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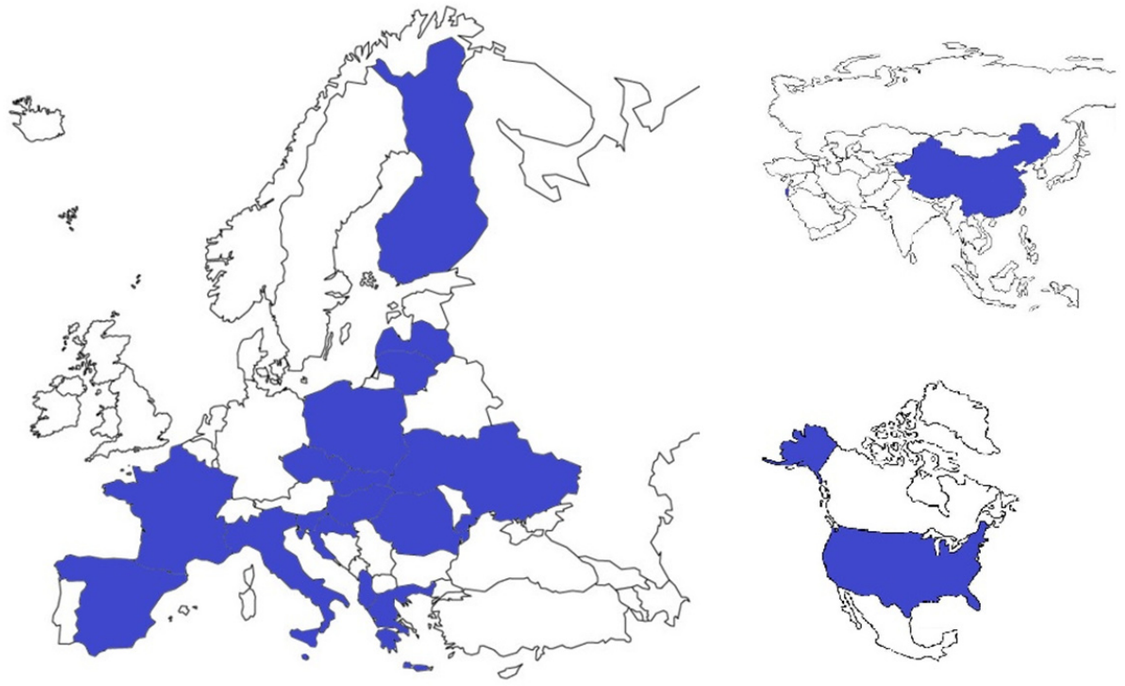

Countries from which we hosted Conference Participants and Reviewers 2020

Publication of Ethics and Malpractice Statement for the International Scientific Conference 'Economic Sciences for Agribusiness and Rural Economy'

While upholding the highest form of ethical correctness, the Editorial Board ensured that the authors included in the publication of the papers, adhered to the ethical standards established by the Programme Committee. Each author was obliged to sign and present an editorial statement on the originality of the paper, and not publish any part or the whole paper before. The statement prepared for the authors required indicating all authors of the submitted paper and confirming their contribution to the study submitted to the editorial staff. In addition, while ensuring the correct use of sources during the preparation of the paper, the authors confirmed the demonstration of all citations used in the paper. The entire publication was planned and prepared in accordance with the highest standards of: the European Charter for Researchers, ensuring compliance with ethical standards over national standards, Polish legislation, ensuring ethical standards for publishing at the national level of the editorial office and the publisher, as well as maintaining the highest ethical standards of the institution represented by the editors of the publication – the Institute of Economics and Finance (formerly: Faculty of Economic Sciences) of the Warsaw University of Life Sciences – SGGW. Under the leadership of the Editor-in-Chief, the entire editorial team, the scientific and organisational committee, as well as reviewers and authors applied the best practices in terms of their duties and ethics. All editorial staff members were introduced to the Code of Conduct and Best Practice Guidelines for Journal Editors of the Committee on Publication Ethics (COPE). In accordance with the COPE Code of Conduct and the Strategic Plan of 2016–2018 promoting integrity in research and its publication, a list of responsibilities and responsibilities were drawn up, necessary to meet the highest standards of ethical behaviour for all parties involved in the act of publication. The Scientific Council and the Editors were responsible for the high level of substantive content, a high rate of internationalisation of publications, implementation of good and better practices in the editorial process and maintaining the highest possible publishing standards.

DUTIES OF EDITORS

Publications decisions

The editorial responsibilities under the direction of the Editor-in-Chief varied depending on the stage of publication. The editors were responsible for maintaining high standards from the point of receiving the articles all the way through to the publication of the study. In mid-2017, the Editor-in-Chief, guided by the '*summum bonum*' of the planned publication, appointed experts with vast scientific and professional experience, as well as achievements in the international field. Thus, the appointed Scientific Council of the publication, consisted of the highest ranking experts for the planned thematic sections of the conference and publication at the same time. The Editors and the Organising Committee were appointed based on the experience of their members, knowledge and acquired skills. A diversity of views was ensured by the appointment of the Editorial Board, consisting of renowned experts from abroad, representing highly-rated scientific institutions. In the decision-making field, it was crucial to appoint reviewers to direct the papers submitted by the authors to the relevant substantive and recognised reviewers. The professionalism of scientists and their unblemished reputation were used as a guideline during the selection process. After obtaining two independent reviews at the discretion of the Editor-in-Chief, the decision on accepting or rejecting the submitted paper remained, however the scale of responsibility for this decision varied depending on the opinions issued by the reviewers. In special cases, the decision of the Editor-in-Chief was addressed to a third, independent review. The editors were responsible for deciding about the need for the author to introduce corrections. The decisions made were comprehensive, considering the fact that 131 papers were sent to the Editorial Office. Since the beginning of work on the publication, editors have been guided by the principles of ethics and responsibilities resulting from current legal requirements regarding such aspects as defamation, copyright infringement and plagiarism.

Fair play

The Editor-in-Chief asked for an assessment of papers based on their substantive content regardless of the origin of the author, the institution represented by them, race, sex, sexual orientation, religious beliefs, ethnicity, citizenship or political philosophy. Total impartiality also concerned the selection of reviewers as well as members of the Scientific Council, the Organising Committee and the Editorial Board. The development of the Fair Play principle can be found below in the Confidentiality section.

Confidentiality

The Editor-in-Chief and every member of the editorial office could not disclose any information about the submitted report to third parties. In order to maintain the highest standard of the Editor's decision, the submitted articles were sent directly to one person from the Editorial Office, which then removed the personal data of the authors before referral for review and further proceedings. Thus, only the Editor-in-Chief and a designated representative for personal data had knowledge of the personal data of the authors. The given report, with the personal data removed, was then submitted to the reviewers appointed by the Council, who possessed no knowledge about the authors of the paper and about each other. The results of the blind, double review were directed to the authors without the disclosure of the personal data of the reviewers.

Disclosure and conflicts of interest

The submitted papers are the intellectual property of the authors and co-authors before, during and after the publication. The members of the Editorial Staff and all persons related to publishing the publications have no right to use them under their own name. In the event of a possible conflict of interest, the Editor-in-Chief issued preventive orders to protect and place the good of the author of the paper above others.

DUTIES OF REVIEWERS

After the deletion of personal data of authors and co-authors, each submitted report was referred for a double, blank review. In situations of contradictory reviews, by decision of the Editor-in-Chief, the paper was sent for a 'super' third review. The editors' policy was to refer the paper to the reviewer from another institution and, if possible, from another city. Referral of the submitted paper to reviewers working in the same unit as the author was forbidden. It was seen as good practice to provide one reviewer for each paper, from a country other than that of the author's. In situations of the third 'super' review, it was the decision of the Editor-in-Chief that the final choice be made by outright experts in a given field, often awarded with an honorary doctorate.

Contribution to editorial decisions

The Editor-in-Chief made decisions about the acceptance or rejection of a paper on the basis of two professional, blind reviews. In some cases the authors also recommended that the paper should be corrected, with the aim of protecting the best interests of the authors of individual papers as well as the good of the entire publication.

Promptness

A professional computer system, the 'Online Journal System' was set up by the Editor-in-Chief prior to the planned work on the publication. This enabled each reviewer selected by the Editor to be granted a request for a review and receive information about the date of acceptance or rejection of the review, as well as a date for its completion. If it was impossible to complete the review within the time frame of the deadline set by the Editorial Board, the request was rejected and the decision required justification. The designated reviewer had 5 days to agree to the review and then 14 days for its implementation. In the case of a reviewer's request for an extension to the deadline, the Editor-in-Chief, taking into consideration the good of the author, decided to extend the deadline for the review to up to 21 days.

Confidentiality

The reviewers were informed of the necessity to maintain confidentiality in the reviewing process and all dissemination of information about the report was forbidden. The reviewer could not show or consult the paper with anyone other than the Editor-in-Chief or the person indicated by him.

Standards of objectivity

Each paper was subject to an unbiased and objective review. No personal criticism of the reviewer was allowed. Every opinion, either positive or negative, had to be supported by arguments concerning the content of the paper. In the case of an unsatisfactory justification, the reviewer was requested to elaborate upon his comments so as to prevent any reservations of the Editor with regard the content and opinion of the review.

Acknowledgement of sources

In the interests of the highest good of science and its creators, reviewers were required to identify situations in which parts of the paper were taken from other sources without this being mentioned by the authors. Any use of the work of other authors should be accompanied by appropriate quotations, which the authors were informed about when completing the statement prepared by the Editorial Board. The reviewer was obliged to draw the Editor's attention to significant similarity between the discussed paper and any other document or publication. It was seen as good practice to use the 'random' function in the database to draw a paper in a unbiased way, that would then be checked by the anti-plagiarism system.

Disclosure and conflict of interest

Each reviewer was obliged to immediately report any cases where the review could be related to the work of the reviewer, or give competitive advantage in any way associated with the reviewer or their work.

DUTIES OF AUTHORS

Reporting standards

All authors and co-authors were required to present original contents, not previously published in fragments or in their entirety. In the case of work based on own research, they were required to present in their research in detail, its time and place, justification for its implementation, and any successes and failures. In the case of a paper based on secondary research, all authors and co-authors were required to provide as detailed information as possible about the origin of the data, their availability and use. All work was required to be presented in detail, in a way that would allow other scientists to use it for the purposes of their future research. All dishonest practices were forbidden and it was part of the editors' and reviewers' responsibility to identify and remove them with the consequences. In projects whose author was a participant and the paper was completed due to the researcher's participation in it, they were obliged to present information about the project in the section of the paper dedicated for such a purpose.

Data access and retention

All authors who based their papers on their own research are required to store a database of such data for a period of at least 5 years from the date of publication of the paper. It is a good practice for the authors to make the database available for research and educational purposes at the request of governmental and non-governmental institutions.

Originality and plagiarism

The authors and co-authors attested the originality of their works in consideration of the protection of intellectual property, good name of science and editorial policy. The statement of originality of the paper, the quotation and presentation of any sources used in the creation of the work were provided in the bibliography together with the content of the paper and sent to the Editor. In addition, papers were selected in a random manner using the 'random' function and checked by a special anti-plagiarism program. Every effort was made to verify the presence of sources for citations and their correctness.

Multiple, redundant or concurrent publication

By submitting a paper to the Editorial Board of the conference 'Economic Sciences for Agribusiness and Rural Economy', the author and co-authors have stated that they have not published, and are not in the process of intending to send the same paper or any part of it to any other editorial office. Publication of a paper based on the same data is considered unethical by the editorial office and is unacceptable.

Acknowledgement of sources

The authors, by drawing on other publications and sources in their papers, were obliged to display their utmost diligence in ensuring the correct quotation of the works that they used to create their own papers. The use of various sources to create own work is the basis for the development of the world of science, which is why the entire editorial team has made every effort to prevent unethical behaviour. A specially prepared review sheet was used containing detailed questions about the correctness of citations and bibliography. Thus, all reviewers were obliged to do their utmost to verify all sources on this basis.

Authorship of the paper

The author who sent the paper was obliged to present all the people who contributed to the creation of the work and list them as co-authors. All co-authors had to sign a statement attached to the paper. The statement contained information about the requirement to list all those who significantly contributed to the creation of the paper and agreed to send it to our editorial staff. It was perceived as good editorial practice to send the collected reviews to both the authors and co-authors.

Hazards and human or animal subjects

In cases when research involved the use of chemical compounds, behaviours or equipment associated with a possible threat to the health or life of animals or people, the author was obliged to clearly identify this threat in the paper.

Disclosure and conflicts of interest

Financial support for creating a paper resulting from cooperation with or membership of a project group should be demonstrated in a specially prepared section of the paper. Regardless of any conflict of interest, the authors preparing the papers were obliged to present the full truth to prevent the spread of unethical behaviour in the world of science.

Fundamental errors in published works

In the case of finding any error, every author and co-author of the submitted and published paper is obliged to immediately contact the Editor-in-Chief in order to withdraw the publication and correct it. Editors also give third parties the right to report errors or any ambiguities in the published publication. Any information about a possible error has always been, is and will be considered with respect to the good of science.

Editor-in-Chief *Mariusz Maciejczak*

Foreword

Dear Readers,

This year, our conference was extraordinary. We have combined our annual 'Economic Sciences for Agribusiness and Rural Economy' conference with our distinguished partners from the Department of Bioeconomy and System Analysis – BIOECON from the Institute of Soil Cultivation, Fertilization and Soil Science – National Research Institute in Puławy, organising the 'Strategies for Bioeconomy in Central and Eastern Europe' meeting. This activity allowed us to expand the subject of the meeting with new topics, many interesting lectures and even more participants.

International Scientific Conference 'Economic Sciences for Agribusiness and Rural Economy' created for the third time a platform for the exchange of views of the scientific community with practitioners, both national and abroad, whose research interests focus on the contemporary needs of the economy. The main topic of the third edition of the conference were **challenges for the bioeconomy**, its strategic options for Poland and also for the countries of Central and Eastern Europe.

In the first plenary session entitled **'Sustainable agriculture for bio-based economy'** we had a great opportunity to listen lectures given by our distinguished guests from **Italy**, **Spain**, **Greece** and **Poland**. In the second plenary session entitled **'Strategies for bioeconomy in Poland and the CEE countries'**, we had a great opportunity to listen to scientific papers prepared by distinguished guests from **France**, **Slovenia**, **Croatia** and **Greece**.

Papers were presented in five thematic sessions: State and deployment of bioeconomy in the CEE countries, Adaptation processes to climate change, Socio-economic aspects of local development, Sustainable agriculture for the bioeconomy, Sustainable production and consumption.

An integral part of the conference was a seminar on 21 September 2020 devoted to the discussion of young scientists. The seminar for young scientists is a continuation of the Polish National Scientific Conference **'Challenges of the modern economy from the perspective of young scientists'**, which has been organized at our institute periodically since 2014.

This years, I have the impression of a well done job by raising an extremely important and timely topic. I am also proud of the involvement of PhD students and young scientists, who were involved both scientifically and organisationally in the event.

Ending up, I would like to emphasise that in **2023** our Institute of Economics and Finance (formerly: Faculty of Economic Sciences) will be celebrating its 70th anniversary, but right now I would like to cordially invite you to participate in this special edition of our conference **'Economic Sciences for Agribusiness and Rural Economy'**.

Yours faithfully
Mariusz Maciejczak

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SOURCES OF INFORMATION ON PRO-ECOLOGICAL BEHAVIOUR OF STUDENTS OF THE FACULTY OF ECONOMICS OF THE WULS-SGGW

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ABSTRACT

The research aimed to verify the sources of information used by students of the Faculty of Economics of the Warsaw University of Life Sciences – SGGW (WULS-SGGW) in shaping their ecological attitudes. The research issues have been reduced to answering the following questions: 'which sources of information on the desired pro-ecological behaviour were most often indicated by the respondents?' and 'is there too much information on appropriate behaviour towards nature in the public space?'. The survey technique was used in empirical research. The sample consisted of 119 students of all fields, levels, and forms of study at the Faculty of Economics of the WULS-SGGW. The research shows that this information was rather easily accessible to the respondents, and the main source was social media and Internet portals. In the opinion of the respondents, the analysed issues are not excessively exposed in the media, as evidenced by the limited traceability of pro-environmental campaigns.

