quality crops. The use of modern technologies in breeding, including in vitro cultures molecular markers, genetic modification of plants, micro-methods for assessing the quality of plant material at early stages of cultivation, allows to shorten the cultivation cycle, conscious and monitored gene transfer, increasing selection efficiency and, as a consequence, significant reduction in cultivation costs of new varieties friendly to the environment, and resilient to climate change (Świącicki et al., 2011, pp. 104–107).

The above-mentioned methods have their supporters and opponents. Proponents of genetically modified plants believe that it is one of the important factors of sustainable agriculture, which reduces the use of non-renewable raw materials and helps protect both agricultural environments (aggro-ecosystems) and natural ecosystems. In their opinion, the use of genetically modified plants prevents soil erosion (by using soil cultivation technology without plowing), reduces water and energy (fuel) consumption, and reduces CO₂ emissions (Świącicki et al., 2011, pp. 104-107).

Opponents believe that genetic modifications are limited to changing only a few features, such as herbicide and pest resistance. Unfortunately, the resistance of existing genetically mutated plant varieties to adverse weather conditions has not changed, as evidenced by the decline in Bt cotton crops in China due to extreme temperature changes (Chen et al., 2005, pp. 330–340) or losses in genetically modified herbicide resistant soybeans in the United States caused by very high temperatures (the Roundup Ready soybean stems were more brittle and halved faster, thus allowing infection to penetrate) (Coghlan, 1999).

An important feature of plant production is its ability to absorb carbon dioxide and thus reduce global warming and strengthen the resilience of ecosystems. Agricultural practices, such as less intensive cultivation of plants absorbing greenhouse gases, favour the carbon sequence and slow down the release of N₂O. It is important to support efficiency in the use of nutrients by optimizing time and the use of inorganic and organic fertilizers. In addition, greater efficiency in the use of resources in the economy is possible, among others, through the management and use of water-saving technologies and water storage. Plant production also has great potential for producing renewable energy and materials giving the opportunity to reduce emissions and better management of the life cycle of raw materials. Plants can replace fossil energy sources thanks to the large variety of bio-energy deposits and technology (bio-fuels, plant waste, perennial energy crops). In addition, plant materials are an alternative to industrial materials. Biopolymers, lubricants and fibers made from plants can gradually reduce the demand for petrochemical products which are energy-intensive (EC, 2009).

Food security and climate change: Guidelines for Poland strategy about food supply

As indicated by PESTA (projection of economic impacts of climate change in sectors of the European Union based on bottom-up analysis), the ongoing climate change significantly affects agricultural crops. An increase in temperatures and changes in rainfall increase the productivity of the agricultural

industry in the north, and decrease it in the centre and south (Pesta, 2009). Food security in many countries is threatened by unpredictable changes in rainfall and temperature, as well as increasingly occurring extreme weather conditions which contribute and will contribute to the damage of crops, especially in the early stages of growth and make it difficult to determine the time of cultivation, thereby reducing farmers' motivation to farm work. Another consequence of climate change is the occurrence of new plant and soil diseases which lead to the destruction of entire crops, and their rapid evolution makes it impossible to find effective safeguards (Morton, 2007, pp. 25–27).

In connection with the above, all methods of improving arable crops are important, increasing their production efficiency and affecting the development of innovation and competitiveness of the Polish economy against the background of European Union countries, especially in the perspective of Union's enlargement by the coastal countries of the Western Balkans, which may become an important market for organic agricultural products in the near future (Dziuba, 2014, pp. 227–228). These actions should lead to an increase in crop resistance to diseases and abiotic stress as well as tolerance to biotic stress resulting from climate change (Świącicki et al., 2011, pp. 104–107).

High and stable yields are currently guaranteed mainly by hybrid (heterosis) varieties, which are characterized by resistance to diseases and lodging, high adaptability, tolerance to soil quality and stressful environmental conditions. They significantly exceed the yield of traditional varieties (populations) by several dozen percent or even more (Świącicki et al., 2011, pp. 104–107).

Diversification of agriculture is the only way to achieve nutritional security in conditions of changing climate. According to many experts, crop diversity is a natural safeguard against adverse changes in natural and agricultural ecosystems (Diaz et al., 2006, pp. 315, 317). Genetic diversity is expected to play a key role in environments with high variability. The greater number of species and varieties in one cultivated field or one ecosystem, the greater the probability that some of them will be resistant to changing conditions. In addition, the diversity of species reduces the likelihood of diseases and

pests, limiting the number of host organisms on which they could develop (Chapin et al. 2000, p. 237).