Key words: pro-ecological behaviour, students, media, information sources
JEL codes: D83, Q56, Q57

INTRODUCTION

The terms 'ecology', 'ecological' and even 'eco' are very often used in public space, everyday language, market messages, and scientific publications. The subject of scientific research is most often ecological awareness, pro-environmental behaviour, and the relationship between these areas. One cannot forget what is also emphasized by Śmiechowska, Newerli-Guz and Kąkol (2009) that the necessary condition for the existence of social consciousness is knowledge, without which it is impossible to talk about the other components of this consciousness. It can take the form of information, scientific judgments, and views and opinions from various sources. The knowledge of the society is based on stereotypes related to the views, value systems, and beliefs of individual social groups and categories. Knowledge comes from both formal (school and academic education) and informal sources. Information sources supplement formal education and sometimes even replace it. The research of Escher and Petrykowska (2015) shows that it is not possible to improve the quality of the natural environment without proper environmental education. Often,

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research on environmental awareness emphasizes the role of reliable information (Patrzałek, 2017). Moreover, research conducted among students also shows insufficient ecological awareness resulting from the lack of knowledge (Bednarek-Gejo et al., 2012).

The premise for the implementation of this research was primarily the importance of the analysed problem and, unfortunately, a large discrepancy between knowledge and behaviour in the field of protection, care, and respect for the natural environment. In the literature, one can come across the view that cosmopolitan units, being more open to the world's problems, are more sensitive to nature and seek information on the possibility of its protection (Kenichi, Leungb and Huang, 2020). Young people, especially those who study, often exhibit cosmopolitan attitudes, which is particularly important in the case of concern for the environment, which is, or at least should be, global in nature. It might seem that in the era of universal access to the media and the high popularity of pro-environmental issues due to, inter alia, 'School strike for climate' or Greta Thunberg, there is more than enough information on the proper use of nature. However, various scientific studies emphasize that the demand for knowledge about human-nature interactions at the level of individuals and entire populations is still growing (Gaston et al., 2018). Ellen (1994) emphasizes that 'objective knowledge is only significantly related to committed recycling behaviours, whereas perceived knowledge is positively associated with committed recycling, source reduction, and political action behaviours'. Therefore, this article is devoted to verifying the sources of information on pro-ecological behaviour used by students of the Faculty of Economics of the Warsaw University of Life Sciences (WULS-SGGW) – a university with over 200 years of experience and traditions in the field of natural environment education.

MATERIALS AND METHODS

The research aimed to verify the sources of information used by students of the Faculty of Economic Sciences of the WULS-SGGW in shaping their environmental attitudes.

The following research problems were adopted in the research:

1. Which sources of information on the desired pro-ecological behaviour were most often indicated by the respondents?
2. Is there, in the opinion of the respondents, too much information on appropriate behaviour towards nature in the public space?

In the research, the diagnostic survey method was used, including participant observation and the survey technique. The questionnaire was prepared on the webankieta.pl platform and the link to it was shared during classes with students of the Faculty of Economics (formerly Economic Sciences) of the Warsaw University of Life Sciences – SGGW. The questionnaire was completed by students, who expressed such a desire, in their free time. The survey used closed-ended, scale, and open-ended questions. The group of respondents consisted of people from all fields of study at the faculty (economics, finance, and accounting, logistics, tourism and recreation, management), both forms and levels. The sheet was quite extensive and also included the issues of tourist and ecological behaviour, but these were the subject of analyses presented in other studies (Balińska, Gabryjończyk and Zawadka, 2019a, b). This study focuses on (yet unpublished) sources of information about environmental behaviour used by respondents. The research was conducted in 2019. 119 correctly completed questionnaires were obtained out of a total of approx. 3 thousand students, therefore the sampling error was 9% for the confidence level of 95%. Thus, due to the overall number of forms and students of all fields' different participation rates, research cannot be considered fully representative.

RESEARCH RESULTS AND DISCUSSION

The majority of the respondents were women (72.3% of the sample). Most of the respondents were residents of Warsaw (68.1%) or the surrounding area, i.e. the area up to 30 km from the capital (21.9%).

According to the respondents, information on pro-ecological behaviour is rather easily available (indicated by 52.1% of respondents) and easily accessible (21.0%). Individuals believe that such information

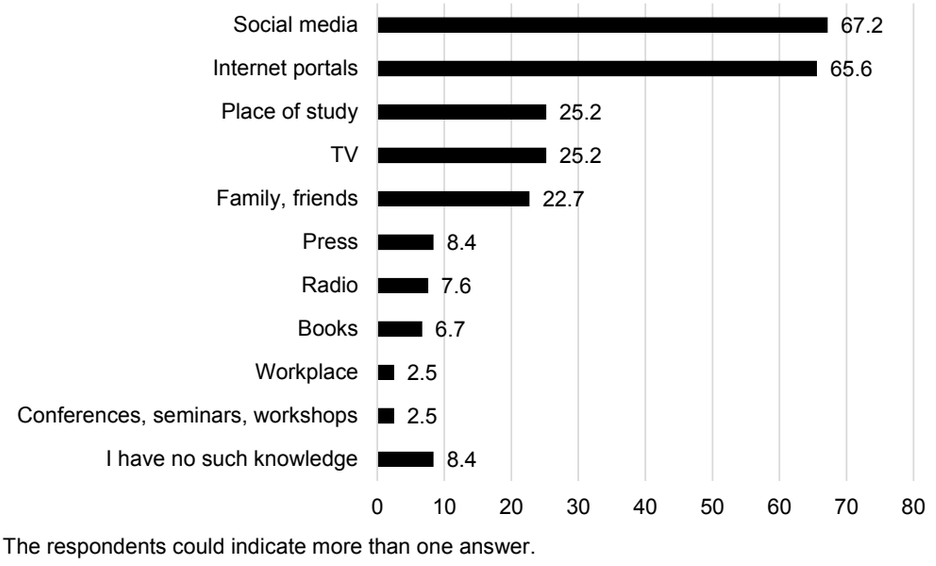

Figure 1. Sources of information on pro-ecological behaviour (%)

Source: own empirical research.

is difficult or very difficult to find (9.2%). The main research issues concern the sources of information used by respondents in this area (Fig. 1).

For the vast majority of respondents, the main source of information on pro-ecological behaviour were social media and Internet portals, and for every fourth respondent television and educational institutions. These results are partially confirmed in the report prepared by PBS Ltd. and BR Ltd. for the Ministry of Climate and Environment (Ministerstwo Klimatu i Środowiska, 2020). They show that the main source of information for people aged 19–24 in 2020 was the Internet (for 90% of respondents), followed by: radio (38%), television (29%), press (23%), school/university (11%) family and friends (10%), books (3%) and general media (2%). Also, in the opinion of students from Olsztyn, it appears that the mass media (53.8%) had the greatest impact on shaping their attitude towards the natural environment, followed by the school (41.3%) and family (31.4%) (Szulborski, 2001).

In research conducted among young people from Bełchatów and its vicinity, one of the most polluted places in Poland, the broadly understood Internet was the most frequently indicated source of information (indicated by 74% of respondents), followed by: social media (58%), own observations (56%), educational institutions (44%), mass media (38%), parents (28%), books (21%), influencers and eco-bloggers (18%), environmental organizations (18%), acquaintances and friends (17%) (Ośrodek Działań Ekologicznych 'Źródła', 2019). The research by Śmiechowska, Newerli-Guz and Kąkol (2009) also shows that the Internet is very popular as a source of information. However, according to consumers, the information posted on the Internet has different credibility, and such perception depends on the age of the respondents. Younger people (i.e. aged 19–30) perceive them as more reliable than people over 30. The research by Kucińska (2009) also shows that the sources of pro-ecological information among young people are to a lesser extent educational institutions, and to a greater extent television, radio, the Internet, and the press.

The subject of environmental burdens and the need to care for the natural environment is very popular in the media. Therefore, it was verified whether this topic is too exploited. In the opinion of only 11.8% of

the surveyed students of the WULS-SGGW, this subject is excessively present in the media, and 13.5% of the respondents indicated that it may be so. The majority (52.9%) believed that it was not an overexploited subject. Unfortunately, the knowledge of the campaigns promoting pro-ecological behaviour among the respondents from the Faculty of Economics the WULS-SGGW was low. Only 25.2% indicated that they had contact with such campaigns and WWF was most often mentioned in the open question (cited by 5.9%). The others were mentioned only by individuals and were, among others: 'earth hour', 'cleaning the world', 'Warsaw tap water', 'car-free day', 'park and drive', 'drink here without a straw', 'be a veg for 30 days'.

CONCLUSIONS

Shaping proper pro-ecological attitudes is possible thanks to access to information. In the case of young people, the main source of information, not only in the field of ecology, is the broadly understood Internet, including thematic portals and social media. The respondents do not feel overwhelmed by the excess of information on appropriate pro-ecological behaviour. The vast majority of them use the Internet, which is typical behaviour, confirmed in the results of other authors' research. However, it is worth noting that for every fourth respondent the university is one of the sources of information. In the opinion of the authors of this study, this indicator is distinctly too low, especially in a university with a leading agricultural profile, and the WULS-SGGW is, after all, such a university. Due to the importance of the analysed issues and the unfavourable environmental changes, it seems justified to strengthen the topics related to the possibilities of environmental protection in the study programs. However, it should be a systemic action. The analysis of the available literature also showed that this research topic was more popular at the beginning of this century. Currently, there is too little research on this subject, which is a pity, because due to the changing socio-economic situation, entering the market of new generations and the development of technology, research of this types should be carried out periodically.

The problem in the implementation of this research was a small research sample, which makes it impossible to formulate generalizations on all students in Poland. The research also allowed to obtain feedback on the research tool itself, which should be improved in case of repeating or expanding further studies.

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QUO VADIS ORGANIZATION OF THE FRUIT AND VEGETABLES MARKET IN POLAND? STATE OF ORGANIZATION OF THE POLISH FRUIT AND VEGETABLES MARKET

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ABSTRACT

The article aimed to present the state of the organization of the fruit and vegetable market in Poland in 2020. Based on a library query and available registers, changes in the number of producer groups and organizations, their members, and the selected organizational form and category of products offered in Poland in 2004–2020 were presented. After the introduction of legislative changes in 2012, limiting the co-financing of the market organization process, a chronic decrease in both the number of existing fruit and vegetable producer organizations and their members is noticeable. Such a long-term trend may lead to a decline in the market organization and bargaining power of domestic producers. To prevent further disintegration of producer groups and organizations, it is suggested that they should be provided with institutional support that would be long-lasting and stable.

Key words: fruit and vegetable market, integration, competitiveness
JEL codes: Q13, Q18, D2

INTRODUCTION

In Poland, groups and organizations of fruits and vegetables producers operate pursuant to the Act of 19 December 2003 on the organization of the fruit and vegetable markets and the hop market (Ustawa z dnia 19 grudnia 2003 r.). After Poland acceded to the European Union, Polish gardeners were included in the Common Agricultural Policy program aimed at reducing the differences between fruit and vegetable producers from various European Union countries. The desirability of horizontal integration of producers is justified by the need to increase competitiveness in the market, which is characterized by integration asymmetry. With a large agrarian fragmentation, producers have a weaker bargaining position to more closely integrated recipients, such as, for example, retail chains or processing plants. The process of the organization on the fruits and vegetables market was the goal of researchers' interests, therefore in 2011, the evaluation of the organization was presented by K. Krzyżanowska, in 2013 by W. Sobczak, L. Jabłońska and D. Olewnicki, in 2014, Ł. Kopiński and E. Czernyszewicz. The research conducted so far with A. Matuszczak concluded the observations of the integration process on the fruit and vegetable market

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in 2017. They showed that Polish gardeners dynamically started the process of organizing the fruit and vegetable market after the introduction, in 2007, of the Common Agricultural Policy program promoting the establishment of groups and organizations of fruits and vegetables producers in the countries of the so-called new union. However, after the introduction of legislative changes limiting the level of support, inhibition of this process was noted. This study aims to present, based on the literature on the subject and data from government agencies, the status of the organization of fruit and vegetable producers in Poland in 2020.

THEORETICAL BACKGROUND

Nowadays, there are two ways of developing one's competitiveness – functioning independently or together with others. In the conditions of globalization, the concept of independent operation of producers is experiencing a crisis. If the producer does not want to be a small local supplier, only the way of cooperation is promising. Building various relationships between market entities is conducive to creating competitive advantages and is a manifestation of striving to strengthen their competitiveness (Glabiszewski and Sudolska, 2009). Cooperation is an important factor influencing the development of the fruit and vegetable sector, which enables building sustainable competitive advantages. In the development strategy of Polish agriculture, an important place was assigned to activities related to horizontal integration, such as groups and organizations of fruit and vegetable producers, and vertical integration, resulting from the involvement of sector participants and the willingness to achieve common goals. Achieving the goal, especially in conditions of very strong competition, is possible only when using the potential of other enterprises as part of the implemented cooperation.

For several years, Polish producers of fruit and vegetables, using the instruments of the Common Agricultural Policy, have been integrating creating groups and producer organizations. The growing concentration and intensification of the market power of buyers motivated to develop integration processes on the part of suppliers. The distribution system in Poland has evolved and forced the supply side to change the standards of the sales policy, forcing concentration among producers. Development and concentration among recipients still force changes on the part of producers, therefore, an important role in the development of cooperation between entities in the supply chain should be played by producer groups and organizations, their associations, and interbranch organizations. Glabiszewski and Sudolska (2009) note that building various links between an enterprise and other entities on the market is a sign of strengthening their competitiveness, and the market trends observed by them allow us to conclude that long-term and strategic cooperation to a large extent contributes to creating a competitive advantage. To increase competitiveness in the market, it is important to promote the idea of merging producers. To be successful, producers should offer higher, certified quality, produce local varieties using traditional methods, or use their branding (Guth, Bieniek-Majka and Maican, 2019). However, the economies of scale occurring in agricultural production are not without significance, as they enable larger entities to rationalize costs and a stronger bargaining position, and thus condition the possibility of obtaining larger, less risky income.

In many countries, farmers, seeing opportunities for themselves resulting from shortening the food supply chain by taking over the role of an intermediary, began to take various initiatives to improve their position. One of such initiatives is the cooperation of farmers within producer groups, consisting mainly in organizing joint sales of products produced on their farms (Kozłowska-Burdziak and Przygodzka, 2019). Unfortunately, as noted by Krzyżanowska (2017), the weak point of Polish agriculture is the very low level of organization of producers into groups and organizations. Farmers produce good quality agricultural products and sell them most often to intermediaries who have mastered a large part of the market. Producers are in a losing position by selling in an unorganized way, including to processing plants and trading companies.

In many European countries, associations and organizations of garden professionals are a marker of the development of this market. For example, thanks to its well-organized and highly developed garden industry, Germany boasts some steadily growing

associations, which, importantly, often include representatives of supermarkets and independent garden centre owners. Compared to other European countries, Germany has an unusually large number of associations for professionals in specific market sectors. In the UK the horticultural industry is represented by several major organisations for high-caliber professionals (Fajerski, 2011). In Denmark, the very high (nearly 100%), economic organization of farmers has contributed to the dynamic development of agriculture. In France, on the other hand, cooperatives bring together about 90% of farmers. In the Netherlands, cooperatives are consolidated and also associate almost 100% of agricultural producers. It should be noted that in the Netherlands commodity exchanges operating in the form of cooperatives are very popular, which market 70–100% of products such as fruits and vegetables, milk, fish, ornamental plants, flower bulbs, flowers. Cooperatives in the Netherlands control more than 90% of the fruit and vegetable market, 80% of the milk market, and more than 50% of the grain market (Ciszewski, 2017).

The effect of aid activities as noted by Zielińska-Szczepkowska and Kisiel (2016) is that unions of agricultural producers and processors have become a permanent and socially acceptable element of the EU agrarian structure. They have significantly influenced its modernization, as well as developed various forms of production cooperation in agriculture.

MATERIALS AND METHODS

Based on a library query and data obtained from the Ministry of Agriculture and Rural Development and the Agency for Restructuring and Modernization of Agriculture, changes in the state of organization of the fruit and vegetable market in Poland after 2004 are presented in a graphical, tabular, and descriptive manner.

The choice of the research period was influenced by previous studies conducted by researchers in Poland (K. Krzyżanowska in 2011, W. Sobczak, L. Jabłońska and D. Olewnicki in 2013, Ł. Kopiński and E. Czernyszewicz in 2014, M. Bieniek-Majka, A. Matuszczak in 2017) and the fact that in the current organizational and legal form fruit and vegetable producer groups and organizations in Poland have been functioning since 2004.