There is a great deal of evidence that crop biodiversity will play an important role in climate change adaptation, and simplified crop systems will not be enough to ensure nutritional safety. Genetic diversification contributes to increased flexibility and stabilizes food production (Diaz et al., 2006, pp. 315, 317).

Italy is an example here, where the large genetic diversity of wheat reduced the risk of crop failure following drought. With a 20% drop in precipitation, a mere 2% increase in diversification reverses the downward trend and increases their potential compared to average values (Di Falco et al., 2008, p. 91).

In the United States, crop yields from three years in the state of Michigan were compared and it was found that crop yields with high diversity were nearly 100% higher than homogeneous crops. Moreover, it has been shown that crop diversity improved soil fertility and reduced the need for chemicals (Smith et al. 2008, pp. 789).

However, the great famines in Ireland or Ethiopia are a proof of the inefficiency and sensitivity of homogeneous crops (Fraser et al., 2008, p. 49).

In addition to increasing the diversity of crops and their varieties, also increasing genetic diversity within a single species can play an important role in adapting to climate change. The literature indicates that Marker Assisted Selection (MAS), a selection supported by molecular markers may be the method to achieve this goal. By using natural plant varieties, a significant number of immune traits can be grown. The advantage of MAS is that the markers can be used already in the early stages of cultivation and in the early stages of plant development. This makes it possible to eliminate plants which do not contain the desired genes, which limits the number of materials for further stages of cultivation. DNA markers have practical applications mainly in immune culture and in the selection of some quality-related properties (Świącicki et al., 2011, pp. 104-107).

Thanks to the MAS method, plants have been cultivated which are important from the point of view of resistance to extreme weather phenomena

(drought, extremely high or low temperatures, floods). Flood-proof rice can be an example of success. Thanks to genetic mapping, scientists have isolated a DNA fragment containing a gene that makes rice resistant to long-lasting immersion in water (Xu et al., 2006, pp. 705–708).

As it results from the above considerations, there is a number of solutions which can be used to reduce the rate of growing climate change with the help of plant production, and increasing the adaptability to new, often unpredictable weather conditions. However, do the smart specializations take them into account?

Sustainable development at a regional scale: Regional Innovation Strategies (RSI) in Poland

The list of national smart specializations includes social health, agri-food, forest-wood and environmental bio-economies, sustainable energy, natural resources and precipitation management as well as innovative technologies and industrial processes. The specialization of agri-food bio-economy assumes biological progress in plant and animal production, among others through creative cultivation of plants and fungi, breeding of animals with increased utility values, with the possibility of using molecular and biotechnological tools taking into account the issues of biodiversity and resistance to climate and environmental changes (Internet source B).

Table 1. Regional Smart Specializations distinguished in individual voivodeships

Voivodeship	Important areas
Masovia	Safe food, Intelligent management systems, Modern business services, High quality of life.
Lower Silesia	Chemical and pharmaceutical industries, Spatial mobility, High quality food, Natural and secondary raw materials, Manufacture of devices, machinery, material processing, Information and communication technologies (ICT).

Kuyavia-Pomerania	The best safe food - processing, fertilizers and packaging, Medicine, medical services and health tourism, Automotive, transport equipment and industrial automation, Tools, injection molds, plastic products, Information processing, multimedia, programming, ICT services, Bio intelligent specialization, natural potential, environment, energy, transport, logistics, trade – water and land routes Cultural heritage, art, creative industries.
Lublin	Bio-economy, Medicine and health, Low-carbon energy, IT and automation.
Lubuskie	Industry approach: automotive production and services, Metal industry, Environmental technologies and services, Technologies and services for human health, Social and industry cooperation. Sectoral approach: Green economy, medicine and health, IT and automation, Low-carbon energy.
Lodzkie	Modern textile and fashion industry (including design), Advanced building materials, Medicine, pharmacy, cosmetics, Energy, including renewable energy sources, Innovative agriculture and agri-food processing, IT and telecommunications.
Lesser Poland	Life sciences, Sustainable energy, Information and communication technologies, Chemistry, Production of metals and metal products and products from mineral non-metallic raw materials, Electrical engineering and engineering industry, Creative and leisure time industries.
Opole	Chemical technologies (sustainable), Sustainable construction and wood technologies, Technologies of the machine and metal industry, Technologies of the energy industry (including renewable energy sources), Agri-food technologies, Health and environment protection processes and products.
Subcarpathia	Aviation and astronautics, quality of life, information and telecommunications.
Podlaskie	Nineteen smart specializations grouped in thematic departments: Agri-food sector and related sectors, Metal and machinery industry, boat building and related sectors, Medical sector and life sciences and related sectors, eco-innovations, environmental sciences and related sectors.
Pomerania	Offshore and port-logistics technologies, Interactive technologies in an information-saturated environment, Eco-effective technologies in production, transmission, distribution and consumption of energy and fuels, as well as in construction, Medical technologies in the field of civilization and the aging period diseases.
Silesia	Knowledge and innovation communities, Public service networks, infrastructure of the regional innovation ecosystem, SMEs in the global economy chains, Talents and competences.