RESEARCH RESULTS AND DISCUSSION

During the period in question, the macroeconomic situation in Poland affecting the functioning of fruit and vegetable producer groups and organizations was relatively favourable The value of GDP from year to year (excluding 2020, where the economic effects of the COVID-19 pandemic are preliminarily included in the national accounts) was increasing (Fig. 1). It should be noted that during the financial crisis period

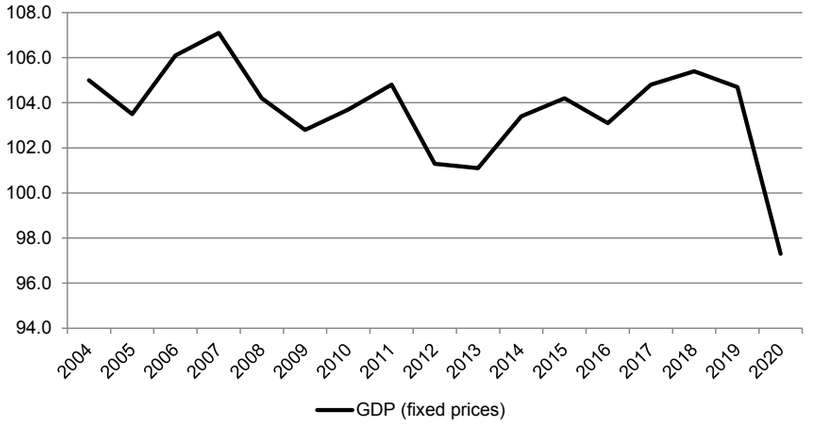

Figure 1. GDP in 2019–2020 (%)

Source: own study based on data of the Statistics Poland (GUS).

in 2007–2009 when there was a decrease in the dynamics of GDP growth, it was a period of dynamic development for the process of organizing the fruit and vegetable market in Poland (Fig. 2).

In Poland, under the Act of 19 December 2003, on the organization of the fruit and vegetable markets and the hop market. In 2004, groups and organizations of fruit and vegetables producers began to appear. Earlier, before Poland acceded to the EU structures, Polish gardeners could establish producer organizations under the Act of 15 September 2000, on agricultural producer groups and their associations, or the Act of 29 November 2000, on the organization of fruit and vegetable markets, hops, tobacco market and dried fodder market. However, it was only the inclusion of Polish farmers in CAP programs, and especially in those aimed at them directly that contributed to the popularization of this form of cooperation.

Stagnation of the integration process can be noticed since 2012, the year in which the European Commission introduced several changes in the rules for granting financial aid to fruit and vegetable producer groups, resulting in a limitation of the amount of aid received by newly established entities.

On 5 April 2012, the Commission Implementing Regulation (EU) 302/2012 entered into force concerning the fruit and vegetables and processed fruit and vegetables sectors, where the European Commission introduced restrictions on support for producer groups (Szalczyk, 2013). Legislative changes have been reflected in the behaviour of fruit and vegetable producers, which can be seen in the data presented in Figure 2 or Table 1.

It is disturbing that the limitation of financial support is directly reflected in the existing and forecast number of functioning groups and organizations of producers of fruit and vegetables. You can push for the idea of organizing a market where there will be a small number of organizations associating many members, which we can see, for example, in the countries of Northern Europe, but as we can see, this does not apply in the Polish reality. As late as 2017, we could see an increase in the number of members with the decreasing number of existing groups and organizations (Table 2).

In 2020, however, only in the case of fruit and vegetable producers from the Mazowieckie and Pomorskie voivodeships we can see an increase in the number of members, with a decreasing number of producer groups and organizations. In other cases, both the number of producer groups and organizations and the number of members associated with them decreased.

The reduction in the number of members was also influenced by the dissolution of associations, i.e. the most numerous organizations of fruits and vegetables producers. As can be seen from the data presented in Table 3. Fruit and vegetable producers most often operate as a limited liability companies.

Analysing the data on the profile of activity of producer groups and organizations until 2017, it could be concluded that the diversification of the

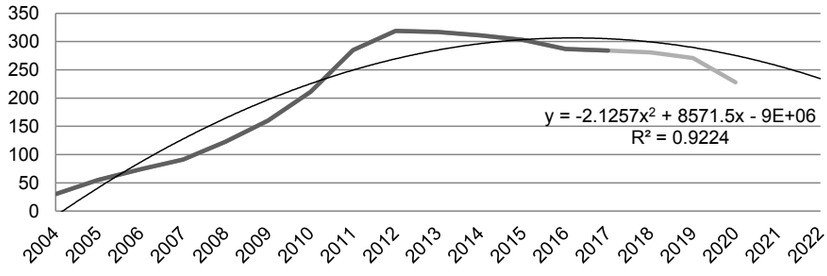

Figure 2. Number of producer groups and organizations in 2004–2020 with a forecast for the next five years based on the trend

Source: own study based on data of the Agency for Restructuring and Modernisation of Agriculture (ARiMR) and the Ministry of Agriculture and Rural Development (MRiRW).

Table 1. Number of producer groups and organizations by voivodship

Voivodship	Number of producer groups and organizations by year				
	2004	2011	2014	2017	2020
Mazowieckie	2	62	95	86	78
Wielkopolskie	8	35	46	46	29
Kujawsko-pomorskie	8	34	43	39	23
Lubelskie	9	25	34	29	24
Małopolskie	0	12	12	11	11
Łódzkie	1	15	20	18	17
Świętokrzyskie	0	9	16	14	11
Lubuskie	1	6	6	5	3
Pomorskie	0	6	11	7	7
Opolskie	0	4	6	5	5
Podlaskie	0	3	3	1	1
Podkarpackie	0	3	6	6	6
Dolnośląskie	0	2	11	10	7
Warmińsko-mazurskie	1	2	2	2	2
Śląskie	0	2	5	4	3
Zachodniopomorskie	0	1	2	1	1
Total	30	221	318	284	228

2011 – as of 16.02.2011, 2014 – as of 05.05.2014, 2017 – as of 02.01.2018, 2020 – as of 24.07.2020.

Source: own study based on Krzyżanowska (2011), Kopiński and Czernyszewicz (2014) and and ARiMR (s.a.).

Table 2. Number of members associated with fruit and vegetable producer groups and organizations

Voivodship	Number of members			
	2004	2011	2017	2020
Mazowieckie	–	1 077	1 984	2 087
Wielkopolskie	–	901	760	502
Kujawsko-pomorskie	–	592	592	231
Lubelskie	–	877	1380	790
Małopolskie	–	801	445	372
Łódzkie	–	652	419	404
Świętokrzyskie	–	264	638	483
Lubuskie	–	62	48	17
Pomorskie	–	51	83	89
Opolskie	–	20	28	28
Podlaskie	–	10	6	6
Podkarpackie	–	94	135	132
Dolnośląskie	–	6	58	43
Warmińsko-mazurski	–	10	10	10
Śląskie	–	10	23	17
Zachodniopomorskie	–	5	5	5
Total	1 155	5 432	6 614	5 216

2011 – as of 16.02.2011, 2014 – as of 05.05.2014, 2017 – as of 02.01.2018, 2020 – as of 24.07.2020.

Source: own study based on on Krzyżanowska (2011), Kopiński and Czernyszewicz (2014) and ARiMR (s.a.).

Table 3. Groups and organizations of fruit and vegetables producers according to legal forms

Legal forms	Number of producer groups and organizations			
	2011	2014	2017	2020
Limited liability company	168	267	234	189
Cooperative	23	24	23	20
Association	30	27	27	19
Total	221	318	284	228

2011 – as of 16.02.2011, 2014 – as of 05.05.2014, 2017 – as of 02.01.2018, 2020 – as of 24.07.2020.

Source: own study based on Krzyżanowska (2011), Kopiński and Czernyszewicz (2014) and and ARiMR (s.a.).

offer facilitates functioning on the market, as there was an increase in the number of producer groups and organizations offering both fruit and vegetables, with a decreasing number of organizations offering either fruit or vegetables. However, in 2020 we are not entitled to make such a conclusion. In 2020, compared to 2017, the number of groups and organizations in total decreased by 20% (Table 4). In the same period, the number of fruit and vegetable producers decreased by 28%, and the number of producers offering only fruit by approx. 15%. The smallest drop was recorded among producers offering only vegetables – approx. 8%.

These data confirm the variability of the conditions in which producers of fruit and vegetables operate. Manufacturers' decisions are often determined by exogenous factors beyond their control. For the organization of the fruit and vegetable market in Poland not to decrease further, institutional solutions that would be stable and long-lasting should be introduced.

CONCLUSIONS

Paying attention to the premises indicating the benefits of integration, it is disturbing that the process of organizing the market is stopped, which may have an impact on the reduction of its bargaining power. It seems, therefore, that a good path of development for Polish producers would be institutional support allowing for the adoption of the model of integration of producers characteristic for Northern Europe (geographically closer), where a smaller number of producer groups/organizations has a larger number of members and thanks to the economies of scale they achieve greater benefits. It would be possible thanks to institutional solutions supporting groups. This policy should be long-term and become an element of the rules of the agricultural market organization. The established rules of operation should be clear and, above all, stable. Because, as noted by Kozłowska-Burdziak and Przygodzka (2019), the biggest problem of currently functioning groups is the changing

Table 4. Groups and organizations of fruit and vegetables producers by product category

Product	Number of producer groups and organizations			
	2011	2014	2017	2020
Mushrooms	15	22	22	18
Herbs	2	3	3	1
Fruit	45	83	68	58
Vegetables	50	93	65	60
Fruit and vegetables	109	117	126	91
Total	221	318	284	228

2011 – as of 16.02.2011, 2014 – as of 05.05.2014, 2017 – as of 02.01.2018, 2020 – as of 24.07.2020.

Source: own study based on Krzyżanowska (2011), Kopiński and Czernyszewicz (2014) and ARiMR (s.a.).

and incomprehensible law. This policy should be outlined in the form of a development program for producer groups and their associations, which will include goals, means of achieving them, and the method of financing.

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STRATEGIC FUNDAMENTALS OF BIOECONOMY DEVELOPMENT IN UKRAINE

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ABSTRACT

The purpose of this study is to identify the global trends in bioeconomic development and to develop the Concept of a State Strategy of Bioeconomic Development in Ukraine for the period until 2030. The authors define the bioeconomy as a set of industries that ensure the sustainable use of renewable resources, the use of biotechnologies for production while reducing the potential environmental damage, contributing to the innovative development of relevant sectors, and providing positive aspects of socio-economic development. The article formulates approaches to measuring the state and effectiveness of the bioeconomic development in Ukraine and the EU countries. Based on the analysis of world experience, it is concluded that to accelerate the development of the bioeconomy in Ukraine, it is necessary to develop the Strategy for the development of the bioeconomy in Ukraine. The conceptual foundations of such a Strategy have been developed by the authors of the article. The results of the study are the basis for the development and implementation of the State Strategy for the Development of Bioeconomy in Ukraine. The relevance of this study is determined by the absence of the Bioeconomic Development Strategy in Ukraine, which makes it difficult for the country to reach a new technological and innovative level of development. At the same time, the development and implementation of this Strategy will help Ukraine enter the international system of production of new knowledge and technologies.

Key words: bioeconomy, concept of the state strategy for the development of bioeconomy, innovative development, biotechnology, bioenergy, bioproduction
JEL codes: O13, Q28, Q18

INTRODUCTION

Trying to combine economic growth with modern challenges, European and other countries of the world are creating new models of innovative development, one of which is the model of the bioeconomy. The transition from a modern economy based largely on the use of non-renewable resources to the bioeconomy is not possible only through market mechanisms, since the price of the commodities does not include the interests of future generations. Therefore, we consider it necessary to apply state

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regulation of bioeconomic development in Ukraine. The adoption of the State Strategy for the Development of Bioeconomy until 2030 will accelerate this process. The purpose of the study is to identify global trends in bioeconomy and develop the Concept of the state strategy for bioeconomy in Ukraine until 2030. The objectives of the study are to define the essence of the bioeconomy, to formulate approaches to measuring the state and efficiency of bioeconomy development in Ukraine and EU countries, to develop conceptual bases of the state Bioeconomy Development Strategy in Ukraine based on the analysis of bioeconomy development experience in EU countries, including Poland.

THEORETICAL BACKGROUND

The priority development of the bioeconomy has been declared by a large number of documents of the European Union. In particular, the updated Bioeconomy Strategy until 2030 identifies specific actions that should be based on the use of biotechnology in primary production, industry, and health care (OECD, 2018). The strategy outlines public policy scenarios aimed at developing the bioeconomy while delivering positive social, environmental, and economic outcomes. The update also responds to new European policy priorities, in particular the renewed Industrial Policy Strategy, the Circular Economy Action Plan, and the Communication on Accelerating Clean Energy Innovation, all of which highlight the importance of a sustainable, circular bioeconomy to achieve their objectives (European Commission, 2018). In particular, the bioeconomy strategy for Italy aims to provide a shared vision of the economic, social, and environmental opportunities and challenges associated with the creation of an Italian Bioeconomy based on longer, more sustainable, and locally routed value chains. It also represents a significant opportunity for Italy to enhance its competitiveness and role in promoting sustainable growth in Europe and the Mediterranean area (Implementation Action Plan (2020–2025) for the Italian Bioeconomy Strategy).

The conceptual foundations for the development of bioeconomy in a global context were investigated by Beluhova-Uzunova, Shishkova and Ivanova (2019). Policy initiatives of various OECD countries, which include supporting the development of the bioeconomy and implementing its results in the healthcare sector, have been studied by Borowiecki and Philp (2019). These scientists made a comparison of the indicated initiatives with an emphasis on public policy goals in specified areas, target groups, industry priorities, budget, time horizon, selection criteria, and international cooperation. Maciejczak (2018) notes that, through the use of renewable biological resources to meet social needs, the bioeconomy presents an alternative growth model that incorporates economic, environmental, social, and political goals, and states that bioeconomic policies do not yet respond to the quality of sustainable development, but being consistent with the Common Agricultural Policy can be changed in this direction.

Altoukhov, Kashkin and Utkina (2021) note even though a great contribution has already been made to the science of bioeconomy, much of it still refers to promising scientific developments in such areas as biology, biomedicine, engineering, artificial intelligence, technology, chemistry, etc. The results of their study point to the need for an in-depth analysis of the challenges and opportunities the world faces on the road to bioeconomy.

The bioeconomy is seen as a catalyst for systemic change, tackles the economic, social, and environmental aspects of the Green Deal, seeking new ways of producing and consuming resources while respecting our planetary boundaries and moving away from a linear economy based on extensive use of fossil and mineral resources (European Commission, 2020).

Despite the global interest in the bioeconomy, there are various challenges associated with the development and implementation of specific national, regional bioeconomy strategies that could ensure sustainable development. Ukraine, together with the world community, requires scientific substantiation, development, and implementation of the State Bioeconomy Development Strategy. This article is devoted to the study of the key principles of such a strategy.

MATERIALS AND METHODS

To execute the research tasks, the authors of this study used scientific literature review and methods of analysis and synthesis, namely the logical and constructive methods as well as induction and deduction analysis method. The concept of the state strategy for the development of the bioeconomy in Ukraine was developed based on an epistemological analysis of literature. The basic research method was the review of policy and scientific papers from the perspective of the proposed Concept of the state strategy for the development of bioeconomy. The conceptualization of the short and long-term state support strategies has been elaborated through the epistemological analysis of the literature. The research involved the analysis of the dynamics of phenomena, comparative analysis of indicators. In the theoretical part of the paper, source material from foreign literature devoted to the study of the bioeconomy phenomenon was used (more than 50 sources). The main source of information for our study was: data provided through official sources (World Bank, Eurostat, State Statistics Service of Ukraine, official European Union website), consultation with the experts of the field, similar studies conducted in this field. Having studied and analysed all these sources, the authors were able to form their approaches to creating the conceptual framework of the Strategy for the Development of the Bioeconomy in Ukraine, which is set out in this paper.

RESEARCH RESULTS AND DISCUSSION

The conducted studies have given grounds to consider the bioeconomy as a set of industries that ensure the sustainable use of renewable agricultural, water and forest resources, waste and organic by-products, relying on the use of biotechnology for biomass processing and the production of various products, while reducing the potential environmental damage, contributing to innovative development of new competitive opportunities in the relevant sectors and providing positive aspects of socio-economic development (Fig. 1).

According to the international expert community, the emerging bioeconomy will be influenced by state support for research and other regulatory measures, protection of intellectual property rights, and the attitude of society towards the bioeconomy. Intellectual property rights can increasingly be used to encourage

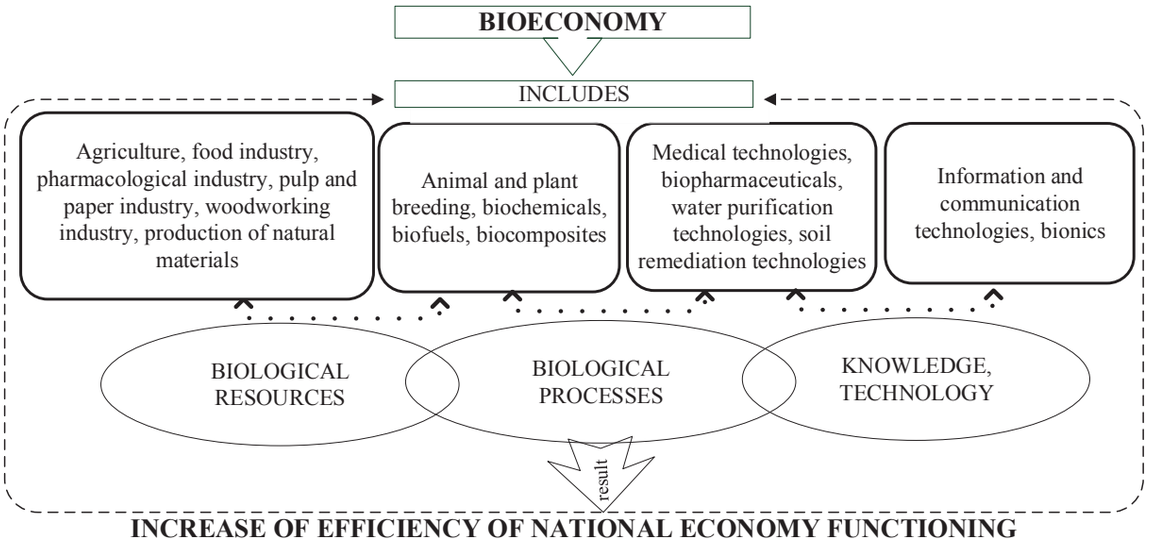

Figure 1. The logical-block diagram of bioeconomy

Source: own elaboration.

knowledge-sharing through collaborative mechanisms such as patent pools or research consortia. Societal attitudes towards biotechnologies will continue to affect market opportunities, but public opinion may change, for example, when biotechnology products provide significant benefits to consumers or the environment (OECD, 2009).

In this regard, an important aspect of scientific research is the formation of approaches to the assessment of the state and effectiveness of bioeconomic development. The state of the bioeconomy in a country can be estimated by the added value that it creates and employment in it. The share of the bioeconomy in total employment is also used as an indicator of the size of the bioeconomy. Based on the approaches proposed by Urmetzer and Pyka (2014) and Zalizko et al. (2018) the authors of the article conducted a comparative analysis of their empirical values in Ukraine, Poland, and Europe. The results are shown in Table 1.

The data in Table 1 allow us to understand how significant the share of bioeconomy is in the economy of Ukraine, as well as to conclude the prospects of the bioeconomy. As the agricultural sector in Ukraine occupies an important place, the bioeconomy has good preconditions for development. The cost indicators characterizing the size of the bioeconomy strongly depend on the interpretation of the bioeconomy used.

European institutions pay considerable attention to the development of both pan-European and national programs and strategies for the development of the bioeconomy (OECD, 2009). In Ukraine, similar

Table 1. Indicators of the bioeconomy value in 2018

Indicator	Ukraine	Poland	EU
Agriculture, forestry, and fishing, value added (% of GDP)	10.14	2.11	1.51
Agriculture, forestry, and fishing, value added (constant 2010 USD)	14.37	10.53	272.25
Forest area (% of total land area)	16.71	30.88	38.09
Arable land (% of land area)	56.58	35.29	24.88
Rural population (% of total population)	30.65	39.94	24.33
CO_2 emissions (metric tons per capita)	4.47	8.76	8.8
CO_2 emissions intensity (kg per 1 000 USD of GDP)	0.57	0.31	–
Energy use (kg of oil equivalent) per 1 000 USD of GDP (constant 2011 PPP)	298.14	98.4	86.58
Share of renewable energy in gross final energy consumption (%)	3.00	11.74	16.73
Renewable energy consumption (% of total final energy consumption)	4.50	11.28	17.98
Artificial fertilizer consumption (kg per ha of arable land)	52.75	172.82	158.38
Water productivity, total (constant 2010 USD of GDP per m^3 of total freshwater withdrawal)	9.16	44.59	76.25
Researchers in R&D (per million people)	994.08	2 528.04	3 822.11
Scientific and technical journal articles (per thousand capita)	23.26	93.80	121.22
Government expenditure on education, total (% of GDP)	5.4	4.6	–
Global Innovation Index	37.4	41.31	–
Renewable internal freshwater resources per capita (m^3)	1 217.09	1 410.09	2 960.96
Share of agricultural land cover (% of total land area)	71.66	49.95	42.82
Terrestrial protected areas (% of total land area)	3.99	39.65	25.94
Employment in agriculture (% of total employment)	15.25	10.05	4.10

Source: World Bank, Eurostat database.

programs, unfortunately, have not yet been adopted at the state level, which, given its orientation towards the EU, is a major drawback. First and foremost, in this regard, it is necessary to have a scientific background for such programs. The authors of this article are developing the Concept of the State Strategy for the Development of Bioeconomy in Ukraine.

As the main objectives of the Concept, the authors classify the following: creation of industrial and innovative bioeconomy infrastructure; formation and implementation of priority innovation and investment projects in the field of bioeconomy; large-scale development of the bioeconomy in the regions of Ukraine by involving local governments in this process; ensuring the competitiveness of the applied research and development sector; creation of a unified educational space of biotechnological direction by improving modern educational programs and a system for training and retraining of personnel in the fields of bioeconomy; conservation and development of bioresource potential as a basis of the bioindustry; integration of domestic biotechnology into the global bioeconomy; improvement of the legal, economic, informational and organizational base; formation of territorial agribiotechnological clusters and technological platforms, which combine the development and production of high-tech bioproducts, contribute to the effective interaction of the bio-industry market participants; creation of an environment for stimulating the demand of organizations and households for biotechnological products by forming its positive image among consumers; introduction of biotechnology in both industrial and non-production spheres; formation of a system of 'green nature management' (Fig. 2).

To address the issues of bioeconomic development, it is necessary to take a balanced approach, as too radical innovations can lead to the decline of firms and manufacturing structures, which can create an additional burden for policymakers, while at the same time contributing to a significant increase in

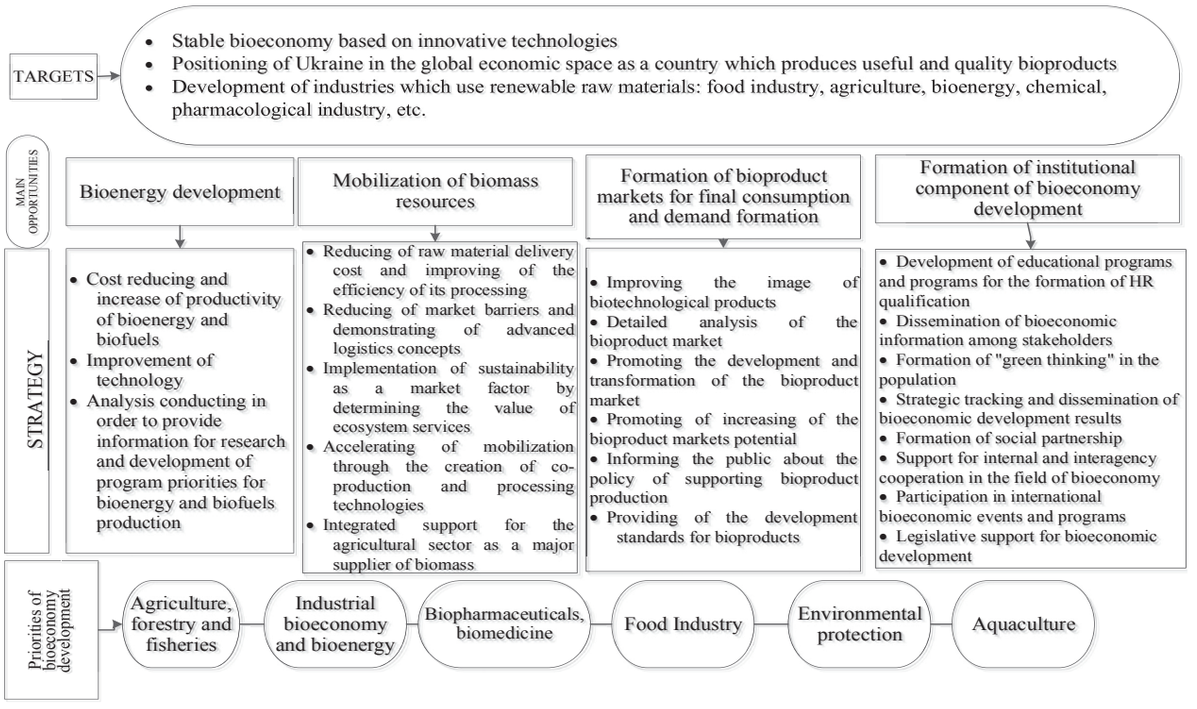

Figure 2. Designing the Policy Agenda 'Bioeconomy in Ukraine 2030' at a glance

Source: own elaboration.

labour productivity, so the scientific justification for public policy options is needed that includes consideration of primary production, healthcare, and industrial biotechnology issues, analyses cross-cutting intellectual property and technology transfer problems, assesses global challenges. Therefore, it is necessary to develop the main directions of a long-term and short-term policy of state support for the development of the bioeconomy.

Thus, in the authors' opinion, following the Policy Agenda, long-term state support for the development of bioeconomy should be directed to: (1) the development of the scientific and resource base that includes such areas as improving the personnel training system for biotechnology enterprises, as well as for conducting research works; formation of the relevant legislative field; integrated support of the agricultural sector as a major bioeconomic resource base; (2) the development of a competitive research and development sector in the field of biotechnology; narrowing the gap between research and the market; publicity and popularization of biotechnology among both producers and consumers; formation of 'green thinking'; (3) support (assistance) in the creation of agribioclusters on the territory of Ukraine, the rational use of bioresources as a basis for the creation and further development of territorial; development of alternative energy. The implementation of the measures outlined by the authors will facilitate the solution of important economic, social and environmental problems, such as increasing the production of innovative products; creating new high-tech jobs, increasing investment in the bioeconomy; formation of bioregions with the possibility of long-term economic development while preserving the natural environment, securing employment and income growth.

CONCLUSIONS

Further development of bioeconomy should be based on: the definition of the essence of bioeconomy, directions of economic and research activities related to bioeconomy, which will allow monitoring and comparative analysis of the development of bioeconomy at national and regional levels and provide information support; development and adoption of the State Strategy for the Development of Bioeconomy in Ukraine that will enable planning, coordination and communication regarding bioeconomic development processes; state regulation of strategic planning, coordination, harmonization and unification of efforts aimed at scientific research and implementation of its results in practical activities on the basis of social partnership; more specialized support for the functioning of value chains in various sectors of the bioeconomy; ensuring international cooperation on the exchange of knowledge and tools for the bioeconomic development; support and involvement of traditional sectors of the economy (for example, agriculture, trade, food, chemical industry, etc.) in bioeconomic development processes; supporting the development of interdisciplinary and specific competencies and skills in various areas of bioeconomic development; creating better conditions for financing small-scale demonstration activities and pilot facilities in the bioeconomy sector until new value chains and new technologies reach a sufficient level of profitability to be competitive in the market; taking measures to raise public awareness and perceive the benefits and threats of bioeconomic development. To reap all the benefits from the development of the bioeconomy, a purposeful government policy is needed. This will require a partnership between the government and leading companies to set goals for the use of biotechnology in primary production, processing industries, as well as in healthcare; creating the structural conditions necessary to deliver results, such as the conclusion of regional and international agreements, and developing mechanisms that will allow the policy to flexibly adapt to new realities. As a result, the impact of the bioeconomy on GDP in the future will depend on the interaction between public administration, including the level of international cooperation and the competitiveness of biotechnological innovations.

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ARE AGRICULTURAL COMMODITY PRICES AFFECTED BY COVID-19? A STRUCTURAL BREAK IDENTIFICATION

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ABSTRACT

The paper aims to identify the COVID-19-driven structural break in agricultural commodity prices time series. We assume the official outbreak of the COVID-19 pandemic, i.e., 11 March 2020, as the breaking point. We use data on the S&P GSCI Agriculture and Livestock Index and the S&P 500 from Refinitiv Datastream. The structural break is identified based on the Chow test. We prove the existence of structural break in both the S&P 500 and the S&P GSCI Agriculture and Livestock Index triggered by the official outbreak of the COVID-19 pandemic. Moreover, to assess the causality between the analysed series, we apply the Granger causality test. We reveal a unidirectional causal relationship from the stock market to the agricultural commodity market.

Key words: agricultural commodities, stock market, COVID-19, structural breaks
JEL codes: Q02, G12, G01, E44

INTRODUCTION

COVID-19 belongs to the group of infectious diseases and is caused by the severe acute respiratory syndrome coronavirus 2 – SARS-CoV-2 (Andersen et al., 2020). The World Health Organization (WHO) officially classified COVID-19 as a global pandemic on 11 March 2020 (Maier and Brockmann, 2020). The novel coronavirus has shaken the global economy on an unprecedented scale (Barro, Ursúa and Weng, 2020). The recent outbreak of the COVID-19 pandemic has significantly affected the global financial markets (Czech et al., 2020; Goodell, 2020). It is worth mentioning that the financial markets often label COVID-19 as an enormous black swan event (Nicola et al., 2020).

Our paper is focused on the agricultural commodity markets. Since the beginning of the 21st century, the financialization process of commodity markets arises (Domanski and Heath, 2007). The existence of links between stock and agricultural commodity markets is broadly known and proven. To our knowledge, there are numerous studies on the COVID-19 pandemic impact on stock markets (Ashraf, 2020; Zhang, Hu and Ji, 2020) and foreign exchange markets (Benzid and Chebbi, 2020; Gunay, 2020) while the agricultural commodity markets' reaction on the novel coronavirus has not been thoroughly explored. Our contribution is that by applying the Chow test, we proved that the COVID-19 pandemic outbreak triggered structural changes in both stock and agricultural commodity markets.

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The outline of the paper is as follows. The next section presents the literature review. Section 3 describes the material and research methods used. The posterior section includes empirical findings and discussion. The final section offers our conclusions.

THEORETICAL BACKGROUND

In the 21st century, commodity markets have experienced rapid liquidity growth, and an influx of investors attracted to commodities purely as investment products rather than as a means to support real economic activity via the hedging of risks (Vivian and Wohar, 2012; Silvennoinen and Thorp, 2013). Domanski and Heath (2007) state that commodity markets have adopted more and more features of traditional financial markets. Consequently, commodities have turned out to be an attractive investment alternative (Irwin and Sanders, 2012). Creti, Joëts and Mignon (2013) show that the links between stock and commodity markets evolve through time and are highly volatile, particularly since the global financial crisis. As a result, the phenomenon of commodity markets' financialization arises.

The commodity market could be characterised by large price changes, particularly during unexpected events and high uncertainty times (Kamdem, Essomba and Berinyuy, 2020). Baffes and Haniotis (2010) show that speculation is a key factor affecting commodity prices during a crisis. Creti, Joëts and Mignon (2013) observe that financial markets consider agricultural commodities, including coffee and cocoa, as speculative assets. According to Zhang and Broadstock (2018), food became the most influential commodity class in the market after the global financial crisis.

Shalini and Prasanna (2016) indicate that the transmission of the shocks across the financial markets during the financial crisis results in structural changes in commodity volatility. Structural breaks in the time series of food prices interest research studies (Jin and Kim, 2012). Vivian and Wohar (2012), studying all classes of commodities, found structural breaks in the volatility during the crisis period only in agricultural grain commodities. Nazlioglu, Erdem and Soytas (2013) show that the dynamics of volatility transmission changes significantly following the food price crisis, particularly interrelationships between energy and agricultural markets. In the paper, we investigate whether the COVID-19 pandemic triggered the structural breaks, similarly to the recent global financial crisis.

Salisu, Akanni, and Raheem (2020) show the existence of a positive relationship between commodity price returns and the COVID-19 global fear index, confirming that commodity returns increase as COVID-19 related fear rises. Rajput et al. (2020) observe a sudden drop in the demand and supply of all commodities, including agricultural ones, due to the novel coronavirus outbreak. Barichello (2020), based on the UNCTAD Report Update, showed that in the first quarter of 2020, the average price decline was 6.8% for all agricultural commodities.

MATERIALS AND METHODS

The paper aims to identify COVID-19 driven structural break in agricultural commodity prices time series. Knowing the impact of COVID-19 on the stock markets and the links between the stock and agricultural commodity markets, we build three research hypotheses to achieve the main aim of the study.

- H1: There is a causal relationship between stock and agricultural commodity markets.
- H2: The outbreak of the COVID-19 pandemic has triggered a structural break in the S&P 500 index series.
- H3: The outbreak of the COVID-19 pandemic has triggered a structural break in the S&P GSCI Agriculture and Livestock Index series.