Świętokrzyskie	Metal and foundry industry, Modern agriculture and food processing, Resource efficient construction, Health and pro-health tourism, Information and communication technologies, Trade fair and congress industry, Sustainable energy development.
Warmia-Masuria	Water management, Wood and furniture industry, High quality food.
Greater Poland	Bio-raw materials and food for conscious consumers, Interiors of the future (furniture and interior decoration industry), Tomorrow's industry (machine production and repair industry, automotive industry), specialized logistics processes, ICT industry, modern medical technologies.
West Pomerania	Large-scale water and land constructions, Advanced metal products, Wood and furniture products, Environment-friendly packaging, Chemical and material engineering products, Modern agri-food processing, Multi-modal transport and logistics, Products based on information technologies.

Source: Author's own study based on voivodeship strategic documents on the development of smart specializations between 2014 and 2020.

In Masovia, as part of safe food, priority directions of activities are: crop techniques, measures and methods limiting the negative impact of plant production on food and the environment, methods of producing/obtaining high-quality food as well as special-purpose food and functional food, including food produced using traditional techniques, methods and measures extending the usability of agri-food products (including the development of specialized packaging adapted to specific needs), technological and tool solutions for assessing food safety, development, assessment and production of pheromone dispensers attracting insects and crop pests, designing biodegradable functional materials made from renewable raw materials for applications in the food and packaging industry and the introduction of new technological processes in existing production which will be energy-efficient, safe for the environment, and at the same time ensure high quality and production efficiency (Internet source C).

The diagnosis of the development of the Lower Silesian Voivodeship up to 2020, among the significant phenomena conditioning the further development of the region, identified a multi-polar arrangement of geopolitical

forces, green development, increase in efficiency, knowledge-based economy, increase in public awareness of the factors of sustainable development, including the climate threat. It was noted in this point, that due to society's dependence on the natural environment the demand for warning systems, new technological solutions, preventive investments and rescue services is growing. However, the description of the specific objectives of the strategy lacks other specific indications for actions aimed at preventing the negative impact of the climate on the economy, including food security (Regional Innovation Strategy of Lower Silesia, 2011).

In the strategy of the Kuyavian-Pomeranian Voivodeship, "The best safe food - processing, fertilizers and packaging" was listed among development potentials. This area includes the system from the production of agricultural products, through processing to distribution and delivery to customers along with all related production and service aspects. The specialization is based on highly advanced agriculture, a highly developed sector of enterprises from the food, fertilizer and packaging industries. Among the smart specializations of the voivodeship there are Agricultural and Food, Forest and Wood and Environmental Bio-economy, which includes: innovative technologies, processes and products of the agri-food and forestry-wood sectors, healthy food (of high quality and ecological production) and biotechnological processes and products of specialist chemistry and environmental engineering (The Kuyavian-Pomerania Voivodeship Board, 2015).

In the Lublin Voivodeship, "Bioeconomy" is a key intelligent specialization and covers all types of economic activity based on bio-technologies, especially plant and animal production, feed manufacturing and agri-food processing, pharmaceutical and chemical industries, renewable energy sources (bio-refineries, bio-fuels), public health and environmental industries and services (eco-business), including pollution level management (Regional Strategy of Lublin Voivodeship, 2014).

In the Regional Innovation Strategy of the Lubuskie Voivodeship, one of the smart specializations in the sectoral approach is "Health and quality of life"

and it includes healthy, safe food (including regional products) covering the entire production process from agriculture through processing to sales on the regional, national market and foreign markets (export) (Internet source D).