The S&P GSCI Agriculture and Livestock Index belongs to the S&P Dow Jones Indices group and measures agricultural commodity market performance. It is considered a benchmark for investment in agricultural commodities and is designed to be a tradable index accessible to financial market participants. Moreover, the S&P GSCI Agriculture and Livestock Index reflects price movements and inflation in the global economy, enhancing its suitability as a benchmark. The index includes prices of the main agricul-

tural commodities, i.e. wheat, corn, soybeans, coffee, sugar, cocoa, cotton, lean hogs, live cattle, and feeder cattle (S&P GSCI, 2020).

The S&P 500 is an iconic financial market indicator and is recognized worldwide as one of the premier benchmarks for stock markets. The S&P 500 is the world's most-followed stock market index (Revenue, 2016). The index comprises 500 constituent companies and measures the performance of the large-cap segment of the market (S&P U.S., 2020a, b).

Daily data on the S&P GSCI Agriculture and Livestock Index and the S&P 500 come from the Refinitiv Datastream. The research covers the period from the beginning of 2000 till 2 September 2020.

To assess the causality between the S&P 500 and the S&P GSCI Agriculture and Livestock Index, we apply the Granger causality test (Granger, 1969). *X* is said to Granger-cause *Y* if *Y* can be better predicted using the lagged values of both *X* and *Y* than by using the history of *Y* alone. The null hypothesis states that *X* ddoes not Granger-cause *Y*. The Granger causality test is sensitive to the stationary of variables series. The series stationarity is checked based on the augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979). The ADF null hypothesis assumes that the time series is integrated of order 1 (I(1)), implying that the process contains a unit root and is therefore non-stationary.

We investigate the impact of the official announcement of the COVID-19 pandemic on agricultural commodity markets, searching for a structural break in the analysed time series. Structural breaks identification is the way to measure price-variation, including commodity markets (Jin and Kim, 2012). Structural change is identified based on the first--order autoregressive model (1):

$$y_t = \alpha + \beta y_{t-1} + \varepsilon_t, \quad (1)$$

where ε_t is a time series of serially uncorrelated shocks, α, β are the model parameters and explanatory variables y_{t-1} are lagged values of y_t. The structural break occurs when at least one of the above-mentioned parameters is changed in the sample period at some date. In other words, it is called a structural break when a time series abruptly changes at a certain point in time.

The classical test for structural change is introduced by Chow (1960). Hansen (2001) provides the main disadvantages of applying the Chow breakpoint test and stresses that the test's main limitation is that researcher needs to know about the structural break date in advance. More advanced tests detecting structural breaks in time series are, e.g. Andrews (1993) or Bai and Perron (1998, 2003). However, in the paper, we would like to check if there is a structural break in the time series for a specific date, i.e. the announcement of the COVID-19 pandemic by the World Health Organization. Therefore, we apply the Chow test, which allows us to identify the structural change within the specific expected date. We assume that the official outbreak of the COVID-19 pandemic, i.e. 11 March 2020, brought about structural changes both in stock and agricultural commodity markets' prices.

RESEARCH RESULTS AND DISCUSSION

The Granger causality test is sensitive to the stationary of variables series. Table 1 presents the calculated *t*-statistic for the ADF unit root test.

The results of ADF tests presented in Table 1 show that the analysed time series are integrated of

Table 1. The ADF test results

Variable	Level		First differences	
	intercept	intercept and trend	intercept	intercept and trend
S&P 500	1.10	–1.41	–22.99***	–23.12***
S&P GSCI Agriculture and Livestock Index	–1.78	–1.54	–70.69***	–70.69

***H_0 is rejected at the 1%, **5%, and *10% significance level.

Source: own calculations based on Refinitiv Datastream.

first-order. We obtain the stationary processes by applying the first differences of the logarithmic values of the original time series.

Researchers emphasize that the stock and agricultural commodity markets are correlated, and their relationship has been significant since the last global financial crisis. The Granger causality test is used to assess the link between stock and agricultural commodity markets. Table 2 depicts the estimated Granger causality F test statistics and the corresponding *p*-values.

Granger causality test results show that we cannot reject the null hypothesis stating that the S&P GSCI Agriculture and Livestock Index does not Granger--cause the S&P 500. However, we prove that the S&P 500 does Granger-cause the S&P GSCI Agriculture and Livestock Index at the significance level below 1%. It implies that the S&P GSCI Agriculture and Livestock Index can be better predicted using the history of the S&P 500 than by applying only its lag values. The Granger causality test reveals a one-side causal relationship from the S&P 500 to the S&P GSCI Agriculture and Livestock Index.

Structural change is identified based on the first--order autoregressive model (1) for the S&P 500 and the S&P GSCI Agriculture and Livestock Index series. The model is built for the first differences of the logarithmic values of the analysed time series. Table 3 presents the estimated models' coefficients. The obtained results are in line with Creti, Joëts and Mignon (2013).

The results presented in Table 3 show that intercept coefficients are not significant. The null hypothesis that slope coefficients in the S&P 500 and the S&P GSCI Agriculture and Livestock Index models equal zero is rejected at 1% and 5% significance levels, respectively. The estimated models (1) are applied to identify a structural break in the S&P 500 and the S&P GSCI Agriculture and Livestock Index series. The results of the Chow breakpoint test are presented in Table 4.

The null hypothesis in the Chow test assumes that there are no structural breaks at specified dates. In the paper, we assume that the breakpoint is the day of the COVID-19 pandemic announce-

Table 2. Granger causality test results

Dependent variable (*Y*)	Predictor variable (*X*)	Test statistic	*p*-value
S&P 500	S&P GSCI Agriculture and Livestock Index	1.31	0.270
S&P GSCI Agriculture and Livestock Index	S&P 500	6.11	0.001

Source: own calculations based on Refinitiv Datastream.

Table 3. First-order autoregressive models for the S&P 500 and the S&P GSCI Agriculture and Livestock Index series

S&P 500			
Coefficient	estimated parameter	*t*-statistics	*p*-value
Constant	0.01	1.16	0.248
Slope coefficient	–0.11	–8.40	0.000
S&P GSCI Agriculture and Livestock Index			
Coefficient	estimated parameter	*t*-statistics	*p*-value
Constant	0.01	0.70	0.482
Slope coefficient	0.03	1.97	0.049

Source: own calculations based on Refinitiv Datastream.

Table 4. Chow breakpoint test results

Variable	Wald test statistic	*p*-value
S&P 500	61.89	0.000
S&P GSCI Agriculture and Livestock Index	5.86	0.054

Source: own calculations based on Refinitiv Datastream.

ment, i.e. 11 March 2020. The test results presented in Table 4 show a structural break in the S&P 500 and the S&P GSCI Agriculture and Livestock Index series, at 1% and 10% significance levels, respectively. The obtained results suggest that the COVID-19 pandemic has affected not only the stock market but also the agricultural commodity market. Our results are in line with study by Vivian and Wohar (2012), which identified structural breaks in agricultural commodity prices' volatility during times of financial crisis.

CONCLUSIONS

Agricultural commodity markets attract investors since the beginning of the 21st century. Links between the stock market and agricultural commodity market have tightened since the global financial crisis. We reveal a unidirectional Granger causal relationship from the stock market to the agricultural commodity market.

Both stock and commodity markets are substantially volatile since the global financial crisis, particularly in times of huge uncertainty. The COVID-19 pandemic labelled as a black swan event is a perfect example of an overwhelmingly high uncertainty period. In the paper, we assess the reaction of the stock and agricultural commodity markets, in detail the S&P 500 index and the S&P GSCI Agriculture and Livestock Index, to the COVID-19 pandemic outbreak, i.e. 11 March 2020. We prove the existence of structural break in both the S&P 500 and the S&P GSCI Agriculture and Livestock Index triggered by the official outbreak of the COVID-19 pandemic. Our results confirmed all three research hypotheses. Explaining the reaction of specific agricultural commodity groups to the COVID-19 pandemic is a challenge for future research.

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DEVELOPMENT OF AGRITOURISM THROUGH THE CONCEPT OF LOCAL GASTRONOMY POINTS

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ABSTRACT

This paper addresses issues regarding the new government initiative Local Gastronomic Points to develop rural areas with agritourism potential in Romania by highlighting the local gastronomy. The main objective of this research is to identify how the concept of Local Gastronomic Points is perceived in terms of the opinion of the owners who manage such businesses and to identify the implications of this concept in the development of agritourism. In this respect, qualitative marketing research based on the semi-structured interview method was conducted at the level of the rural tourist destination Vama Buzaului, Romania. The main conclusion of the study is that the Local Gastronomic Points is an initiative that demonstrates that it can generate horizontal development of the rural areas and the development of agritourism. The research results revealed that this concept enhances the local community and gastronomy. Starting from these results, we propose to design a unitary Gastro Local concept at the county level, which should include specific requirements regarding the culinary preparations and services, the standardization of the marking and signalling of these Points, and intense activity of information and tourist promotion. The results of the study are conclusive and relevant for stakeholders in agritourism, for the responsible public authorities in the field of tourism, to develop competitive rural tourist destinations. The paper also offers future research directions.

Key words: agritourism, rural areas, local gastronomy
JEL codes: O18, Q56, Z31, Z32

INTRODUCTION

The field of tourism and hospitality is undergoing a profound process of transformation in recent years. In the context of increasing the diversity of services in the tourism industry and the requirements of tourists, continuous transformations are needed in tourist destinations, especially those located in rural areas, to increase their competitive advantage. One of the approaches refers to the development of agritourism by emphasizing the importance given to local gastronomy, in the context of the increased interest of tourists to experience traditional products and local recipes.

Agritourism must be understood as a package of social and cultural measures, sports services, and activities specific to the economic field and the geographical environment, provided for tourists and carried out in conditions of minimal investment and environmental conservation (Nedelea, 2007). In agrotourism, constant changes are necessary, the agritourism farms must constantly change and try to surprise

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tourists with new products and offers (Roman and Grudzień, 2021). Assessing the potential of agritourism in terms of innovation requires a close look at the specific characteristics of the agritourism market, both on the demand side and on the supply side (Roman, Roman and Prus, 2020).

In this sense, in Romania, at the level of 2017, the governmental initiative Local Gastronomic Points was developed. The Local Gastronomic Points initiative responds to the growing demand in Romania for the organization of family-type public catering units, offering food products and preparations specific to geographical areas, in compliance with certain rules and conditions of hygiene, so that food is safe and the health of consumers should not suffer (ANSVSA, 2017).

The purpose of this paper is to understand how the concept of Local Gastronomic Points is perceived in terms of the opinion of the owners who manage such businesses and to identify implications of this concept in the development of agritourism.

THEORETICAL BACKGROUND

Agritourism is a form of tourism, practiced in rural areas, based on providing, within the peasant household, the services of accommodation, meals, and leisure. Agritourism capitalizes on the natural and anthropic resources of the area, contributing to raising the living standards of the rural population (Talaba et al., 2013). In an age when most people in industrialized countries live in urban or suburban areas, for rural residents, agritourism (farm or farm tourism) – niche ecotourism – has become one of the fastest-growing segments in the travel industry (Flanigan, Blackstock and Hunter, 2014). 'A viable rural tourism can help socio-economic development of localities, but only if other conditions are fulfilled: a modern infrastructure for communications and transport, sewerage people open-minded but conservative in places that give charm to a local without kitsch, providing at least modest accommodation conditions, keeping the local architecture of the buildings, the principles travel arrangement; the existence of authentic traditions, craftsmen, handicraft workshops, animation tourist; the existence of marketing strategies, social media, and public relations campaigns' (Gavrilă-Paven, 2015). Agritourism can provide additional jobs for rural residents because it generates the development of sectors related to tourism, especially services, trade, food services, processing of agricultural products, traditional crafts, etc. (Marin, 2015).

Agritourism, as a form of service, can be developed in any geographical region that has preserved its unaltered natural landscapes, the existence of a specific and original way of life, and preserves its historical monuments, traditions, and customs. Climate and landscapes, cultural and culinary traditions, folklore and ethnography, ceramics, hunting and fishing opportunities, vineyards and fruit cultivation, but also other resources in rural areas make Romania have multiple possibilities for agritourism.

Mainly through this form of tourism, small accommodation units, public catering, and the development of specific means of recreation supported by the locals are encouraged.

Due to the growing interest of the public to reconnect with their roots and learn about local food and farming systems, agritourism can stimulate rural development, offering various opportunities to create more types of business opportunities (Halim et al., 2020). 'Today people are becoming interested in gastronomic topics, such as reconstruction and conservation of cultural traditions, authentic cuisine, gastronomic customs and traditions at local, regional or national scale, and promotion of local products' (Rivza et al., 2017). Tourists agree that local cuisine is an important part of the culture of the region and that the taste experience is important to the overall experience of the journey (Velissariou and Vasilaki, 2014). Scientific literature abounds today in papers devoted to gastronomy in the different aspects, as well as gastronomic tourism (Lopez-Guzman, Mogollón and Di-Clemente, 2014; Su, 2015; Pavlidis and Markantonatou, 2020), local food, and the tourism experience (Sims, 2009; Seongseop et al., 2016; Seongseop et al., 2020) or gastronomic cultural heritage (Jeroscenkova et al., 2016; Kruzmetra, Rivza and Foris, 2018).

The enhancement of local gastronomy through the concept of Local Gastronomic Point for the development of agritourism did not have been still studied.

The Local Gastronomic Point is a new concept in Romania. At a Local Gastronomic Point, tourists can eat at a local's house. Local Gastronomic Points (LGP) 'a place for preserving the local tradition', is a concept developed by the National Sanitary Veterinary and Food Safety Authority (ANSVSA), based on the Principle of European flexibility. The Local Gastronomic Points have started operating in Romania since the beginning of 2018. Local Gastronomic Points (LGP) are not considered restaurants. The LGP has the following characteristics: (a) a unique menu and a limited assortment range. The menu of gastronomic points is different from that of restaurants. The local gastronomic point has a daily menu with a limited range (1 kind of soup, 1 main course, and 1 dessert); the food will preferably be eaten on the same day; (b) the methods of preparing the menu shall be as traditional as possible, specific to the area, respecting the conditions of hygiene at the time of preparation; (c) is addressed to a limited number of final consumers; (d) the food is produced from raw materials obtained mainly from primary production, at the level of the own holding. The specific conditions regarding the development of an LGP type business (ANSVSA, 2017) are: (1) Those who want to set up these local gastronomic points must constitute a form of legal organization, such as Family Association, Individual Authorized or Trading Company; (2) Considering these types of activities go beyond the framework of private consumption, it is necessary to obtain the veterinary sanitary registration document and for food safety, following ANSVSA Order 111/2008; (3) In the Local Gastronomic Point the food must be prepared only by the owner, or by the members of his family, and their state of health must be checked periodically; (4) The raw materials from which the food is prepared must come only from units authorized/registered for veterinary health and food safety, focusing on those local products, specific to the area where the gastronomic point operates. Until now, ANSVSA has authorized in Romania over 30 LGP. The Intereg Europe – ThreeT Project is underway at the level of Brasov County, one of the actions of this project is 'Creating a network of Local Gastronomic Points in Brasov County'. Vama Buzaului immediately agreed to this project and the Local Gastro Association was founded in 2019. Vama Buzaului is a destination located in rural areas, which recently holds the title of Tourist resort of local interest. Vama Buzaului is a village of Brasov County, Romania, which is crossed annually by about 50 thousand tourists, attracted especially by the Bison reservation. Tourists arriving at the Vama Buzaului tourist destination can eat at several LGP, where the housewives in the village prepare traditional food. The households where the traditional meal can be served have as a distinctive sign a panel with a rooster at the gate. So far, the Gastro Local project has been implemented in 11 households in Vama Buzaului, with 11 accredited LGP and 4 more in the process of accreditation. The menus are fixed, they are displayed on the gate, and the tourists who arrive in the rural tourist destination Vama Buzaului thus can eat homemade dishes, vegetables, fish, and meat from animals raised in the own households of the locals. The purpose of this paper is to understand how the concept of Local Gastro is perceived by those who are involved in this program in Vama Buzaului and to identify the implications of this concept in the development of agritourism.

MATERIALS AND METHODS

Considering the research purpose – mentioned before, the research objectives were set, as follows: (O1) Identifying the motivation of the owners to join the Local Gastro Project; (O2) Identification of the origin of the recipes and ingredients used in LGPs; (O3) Identification of the methods used to promote the Local Gastronomic Points.

To achieve the research goals, descriptive research was conducted using the qualitative method of the interview, within the theoretical framework of Galletta and Cross (2013), the technique of the semi-structured interview, the tool being the interview guide. The data were collected from May to June 2020 from a sample of 6 owners of LGP from Vama Buzaului, located in Brasov County – one of the most important touristic regions of Romania. The selection of participants was based on the official list of the 11 LGP from Vama Buzaului. The interviews were conducted

by a qualified moderator using the interview guide designed to assure the objectives' achievement. In conducting the research, the ethical guidelines were adhered to. Participants were provided with information about the context and purpose of the study, and they were also informed that their participation was voluntary.

RESEARCH RESULTS AND DISCUSSION

The obtained data were analysed following the analytical framework proposed by Galletta and Cross (2013). The research results are structured by considering every objective stated based on the answers to the research questions.

(O1) Identifying the motivation of the owners to join the Local Gastro Project

The reasons why the respondents chose to open a Local Gastronomic Point were various: the passion for cooking, the desire to do something else, the lack of occupation, obtaining an additional income: 'The desire to do something else, and the fact that it represents an extra income for our family' (#2). In the community from Vama Buzaului, most women are housewives taking care of children and the household. This concept brought the chance for housewives to make better use of the time they spend at home and to obtain income from this activity, therefore, new jobs are created. The passion for cooking is the factor that united this community of ladies and led to the establishment of the Local Gastro Association Vama Buzaului in 2019.

Respondents said that the greatest satisfaction they have as owners of Gastro Local is that their work is appreciated, and people who cross their threshold enjoy their food and leave happy. 'Being able to bring joy and contentment to someone's soul is a great thing' (#3) says one of the respondents. They also feel fulfilled by the fact that they have the opportunity to meet new people with whom they socialize and find information on gastronomic habits in the regions where tourists come from. Last but not least, they feel great satisfaction because they have the opportunity to do something for the community they belong to.

(O2) Identification of the origin of the recipes and ingredients used in LGPs

The whole Local Gastro concept is based on traditional recipes: 'Old recipes, everything that is traditional because that's the main idea at the Local Gastro, to have traditional food, made by us with what we have at home, how we cook for ourselves is how we cook for our guests' (#4). The recipes that housewives use are inherited and learned from generation to generation, from grandparents, mothers, or aunts. From soups to donuts and cakes there is a tradition in everything. In the community of the Local Gastro Association, it is cooked in this way, according to recipes inherited from the family, with old and most important recipes, with ingredients from their production or neighbours. Three-quarters of the families in the community raise animals in their household, have sheepfolds, and practice agriculture, fish farming.

The most requested menu differs from house to house, but the resistance piece is definitely 'bulz' (Romanian traditional food with polenta and sheep cheese), in the locality the cheese is a very good one. 'They like "bulz", we have very good cheese in the area, and if there is no "bulz" on the menu, people ask us if we don't have cheese for sale, or from where they can buy it' (#1). Also, soups, fried fish, meat, or other homemade drinks, like sour cherry liqueur are always at the top of tourists' preferences: 'I make a lot of "ciorba", and people say they are very good. Egg ciorba, salad ciorba, beans ciorba, all are prepared in my way and are always appreciated, therefore, many ladies have asked for the recipe' (#4); 'tourists ask about drinks, if we have homemade "visinata" (cherry brandy) or "afinata" (bilberry) and they ask for these because they are better and more natural than the ones sold in the market' (#2). Always using fresh, organic ingredients that come from people's well-groomed gardens, the food can only be delicious, like at home of mom or even grandma.

Between 60% and 80% of the ingredients comes from people's households, either from their own or from other local producers: 'We use 70–80% of what we have here locally' (#4); 'We don't buy, we use what we have here in the garden, what is produced in the local farms and that's all we need for a good meal' (#5). The rest is bought from supermarkets, especial-

ly what they cannot produce, here, for example, sugar or oil. About 20 families in the commune own and care for solariums that serve the community. The climate is not perfect for agriculture but with the help of solariums even peppers, eggplants, tomatoes, cucumbers, and much more are produced. Dairy products come from the many sheepfolds owned by families in the Vama Buzaului community.

(O3) Identification of the methods used to promote the Local Gastronomic Points

Respondents believe that the most effective advertisement is the man who leaves their yard satisfied: 'When someone tells that they have been our guests, surely more people will come' (#5). Word of mouth is one of the most effective forms of promotion in this sector of agritourism. The time that Gastro Local owners spend on social networks is limited due to the multiple activities they carry out in their households during the day. Respondents also said that the concept is promoted by the mayor of the village, who participates in TV shows, gives interviews to various newspapers and online news platforms, and also manages the Facebook page – Gastro Local Vama Buzaului: 'We advertise through quality, the guests are spreading the word that the food is good and that we offer good hospitality, services the host welcoming the mayor manages the Facebook and news activities' (#3).

CONCLUSIONS

The main conclusion of the study is that the Local Gastronomic Points is a Romanian initiative that demonstrates that it can generate horizontal development of the rural areas, by creating new jobs, by contributing of the locals who produce the agricultural products necessary for the activity of these LGP and to generate the development of the agritourism at the national level.

The establishment of Local Gastronomic Points, the initiative that helps the development of agritourism, can provide additional jobs for rural residents because it generates activities related to tourism, especially services, trade, food services, processing of agricultural products, etc. These results confirm those of Marin (2015). Moreover, this initiative creates new business opportunities in the rural areas, which confirms the study of Halim et al. (2020).

The results of the study, regarding the increasing role of women in agritourism, also expand their significant involvement in the development of tourist destinations and rural development, which confirms the study of Halim et al. (2020).

The results reveal that this concept enhances the community and local cuisine. Gastro Local is a project recently started at Vama Buzaului, which is already enjoying success, being able to become an example of good practices for the development of Local Gastronomic Points in as many rural tourist destinations both in Brasov County and at the level the whole country. At the level of Brasov county, we propose to design a unitary Gastro Local concept, which should include specific requirements regarding culinary preparations and services, standardization of marking and signalling these LGP, and an intense tourist information and promotion activity to determine the desire to experiment at tourists, thus highlighting both the cultural and gastronomic heritage and local producers.

The results of the study are conclusive and relevant for agritourism stakeholders, for the responsible public authorities in the field of tourism, to develop competitive rural tourist destinations. From an academic point of view, this study helps to strengthen existing studies on agritourism development in rural destinations and provides the basis for future research. This study presents some limitations. The main limitation of this research is generated by the fact that the sampling for analysis was made up only of owners of LGP, and another limitation is that the research was conducted only at the level of a single tourist destination, in one country, Romania. Future research could be extended to complete this study. The authors aim to continue research on this topic, including qualitative and quantitative studies, and to investigate the presence of other variables in these studies, such as the opinion of stakeholders at the destination level in Romania and other states, and to expand research to other destinations.

Also, the authors intend to go further regarding the research of the Local Gastronomic Points through the experience of tourists, their preferences, and expectations, to improve this concept.

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THE HACCP SYSTEM AS A GUARANTEE FOR FOOD SAFETY IN UKRAINE

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ABSTRACT

The research points out the principal concept of the HACCP system, ensuring product safety along the whole food chain 'from the field to the table'. It focuses on HACCP as the food safety management system that proved to be effective and has been accepted globally. In recent years the HACCP system has been gradually introduced in Ukrainian business entities. The article reveals the emergence of the HACCP system and the adaptation of the legal base of Ukraine in the area of food safety requirements. It provides evidence that the harmonization of Ukrainian and international standards in the field of food quality and safety calls for the necessity to introduce HACCP-conforming technologies at all stages of production in Ukrainian companies. The results of the audits of food product safety in Ukraine for the period 2016–2019 were evaluated.

Key words: management system, HACCP, Critical Control Point (CPC)
JEL codes: M40, L15, K13

INTRODUCTION

Food safety is a global problem requiring the managerial tool that provides measures for building an effective hazard control system. Nowadays, food safety management systems acquire particular attention in many emerging markets. In Ukraine, standards such as DSTU 4161-2003 'Food Safety Management System. Requirements' and DSTU ISO 22000:2007 'Food Safety Management Systems. Requirements to the organization of the food chain' establish the framework for the development and implementation

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of food safety management systems according to the HACCP principles (KhASSP, 2019). Following amended and supplemented the Law of Ukraine 'On food safety and quality' of 1997 (Zakon Ukrayiny vid 23 hrudnia 1997 r. No 771/97-VR), food manufacturers have to ensure the safety and quality of manufacturing and food circulation under the requirements of the HACCP system (Systema HASSR v Ukraini, 2020).

THEORETICAL FRAMEWORK

Hazard Analysis and Critical Control Point (HACCP) is a scientifically based risk management system assuring safe food production. The core concept of HACCP is to ensure product safety all along the food chain 'from the field to the table' (Istoriia stvorennia HACCP, 2016). Mayes and Mertimor (2005) analysed and summarized the experience of applying HACCP in the food industry worldwide. Deming elaborated on the theory of quality management that was widely used to solve critical issues of Japanese food quality in the 1950s. He was among the authors who developed the concept of Total Quality Management (TQM) focused on the integrated approach to manufacturing, improving quality, and cutting costs (Systema HASSR, 2003). However, the role of regulatory authorities in the development and application of HACCP remains crucial (Commission Regulation (EC) 466/2001).

Hazard Analysis and Critical Control Point proved to be a food safety management system that demonstrated its effectiveness and has been approved by many international organizations (Systema HASSR v Ukraini, 2020). However, the harmonization of domestic and international food quality and safety standards requires introducing HACCP-conforming technologies at all stages of food manufacturing in Ukraine. Moreover, there is a need for further research devoted to the functioning of food safety systems in Ukrainian agri-food enterprises.

MATERIALS AND METHODS

This article aims to study the evolution of the development of the food safety management systems and identify the ways of implementing HACCP under the legislative framework in Ukraine. The methods used in the research included induction and deduction, comparison and generalization, and retrospective analysis. The data on the government control of food safety in business entities were provided by the State Service of Ukraine for Food Safety and Consumer Protection.

RESULTS AND DISCUSSION

The introduction of an adequate food quality management system requires primarily training of top management, the HACCP team, and operational controllers whose work affects food safety. It may lead to a change in technological processes or packaging methods, revision of rules for raw materials suppliers, replacement of production facilities, or redeveloping of premises. Therefore, it is essential to motivate the employees of all levels in the organization to implement the quality control and food safety system (Systema HASSR v Ukraini, 2020). The advantages of the introduction of the HACCP system are presented in Figure 1.

The phases of the evolution of HACCP globally and in Ukraine are presented in Table 1. An assessment of the development of the HACCP system suggests that Ukraine has adopted several legislative acts recently aimed at increasing food quality.

In Ukraine, four government bodies are in charge of controlling food safety, including the Ministry of Health of Ukraine (the State Sanitary and Epidemiological Service of Ukraine), the Ministry of Agrarian Policy and Foodstuffs of Ukraine (the State Veterinary and Phytosanitary Service of Ukraine), the Ministry of Economic Development and Trade of Ukraine (the State Committee of Consumer Safety and Health), and the Ministry of Environmental Protection (the State Ecological Inspection). These bodies control certain production areas rather than assure product safety as a whole. They contribute to the popularization of HACCP and its implementation to enhance control efficiency at all stages of food manufacturing and achieve high product quality.

To fulfil the obligations of the Association Agreement with the European Union, Ukraine is reforming its system for state control over food quality and

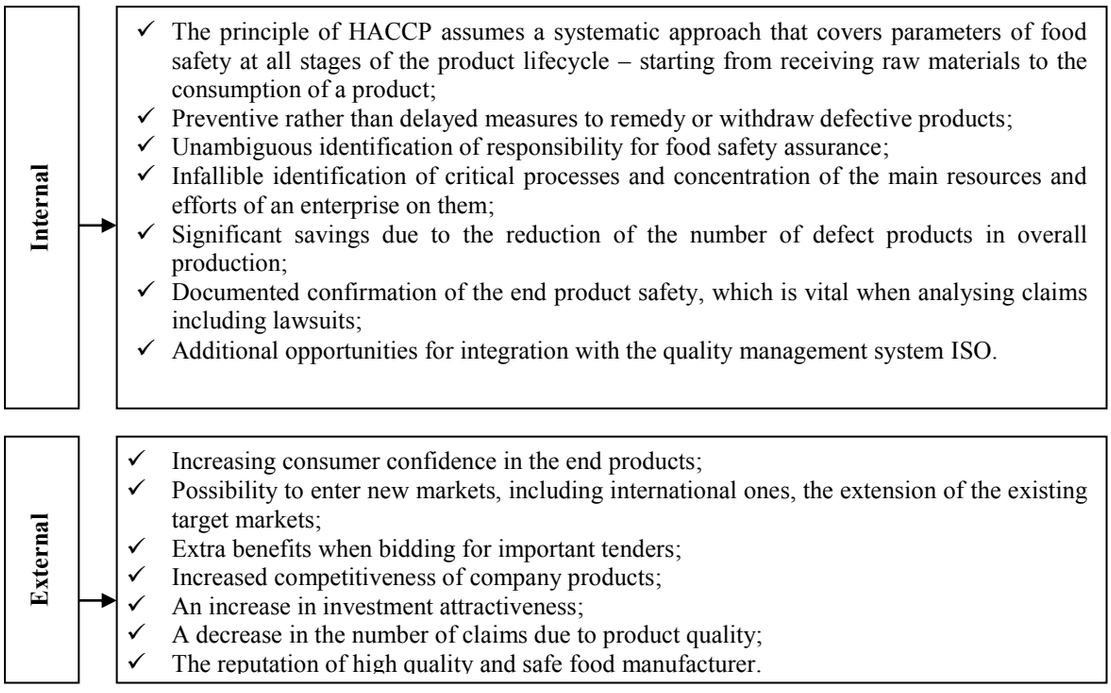

Figure 1. The advantages of the implementation of the HACCP system

Source: formed on the base (Istoriia stvorennia HACCP, 2016).

safety to ensure the protection of human life, health, and legal rights. In Ukraine, the requirements for developing and implementing food safety management systems under HACCP are enforced by DSTU 4161-2003 'Food Safety Management System. Requirements' and DSTU ISO 22000:2007 'Food safety management systems. Requirements for the food chain organization' (Holovni polozhennia…, 2019). The standards combine generally accepted key elements covering the interactive information, the system control, the prerequisites, and the principles of HACCP for agri-food companies. The gradual introduction of the HACCP system in Ukraine involved manufacturers of pork, beef, chicken, milk in 2017; confectionery factories, processing enterprises, fruit and vegetable manufacturers in 2018; and small food enterprises in 2019. The control over food safety under the principles of HACCP is conducted by the State Service of Ukraine of Food Safety and Consumer Protection regularly (Table 2).

The information provided by the State Service of Ukraine for Food Safety and Consumer Protection showed that in 2019 the number of inspections increased, and 19 597 people were brought to justice.

Implementing the food management system is possible due to the adoption of seven HACCP principles that represent generalized requirements and identify hazards in the production chain to ensure product safety for consumers. This system covers all stages of food manufacturing on their way to consumers, such as the supply of raw materials, food manufacturing and processing, and distribution.