The strategy of the Lodzkie Voivodeship among smart specializations includes "Innovative agriculture and agri-food processing", but the recommendations it contains are of a general nature and relate mainly to the search for new technological solutions for the development of these areas of specialization (Internet source E).

The identified intelligent specialization of the Lesser Poland Voivodeship, "life sciences", includes "healthy food and nutrition", one of the indicated subsections. The specialization includes research, development and implementation of technologies and methods of production, processing, storage and distribution of high-quality food, in particular functional food, i.e., having specific characteristics which meet specific nutritional needs, as well as food with traditional, regional and ecological values. "Sustainable agriculture" is another subsection, which is based on obtaining high-quality agricultural products intended for food and recreation purposes and used as raw materials for infrastructure and insulating materials (Lesser Poland's Intelligent Specializations, 2015).

Selected intelligent specializations of the Opole Voivodeship within the scope of "agri-food technologies" indicate the use of molecular and biotechnological tools for the production of seed and nursery material as well as innovative methods of plant cultivation, increasing their resistance to diseases, pests, climate and environmental changes (Smart specializations in the Opole Voivodeship, 2016).

One of the leading smart specializations of the Subcarpathian Voivodeship was defined as the area of "quality of life". In the next step, it is grouped into the following areas: production and processing of the highest quality biological and health food, ecological and sustainable agriculture and processing, sustainable and responsible tourism, health and well-being, eco-technologies: renewable energy sources (distributed energy, smart grids, wind turbines, water turbines, solar panels, biomass boilers, geothermal energy)

and energy-saving and intelligent construction (passive, zero energy and plus energy houses) (Regional Innovation Strategy of the Subcarpathian Voivodeship, 2015).

In the Podlaskie Voivodeship development plan, one of the departments into which smart specializations are grouped is “agri-food, forestry and wood bio-economy” and includes: innovative technologies, processes and products of the agri-food and forestry-wood sectors, high-quality food, biotechnology processes and products of specialized chemistry and environmental engineering. The planned activities related to the implementation of the development plan based on smart specializations, as well as the rest of the document, do not mention the issue of climate change and adaptation activities related to it (Podlaskie Voivodeship Board, 2016).

In the Świętokrzyskie Voivodeship the “modern agriculture and food processing” specialization includes: research, development works and technological, raw materials, and packaging innovations, safe and healthy food as well as management of production, distribution and marketing processes in the field of: agricultural crops, raising and breeding of animals, production of food and drinks, forestry, fishing, services activities related to the rent and lease of machines and equipment. The sub-areas of this specialization include “arable crops, raising and breeding of animals”, including bio-technologies taking into account the sustainable development of agriculture, biodiversity, breeding plants and animals using molecular sciences and resistance to climate and environmental changes; automation of plant cultivation, raising and breeding of animals, the use of methods of cultivating plants, raising and breeding of animals, which increase productivity and at the same time reduce the burden on the environment and methods with increased utility values. On the other hand the “agri-food production and processing” sub-area includes food safety, including quality control and safety systems for food raw materials and food in individual links in the food chain, product identification, food prognostic testing techniques, development of safe and environmentally friendly methods of production technology, processing and storage of food,

production and processing of food and genetically modified forage at the same time examining the benefits and threats to the environment and human health. Another sub-area, "Agricultural machinery and equipment", includes modern machinery and equipment for collecting, storing plant and animal products, processing – reducing losses in energy and water consumption, increasing food durability and low cost, low-emission food security [Smart specializations of the (Świętokrzyskie Voivodeship, 2015).

In Warmia and Masuria, high-quality food is among the smart specializations. Due to the fact that arable land constitutes more than half of the voivodeship's area (54.71%), it is necessary to constantly develop the sector by increasing innovation and introducing new technologies – they stimulate cluster structures operating in the voivodeship, including dairy and beef producers. The degradation of the natural environment, which can change the favorable image of Warmia and Masuria as a clean region with high natural values, underlies the development of negative scenarios for the specialization. According to the SWOT analysis, the weaknesses of the region include a short vegetation period and a harsh climate - reducing the possibilities of growing many plants, and limiting the size of crops, however, the danger point and the recommendations regarding this specialization do not mention climate change (Dzieminowicz et al., 2015, pp. 67–70, 83–90).