The compliance of Ukrainian manufacturers with HACCP requirements results in promoting national food products on the global market and the intensification of international trade. In 2019 the implementation of international treaties such as 'Protocol of Veterinary and Phytosanitary Requirements for the Export of Rapeseed' with the People's

Table 1. The selected points of the evolution of HACCP globally and in Ukraine

Period	Description of the period
1959	For the first time, HACCP was developed in the United States by the Pillsbury Company, working for the NASA. It was vitally important to ensure food safety for American astronauts.
1971	HACCP was presented at the First American National Conference on Food Safety and approved for implementation in the food industry.
1973	US Food and Drug Administration (US FDA) approved the HACCP concept.
1985	HACCP was recommended by the National Academy of Sciences of the USA for microbiological risk control.
1989	Manual on the Development and Implementation of HACCP, which featured and analysed seven principles of HACCP and outlined six main types of microbiological hazards, was published by the National Advisory Committee on the United States Microbiological Criteria for Food.
Since 1990	HACCP became mandatory for use in the USA, Canada, Australia, New Zealand, and some other countries.
1993	Codex Alimentarius Commission (CAC) published a set of guidelines for the development and implementation of HACCP (FAO, 2007). Council Directive 93/43/EEC on the hygiene of foodstuffs, suggesting the mandatory application of control systems based on the HACCP principles in food manufacturing, was adopted in the EU (Regulation (EC) 852/2004).
1996	HACCP rapidly spread in food-processing companies in America, Europe, and Australia. Nowadays, the implementation of the HACCP method in the food industry, as well as HACCP certification in the countries of the European Union, the USA, and Canada, are mandatory.
1997	CAC/RCP Standard 1-1969 (Rev. 3-1997) was revised and supplemented with the standard 'System of the Analysis of Hazards and Critical Control Points (HACCP) and application guidelines'.
2002	Regulation (EC) 178/2002 of 28 January 2002 establishing the general principles and requirements of food law, establishing the European Food Safety Authority, and laying down procedures in matters relating to food safety.
2003	The latest revision of Rev. 4-2003 CAC/RCP 1-1969 '**Codex Alimentarius Commission, Joint FAO/WHO Food** Standards Programme. General principles of food hygiene' was published.
2004	Regulation (EC) 852/2004 'On Food Hygiene', which replaced Directive 93/43/EU was adopted.
2005	International Standard ISO 22000:2005 'Food Safety Management Systems. Requirements for any organization in the food chain' was introduced by the ISO organization.
2006	The application of the HACCP system became mandatory in EU countries.
2010	New Certification Scheme FSSC 22000 was adopted. HACCP became the basis for international standards such as BRC Technical Standard, IFS, SQF 2000 Standard, Dutch HACCP.
2011	In the Republic of Belarus, the Republic of Kazakhstan, and the Russian Federation, the implementation of the principles of HACCP for all organizations involved in food production became mandatory following the Technical Regulation of the Customs Union 'On food safety' (TR CU 021/2011). National standard DSTU-N CAC/RCP 1:2012 'Foodstuffs. Guidance on the general principles of hygiene' (CAC/RCP 1-1969, Rev. 4-2003, IDT) was adopted in Ukraine.
2014	European model of food safety and quality system based on HACCP procedures was introduced in Ukraine. A single food safety supervisory body was created, authorizations and procedures non-existent in the EU were cancelled, and the Euro-pean principles of the GMO regulation, in particular, registration of the GMO sources in Ukraine, were adopted.
2015	Order of the Ministry of Agrarian Policy and Food of Ukraine approved the amendments to the requirements for the development, implementation, and application of permanent procedures based on the principles of the Food Safety Management System (HACCP).
2016	Chapter VII of the Law of Ukraine 'On basic principles and requirements to food safety and quality – general hygiene re-quirements to food products' came into force, requiring all food business operators to have HACCP prerequisite programs (hygiene requirements) (Parliament of Ukraine, 2016).
2017	Order of the Ministry of Agrarian Policy and Food of Ukraine under the title 'Approval of the form of the audit report on the compliance of market operators with the requirements of the legislation regarding permanent procedures based on the principles of the system of analysis of dangerous factors' came into force.
	Order of the Ministry of Agrarian Policy and Food of Ukraine 'Approval of the form of the state control report on the observance of the food hygiene by market operators' was put into force.
2018	Resolution of the Cabinet of Ministers of Ukraine 'Procedure for determining the frequency of implementation of plan-ned measures of State control for compliance of market operators with the requirements of the legislation on food, feed, animal health, and welfare, performed by the State Service for Food Safety and Consumer Protection, and the criteria for the degree of risk of its implementation' was adopted.
	Law of Ukraine 'Information on food for consumers' made Ukrainian legislation compliant to the EU Regulation 1169/2011 of 25 October 2011 on providing consumers with food information (Zakon Ukrayiny vid 6 hrudnia 2018 r. No 2639-VIII).

Source: formed by authors.

Table 2. The control over food safety in Ukraine in 2016–2019

Indicator	2016	2017	2018	2019
Business entities controlled	320	644	235	752
Violations have been detected (%)	67.8	39.0	37.3	44.0
Brought to administrative responsibility (number of people)	184	1 376	3 505	19 597
Refunded by perpetrators (thous. UAH)	30.4	189.7	7 114	15 964

Source: formed on the base the SSUFSCP database (2020).

Republic of China (USDA FAS, 2019), and 'Protocol for Exported Honey with the Republic of Lithuania' (WTO, 2019) proved the expansion of Ukrainian food exports.

CONCLUSIONS

Based on the results of the research, the following conclusions have been formulated:

1. The introduction of an effective food safety management system is necessary for ensuring operational control throughout the management structure of a business entity, including top management, HACCP team, and workforce responsible for operations. However, due to a series of measures implemented by the Government of Ukraine for the implementation of HACCP, unfortunately, there are still some obstacles, including the low level of knowledge and lack of experience of managers, limited provision of adequate financial resources for the HACCP assurance, turbulent business, and juridical environment, and deficient public awareness on the need for implementation of the principles of the HACCP system in the food chain.
2. Ukraine adopted several legislative acts and gradually introduced HACCP in 2017–2019 for 200 000 entities operating in food manufacturing and distribution, education, health, and social services.
3. To facilitate the effectiveness of state control over the implementation of procedures based on the principles of HACCP, the Ministry of Agrarian Policy of Ukraine adopted regulations on the audits of food safety among market operators.
4. Implementation of HACCP in agribusiness entities provided many benefits for Ukrainian customers, including better government control, the legal responsibility for violations of standards, and timeliness in preventing risks for food safety.

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COGNITIVE MODELLING OF AN EFFECTIVE SYSTEM OF INFORMATION SUPPORT OF AGRICULTURAL ENTERPRISES

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ABSTRACT

This article encompasses the methodology of cognitive modelling of complex poorly structured systems. Based on the expert method and with the help of this modelling methodology, the main factors that influence the effectiveness of information support of agricultural entrepreneurship were identified and the direction of their action was determined. There has been developed a cognitive map that reflects the cumulative impact of various factors on each other, as well as on the effectiveness of the information system for agricultural entrepreneurship. Hidden patterns between factors influencing the effectiveness of information support of agricultural entrepreneurship are revealed based on the cognitive map. The scenario approach is simulated based on different trends that reflect the current situation. This model allows us to further evaluate the performance of the system of information support of agricultural entrepreneurship under the influence of the environment, to predict its development, as well as to develop optimal strategic decisions that are aimed at ensuring sustainable development.

Key words: information support, cognitive approach, modelling, forecasting, poorly structured system; cognitive modelling of efficiency of functioning of the information system of agricultural entrepreneurship
JEL codes: C30, D80, Q13

INTRODUCTION

One of the main elements of the whole management system of various forms of agricultural entrepreneurship is information support. It includes a set of communication processes, information resources, methods of their organization to perform effective management and analytical processes that will contribute to ensuring sustainable production and economic business activity.

It should be noted that cognitive modelling is one of the effective scientific methods that increase the level of management efficiency in complex economic systems. This method is based on modelling

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processes, which aim to establish different patterns of behaviour for a particular object, followed by the scientifically grounded decisions of its management.

The purpose of the article is to identify the main internal and external factors that affect the effectiveness of the information support system of agricultural entrepreneurship and forecasting based on a cognitive model of possible trends in the development of the system elements.

THEORETICAL BACKGROUND

Various issues of the effective development of agricultural enterprises have been explored in the works of well-known economists, namely A. Malak-Rawlikowska, O. Yermakov (Yermakov and Kharchenko, 2014), T. Kalna-Dubinyuk (Kalna-Dubinyuk, Kharchenko and Kharchenko, 2016), S. Lupenko, S. Milovanović (Milovanović, 2014), and others. Scientific research of the cognitive method has been actively developing since the beginning of the 21st century. Axelrod is the founder of this approach (Axelrod, 1976). A significant contribution to the study of the problem of informatization and agricultural enterprises' economic activity has made such scientists as Z. Avdeeva, S. Kovryha and D. Makarenko (Avdeeva, Kovryha, Makarenko, 2007), J. Kania and J. Żmija (Kania and Żmija, 2016), B. Szafranska (Szafranska et al., 2020), D. Ross (Ross, 2005). However, the effectiveness of the agricultural information support system remains poorly researched and needs further study.

MATERIALS AND METHODS

Cognitive modelling is one of the methods of effective management decision support. In general terms, the model is a simplified view of reality, which is used to explore its main properties. The 'cognitive' category comes from (latin *cognitio* – knowledge, cognition) and involves the mental perception and processing of external information. A cognitive approach is used to solve various process management tasks. This type of modelling combines structural system and simulation modelling that adequately reflect the object under study. This simulation method is relatively open to experts in various fields and allows them to develop mathematical models, the results of which are easily interpretable. The actual methodology of cognitive modelling is used to analyse and make decisions in poorly structured systems. Especially this approach allows modelling a set of information support processes for agricultural enterprises.

The purpose of cognitive modelling of poorly structured systems is to find out the mechanism of functioning of the system, to predict the development of the system, to control it, to determine the possibilities of its adaptation to the external environment. Cognitive modelling in terms of analysis and management of poorly structured systems is a study of the functioning and development of poorly structured systems and situations by building a model of a poorly structured system based on a cognitive map. In this model, the cognitive map reflects the idea of the problem under study, the situation associated with the functioning and development of a poorly structured system. The basic elements of the cognitive map are the underlying factors and the causal relationships between them.

It should be noted that cognitive analysis is a preliminary stage of cognitive modelling based on graph language, which is a convenient tool for describing various physical, technical, economic, and other systems.

So, the task of analysing situations based on cognitive maps is divided into static and dynamic. Static or impact analysis is the analysis of the system under study by examining the structure of the interconnections of the cognitive map, which allows us to identify the structure of the system, find the most important component elements, evaluate their mutual influence. The study of the interaction of component elements makes it possible to estimate the spread of influence on the cognitive map, which changes their state. Dynamic analysis is the basis for the generation of possible scenarios for the development of the situation over time (impulse modelling).

At the first stage of the cognitive analysis application and modelling of complex systems, there is performed the cognitive model development by constructing a cognitive map, or as a parametric vector functional graph of the following form (Horelova, Zakharova and Hynys, 2005):

$$\Phi_n = \langle G, X, F, \theta \rangle, \quad (1)$$

where:

G – oriented graph (cognitive map), $G = \langle V, E \rangle$;

V – set of vertices, $V = \{v_i \mid v_j \in V, i = 1,2,...,k\}$ and their elements $v_{ij} \in V, ij = 1,2,...,k$;

E – set of arcs $E = \{e_i \mid e_j \in E, i = 1,2,...,k\}$ and arcs $e_{ij} \in E, ij = 1,2,...,k$ that reproduce the relationship between the vertices V_i and V_j;

$F = f\{v_i, v_j, e_{ij}\}$ – function that reflects the relationship between vertices V_i and V_j;

X – set of vertex parameters, where $X = \{X^{(v_i)} \mid X^{(v_i)} \in X, i = 1,2,...,k\}$, $X^{(v_i)} = \{x^{(i)}{}_g\}, g = 1,2,...,l, x^{(i)}{}_g$;

g – vertex parameters V_i, if $g = 1$, then $x^{(i)}{}_g = x_i$;

θ – space of parameters of vertices, each vertex corresponds to a vector of independent variables.

Also, the cognitive map can be reproduced not only graphically but also by the matrix of relations A_G. Given a square matrix, in which rows and columns are denoted by vertices of the graph, as well as at the intersection of the i-th row of the j-th column, there are (or not) 1 or 0, if there is (or not) a relation between the elements V_i and V_j in the following form:

$$A_G = [a_{ij}]_{k \cdot k}, \quad (2)$$

where a_{ij} = 1 if V_i is related to V_j; provided that V_i is not related to V_j then $a_{ij} = 0$.

Generally, cognitive modelling is performed step by step or impulse. In impulse modelling, some impulse (change) of an indicator occurs on any one or more vertices of a graph. These actions disrupt the entire metric system and transit the system from one state to another.

If there are several vertices V_j correspondingly adjacent to V_i then the process of perturbations spreading on the graph in the presence of internal pulses P_j and the absence of external perturbations is calculated by Equation (3) (Walliser, 2008):

$$X_i(n+1) = X_i(n) + \sum f(X_i, X_j, e_{ij}) P_j(n), \quad (3)$$

f the initial values of $X(n = 0)$ are known in all vertices and the initial perturbation vector $P(0)$. In the case where there are external perturbations Q_i, the impulse process is determined by Equation (4):

$$X_i(n+1) = X_i(n) + \sum f(X_i, X_j, e_{ij}) P_j(n) + Q_i(\mathrm{n}+1). \quad (4)$$

The model of impulse processes can also be presented in a matrix form, which is convenient when modelling on sign graphs. Suppose that the vector of vertex parameters at a certain time t is given by Equation (4). Then the change in the parameters of the vertices in the general case will be given by this equation:

$$X_i(n+1) = X_i(n) + AP(n) + Q_i(n+1), \quad (5)$$

where A is the matrix of relations G of the cognitive map. We obtain from Equation (5) concerning Equation (4) for $P(n)$.

$$P(n) = A^{n-1} Q_0 + A^{n-2} Q_1 + \cdots + AQ_{n-2} + \mathrm{I}Q_{n-1}, \quad (6)$$

where I is a unit matrix.

So, to develop a cognitive model and use it as a predictive one, the following steps must be completed: (1) Build a cognitive model according to the available quantitative and qualitative information. (2) Perform scenario modelling (using impulse modelling) based on a cognitive model that reflects the possible development of situations in the system under study – the prediction of situations development. (3) Compare simulation results with observational data.

RESEARCH RESULTS AND DISCUSSION

The effectiveness of the formation and use of information systems for agricultural entrepreneurship is affected by various organizational, economic, social, and other factors. Actually, the information system for agricultural entrepreneurship is poorly structured because it has complex interconnections between different elements (Kharchenko, Kharchenko and Malak-Rawlikowska, 2018).

Therefore, to ensure the conditions for the effective functioning and development of the information system for agricultural entrepreneurship, it is necessary to study the influence of the main internal and external factors on this system, as well as to identify the interaction of these factors with each other. With the help of experts, the most important factors were selected under the influence of which the formation of the level of functioning efficiency of the information support system of agricultural entrepreneurship is formed:

1. The effectiveness of the information support system.
2. Information transmission hardware.
3. Client and server software for data transmission and processing.
4. Developed IT infrastructure and Internet.
5. Increasing the level of IT awareness among staff.
6. Legal regulation of information support processes.
7. The level of innovation processes.
8. Access to analytical information sources when making management decisions.
9. Organization of information security.
10. The level of investment and investment in the implementation of information support.
11. Functioning efficiency of information-consulting centres.
12. The price level for hardware and software.

These variables are vertices of the graph. Note that these factors affect each other. Yes, if one factor increases or decreases, leading to another factor increasing or decreasing, the impact will be considered positive. If an increase in the level of a certain factor causes a decrease in the level of another factor, then this influence is negative.

It should be noted that it is the cognitive map and further analysis of the level of information system efficiency of agricultural entrepreneurship that will identify the factors that need operational development and need to be improved. On this basis, a cognitive model was constructed, based on external and internal environmental factors, and the direction of their action was determined (Fig. 1).

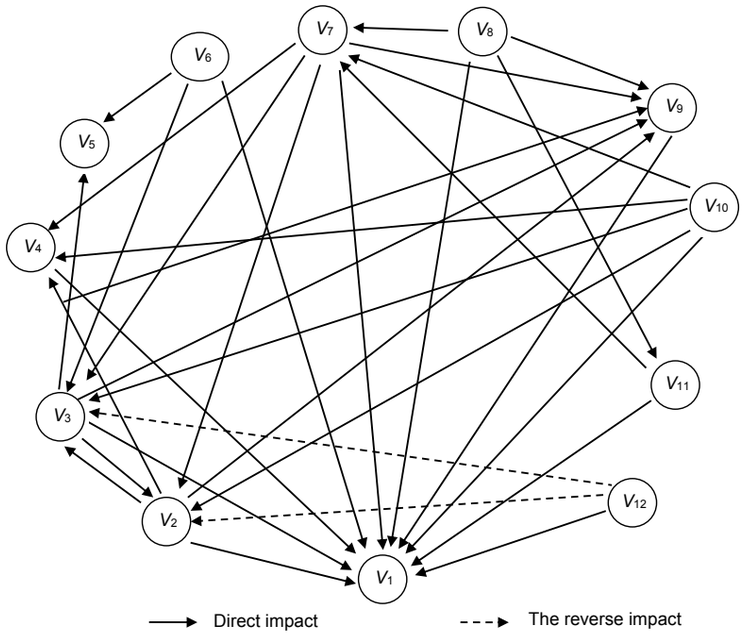

Figure 1. The cognitive model of internal and external factors influences the effectiveness of the information support system of agricultural entrepreneurship

Source: developed by the authors.

Considering that in a linear dynamic model, which is based on a cognitive map, the studied factor is defined as a variable that takes values from some numerical scale. The set of interrelations of different factors of the model is given in the matrix of adjacencies of vertices of the oriented graph (Table 1).

In this case, the vector functional graph of the system functioning of information support efficiency of agricultural entrepreneurship is given by the corresponding matrix. In the matrix, the number +1 means that if V_i increases, there will be an increase in V_j, a negative number –1 indicates that if V_i increases, there will be a decrease in the factor V_j, the number 0 indicates a weak connection or none at all. A cognitive map that has been developed reflects the cumulative impact of various factors on each other, as well as on the effectiveness of the information system for agricultural entrepreneurship. The scenario approach was then modelled based on different trends that reflect the current situation.