In the adopted innovation strategy of the Greater Poland Voivodeship, the area of bio-raw materials and food for conscious consumers includes the production of bio-raw materials and food throughout the entire value chain, from good quality raw materials, using modern methods and technologies as well as sales and distribution, and also management of post-production waste. The justification for the choice of specialization emphasized the increase in added value generated by the food and agricultural industries by increasing product innovation in response to consumer needs and new challenges such as climate change, decreasing energy, water and food resources or aging. The strategy of the Greater Poland Voivodeship, despite the emphasis on the significance of plant production resistant to climate

change in the most important courses of action for the development of specialization until 2020, provided no guidelines for activities (Department of the Economy of the Voivodeship Marshal's Office, 2015).

The list of smart specializations of the West Pomeranian Voivodeship includes "modern agri-food processing". This specialization was distinguished from bio-economy sector and includes agricultural activities, including various types of crops, animal husbandry and breeding, fisheries, and services supporting plant and animal production as well as food production. The specialization is to focus on concentration and consolidation of the industry towards functional food and improve its microbiological quality. The document indicates the strong need to oppose global brands/products and overcome the following barriers: poor cooperation between suppliers and producers and poor cooperation between small producers and distributors (wholesale/retail trade) (Marshal's Office of the West Pomeranian Voivodeship, 2016).

The following voivodeships did not distinguish food safety or agricultural production issues as smart specialization: Silesia, Pomorskie and Lubuskie.

Conclusions

Thirteen voivodeships took into account food security and its important component, the agricultural sector in their smart specializations, but only three of them indicated the need for adaptation to climate change. Against the background of all voivodeships, in the context of climate change, the Opole Voivodeship stands out, which indicated specific agricultural adaptation tools, which also increase food security.

Low-carbon emission economy, is recommended in regional innovative strategies to reduce the negative impact of the economy on the environment. There is, however, no information on the costs of this impact, not to mention the promotion of activities aimed at better adaptation to new weather conditions, also in agriculture. Considering the scale of the threats posed by

climate change, the analysis of voivodeships' innovation strategies reveals serious problems, such as low awareness of the consequences that climate change may have for agriculture and for the directly related food security. These specializations are designed to indicate industries and problems relevant to the region but unfortunately they ignore issues related to the impact of climate on the agricultural industry. It should be remembered that this is a document reaching a wide range of recipients, due to the issues of obtaining financing, therefore it should also be used to raise awareness of significant environmental, social and economic problems. Agriculture will not only be severely affected by climate change, but also to a large extent contributes to increasing greenhouse gas emissions to the atmosphere. The strategy of mitigation and adaptation to climate change is implemented by choosing cultivation techniques which increase soil carbon dioxide content and the use of resistant cultivation systems (Internet source F).

Cultivation of mixed varieties in Poland requires scientific support, both in terms of the genetic basis of this phenomenon, as well as estimating the effects of heterosis in various different varieties, predicting the occurrence of the phenomenon of heterosis and selecting components for hybridization, and in the case of self-pollinating plants, developing techniques to obtain desired, large number of mixed seeds. It is necessary to develop new methods and tools based on the latest achievements in the field of genetics, genomics and physiology of plants, which could be used in hybrid breeding of the most important agricultural plant species, in particular self-pollinated cereal species, but also rye, triticale and maize (Świącicki et al., 2011, p.102).

The use of in vitro cultures and DNA-based technologies at plant breeding stations is associated with the need to have greenhouses and appropriate laboratory equipment for conducting molecular analyzes and in vitro cultures as well as highly qualified staff. For these reasons, these methods are used to a very limited extent in Polish commercial companies, while in Western and American companies they have a significant share in breeding programs. This is one of the reasons why Polish plant breeding cannot keep up with

the biological progress represented by foreign varieties (Święcicki et al., 2011, pp. 104–107).

Unfortunately, given Poland's past experience in the field of innovation (including eco-innovation and climate change), it is difficult to expect a breakthrough caused by RIS. At the end of the current financial perspective, it may turn out that, as was the case with the previous EU development strategy, the grandiose terms conceal the mediocre quality of actions (Burchard-Dziubińska, 2016, pp. 83–85). Most Voivodeship Development Strategies are documents with several hundred pages, often written in scientific language, which the entrepreneur must wade through to prepare an application for financing, equally rich in detail. This is probably not conducive to the development of innovation, but only drives bureaucracy and generates unnecessary costs.

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