In impulse modelling, +1 changes were made alternately to each of the vertices of V_n, which makes it possible to trace and determine the influence of a single n factor on the effectiveness of the information system of agricultural entrepreneurship. Table 1 shows the modelling results when you make $a + 1$ change to the vertex 'capital investment and investment', with six modelling cycles.

In Figure 2, the abscissa axis shows six modelling cycles ($n = 1, 2, 3, 4, 5, 6$), and the ordinate axis shows changes in the indicator values in relative units.

Table 1. The results of the impulse process modelling, when you make $a + 1$ change to the vertex V_{10}

Variable	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}	V_{11}	V_{12}
X_0	0	0	0	0	0	0	0	0	0	0	0	0
X_1	0	0	0	0	0	0	0	0	0	1	0	0
X_2	1	1	1	1	0	0	1	0	0	1	0	0
X_3	5	3	3	3	1	0	1	0	4	1	0	0
X_4	15	5	5	5	3	0	1	0	11	1	0	0
X_5	28	7	7	7	5	0	1	0	19	1	0	0
X_6	42	9	9	9	7	0	1	0	27	1	0	0

Source: the authors' calculations.

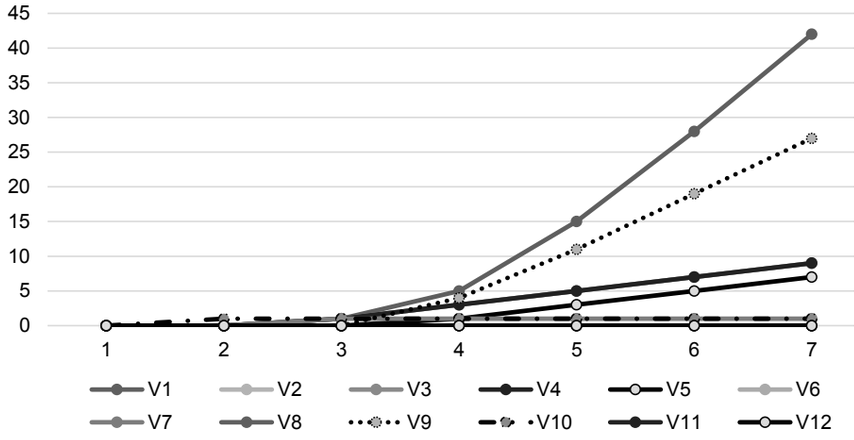

Figure 2. Graphic representation of the impulse change in vertices V_1–V_{12}, when the +1 is changed in vertex V_{10}

Source: the authors' calculations.

The results of the scenario modelling make it possible to conclude that with the increase of investments there is an increase in the level of efficiency of the information support system of agricultural entrepreneurship.

It should be noted that the peculiarity of the forecast obtained using the cognitive model reflects the directions of the processes developed in the system under study. It reproduces alternative ways of developing the system, providing the changes in the various elements that will affect it in the future. Therefore, the use of cognitive modelling based on the object observation allows obtaining the prediction results using the impulse modelling method on cognitive maps.

CONCLUSIONS

A built-up, vague cognitive map is an objective approximate way to build an adequate model of the information system efficiency of agricultural entrepreneurship. With the help of the developed model, it is possible to identify factors that positively and negatively affect the functioning and development of the system, identify hidden patterns between factors, carry out cognitive modelling, which in the complex will allow to evaluate the performance of the information system of agricultural entrepreneurship under the influence of the environment and to predict its development. The cognitive model explains which component element or interrelationship of elements must be influenced, with what force and in which direction, to achieve the goal with minimal costs. A properly constructed cognitive model allows the expert to develop the correct solution to problem situations in complex, poorly structured systems.

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GLOBAL AREAS OF AGRARIAN BUSINESS DEVELOPMENT

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ABSTRACT

The following research methods are used to achieve this goal: theoretical synthesis, analysis, abstract and logical – to reveal the relationship of the global food crisis in the context of achieving food security goals; interpretation and comparison – to determine the prospects for improving food security; tabular and graphical – for a visual representation of food security in the world. It has been established that food security is an objective necessity for human development. Its provision is a guarantee of regular access of the population to high-quality food necessary for leading an active and healthy life. Taking into account the analysed indicators of food security, reserves have been identified for improving the growth of food security in the strategy of sustainable development of Ukraine and the world. A cumulative interrelated analysis of pandemic and post-pandemic poverty growth, declining profitability, and price differentiation in food security has been conducted. The assessment of divergent changes in the food sector of Ukraine and other countries is carried out taking into account the challenges of the environmental environment. The results of the study on food security can be used in the management of the economy and the agro-industrial sector as one of the goals of sustainable development.

Key words: food security, pandemic, poverty, reduction of profitability, strategic development goals, global environment, food security indicators, consumer price index

JEL codes: Q14, Q18

INTRODUCTION

Economic globalization in the process of its development affects the involvement in commodity-money relations of a large number of new regions and areas of human activity. International trade and capital movements are growing sharply between countries, and national economies and their respective industries are gaining a strong export orientation. At the present stage of expansion and liberalization of international trade, economic and political integration, internationalization of aggregate effective demand, development of science, and exacerbation of global environmental problems, completely new forms of globalization are being created. As a result, the world economy in all its multilevel structures is involved in the competition, in which the decisive role belongs not to national but to international competitive advantages. In particular, T. Levitt (1983) notes that the internationalization of markets is accompanied by an increase in the level of international specialization. Whether we examine agrarian relations as conditioned by global forces, or as intrinsically political because states are institutions of the world market (McMichael, 1987), the agrarian question has always been situated globally. We agree with the opinion of scientists such as E.F. Lambin

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and P. Meyfroidt (2011) that globalization increases the worldwide interconnectedness of places and people through markets, information and capital flows, human migrations, and social and political institutions.

Such trends should determine the clarity of specialization in a particular regional part of the world economy because each country or group of countries has certain types of resources located in a certain geographical zone, which affects the natural and climatic features, which is the result of a specific type of economic activity. In the current context, globalization has a significant impact on all spheres of society, but this phenomenon plays the most important role in the world economy in the 21st century. It provides a powerful impetus and creates new conditions for the functioning of international relations and the interaction of national economies.

The purpose of the article is to consider current trends in agricultural development in terms of individual countries and their impact on the formation of global agricultural business.

THEORETICAL BACKGROUND

According to the United Nations, globalization is a general term meaning an increasingly complex set of cross-border interactions between individuals, businesses, institutions, and markets, which is manifested in the expansion of flows of goods, technologies, and funds, in the steady growth and strengthening of the influence of international civil society institutions, the global activities of multinational corporations, a significant expansion of cross-border communication and information exchanges (Globalization. Resource library). Thus, globalization has a significant impact on all economies of the world. At the same time, new development trends are emerging, which are forming structural changes due to globalization processes and influencing the new transformation of the agri-food market. At the same time, there is a changing trend of globalization, characterized by the intensification of the food crisis and increasing threats to food security:

– population growth causes a shortage of food resources;
– the natural potential of biological resources is exhaustible, so it is unable to meet the growing needs of mankind;
– there is a development of traditional and non-traditional technologies that contribute to the intensification of agricultural production;
– in the conditions of the imperfection of the international relations inefficiency of mechanisms of the international trade in agro-food is shown;
– the effectiveness of agricultural development in the context of global competitiveness is manifested only in the production of goods with high added value;
– most countries with high agri-food potential export mainly raw materials, losing a significant share of income (Van der Ploeg, 2008). Thus, the largest share of agriculture in world value added is observed in poor countries with significant external debt. The smallest share of agriculture is formed in the value-added of North America and the Eurozone – 1.6–1.8%. For low-income countries in Europe and Central Asia, this figure is slightly higher – 6.5%. The share of agriculture in East Asia and the Pacific region is 5.4% (FAO database).

MATERIALS AND METHODS

The data used for documenting the paper was collected mainly through desk research. Different information sources from the European and national level, such as reports, country fact sheets, and articles were consulted.

The work included an analysis of available scientific literature on the development of agrarian business and the export of products. The criterion for choosing literature for consideration was the current and potential impact of the dynamics of agricultural production, imports, and exports.

RESEARCH RESULTS AND DISCUSSION

The main patterns of globalization in agrarian business are:

– weakening of the natural and climatic factors and industrialization of agricultural production with the widespread use of all elements of the post-

-industrial economy – knowledge, information, management and control technologies, etc. This reduces the negative effects of natural and climatic factors and creates additional competitive advantages;
- development of processes of centralization and concentration of production. Fierce competition in international markets obliges agricultural producers to use high-performance equipment, knowledge-intensive and energy-saving technologies, train staff, and invest heavily in their retraining and further training;
- the use of the latest advances in science, innovation, the development of biotechnology, reducing the use of pesticides and herbicides and thus reducing the chemical impact on the soil, maintaining a high level of better resources becomes possible only for large industries that attract significant investment;
- territorial disparity in food production and consumption in the world. Disparities in food production are growing in some regions of the world (China, India, Pakistan, Iran, Africa) and the volume of effective demand for food, due to the standard of living that has formed in this or other countries. There is a significant gap in income and consumption levels between the population of developed countries and developing countries. This affects the caloric content and quality of the diet of the population of the world;
- unification of normative and legal bases of agricultural production within the framework of international norms and standards. At the present stage in international trade, the issue of safe and quality food is becoming relevant, and environmental safety and quality of agricultural products in modern conditions are the main factors of its competitiveness.

Standards are now a signifi cant new vector in the global food production complex. The World Trade Organization regulation of trade relations is complemented by a far-reaching private regulation of production standards, regarding quality, food safety, packaging, and convenience. It is integral to the centralization of retailing capital, and the dual imperatives of satisfying quality demands of relatively affluent consumers and replacing smallholding by global/factory farms to realize those standards. UK supermarkets, for instance, believe that concentrating their grower base will reduce their exposure to risk by giving them greater control over the production and distribution processes (Dolan and Humphrey, 2000).
- strengthening the regulatory role of countries in establishing international economic relations in agricultural segments of the world market and strengthening neoprotection policy – a more latent, flexible, and effective mechanism for protecting the national market, based on non-tariff methods of regulation that are constantly modified, complicated and are the main problem area of multilateral negotiations in the World Trade Organization;
- disparities in the use of intensive and extensive methods of agriculture, which lead to increased production of agricultural raw materials and food production and the efficiency of the industry while reducing the share of the agricultural sector in total world production. However, there are exceptions. So, the universalization of the Northern model of industrial agriculture through the 20th century has resulted in the loss of 75% of the genetic diversity of crops across the world. Green revolution crops (new, bioengineered varieties) now account for more than half of the South's rice culture. The adoption of transgenic technology substitutes monopoly for diversity, threatening ecological and social sustainability, and local food security. A century ago, hundreds of millions of the world's farmers controlled and reproduced their seed stocks, whereas today 'much of the seed stock has been bought up, engineered, and patented by global companies and kept in the form of intellectual property, converting farmers into consumers of genetically altered seeds (Rifkin, 1998).

Modern globalization has allowed agricultural production to grow much faster than in the past, in particular, in the 70–80s it was 3% per year, today it is 4–6%. However, this growth is due to significant changes in the factors of this growth and the structure of food production. Thus, much of the increase was due to non-food rather than basic foodstuffs; the possibilities of export markets have changed (trade

restrictions); increasing the share of goods of higher value in the structure of world trade; TNCs have provided high incomes for their agricultural enterprises in high-income countries, which has given rise to their 'disinterest' in agricultural production in small niche markets in less developed countries, not to mention the 'poverty belt' countries.

Examples are the coffee and tea markets, the export market for horticultural products, which have grown tremendously in recent decades and continue to grow today. Thus, the largest share of agriculture is in countries such as Sierra Leone – 60%, Chad – 50%, the Central African Republic – 45%, Mali – 38% and other countries in Central Africa, Central, and East Asia, where the share of agriculture is more than 25%. Among European countries, Albania has the greatest dependence on agriculture, with 23% of agriculture in GDP. The country specializes in growing corn and wheat, as well as tobacco and cotton. The second place in the ranking is occupied by Moldova (16%), half of the export in the structure of foreign trade is occupied by an agricultural business.

The agrarian sector of Ukraine with its basic component of agriculture is increasingly becoming the system-forming factor in the national economy. It creates the factors for maintaining the sovereignty of the state: food and, within certain limits, the economic and ecological, energy security of the state, ensures the development of technologically related branches of the national economy, forms the market for food products (Putsenteilo, Klapkiv, and Kostetskyi, 2018). Ukraine ranks third with a 13% share of agriculture in GDP.

Consequently, the agrarian sector is a complex diversified set of economically interconnected production and technological division of labor of agricultural sectors specializing in the production of agricultural products, their industrial processing, storage, and sale, which also covers information and scientific support systems and is characterized by deep differences and specifics of individual elements, which requires the construction of an individual organizational, economic, and technological and technological policy regarding all business entities.

Also dependent on agricultural countries are Macedonia, Montenegro, Serbia, Belarus, Bosnia and Herzegovina, Bulgaria, Romania, whose share of agriculture in GDP ranges from 11% to 5%, respectively. In terms of the world's countries, the largest share in the added value of agricultural production is occupied by China (975 billion USD) and India (362 billion USD), their shares in world production in 2018 were 32% and 12%, respectively. Also among the leaders of the agri-food market on this indicator are the United States, Indonesia, Nigeria, Brazil, Pakistan, Turkey, Argentina, Russia (FAO database).

Significant volumes of production in these countries are largely determined by the size of countries, so to assess the scale of development of the agricultural sector, it is advisable to calculate relative indicators. It should be noted that the value-added of Chinese agriculture is only 1.5% of the total GDP of the country. In India, this figure is 34% of GDP, indicating a significant dependence of the country on agriculture. Among European countries, the largest volumes of value-added production in agriculture were formed in Italy – 40 billion USD, France – 38 billion USD, Spain – 36 billion USD (FAO database).

Evaluation of the data in Table 1 shows that the production of certain types of agricultural products during 2015–2018 increased. This applies to wheat, soy, vegetables, and livestock products: beef and veal, pork, poultry, butter, and cheese. The largest increase in imports was in corn, soybeans, vegetables, and livestock products. Accordingly, there was an increase in exports of certain agricultural groups of goods: sugar and livestock products.

Thus, for example, in conditions where crops have continued to play an important role in ensuring food security in a global economy, and reduced cost of delivery, two conditions in developing countries could lead to increased imports of grain. Firstly, globalization and specialization can lead both to an increase in sown areas and an increase in the cost of goods, and potentially to a decrease in sown areas under cereals, but an increase in production intensity. Secondly, any differentiation in the distribution of income in relation to low-income levels, lack of food security, will stimulate increased demand.

Thus, low-income countries can benefit from lower grain prices, even when they lose from lower prices for other agricultural products. In addition,

Table 1. OECD Agriculture dynamics (thous. tons)

Commodity	Variable	2010	2015	2016	2017	2018
Wheat	Production	274 956.33	297 604.20	299 586.22	279 494.92	265 527.58
	Imports	32 476.69	35 846.23	36 406.23	39 272.56	38 592.25
	Exports	99 028.78	100 705.85	108 048.69	89 902.18	87 783.30
Maize	Production	419 508.88	453 107.83	499 695.96	487 072.01	483 367.68
	Imports	48 192.82	63 123.34	64 993.57	74 625.55	83 483.40
	Exports	50 853.76	53 734.37	64 704.08	68 311.65	59 212.76
Soybean	Production	96 956.00	116 638.71	127 088.93	131 475.98	131 636.13
	Imports	25 437.87	28 784.60	28 159.07	28 176.65	31 138.61
	Exports	43 789.19	56 169.64	62 791.38	62 479.28	52 527.09
Vegetable oils	Production	34 591.76	39 463.40	40 330.40	43 012.51	43 189.70
	Imports	17 707.20	22 067.05	22 366.56	23 150.87	23 814.08
	Exports	7 186.57	8 221.19	9 051.03	8 901.60	8 680.07
Sugar	Production	36 740.00	38 481.37	41 666.63	46 129.30	41 981.56
	Imports	14 924.83	13 288.77	11 844.09	10 987.47	11 624.30
	Exports	6 668.96	8 757.30	8 560.11	9 781.14	9 822.95
Beef and veal	Production	28 662.64	28 105.08	28 584.34	29 041.32	29 700.85
	Imports	4 231.14	4 673.47	4 718.14	4 773.72	5 245.52
	Exports	5 159.68	5 888.74	5 724.80	5 847.77	6 239.38
Pigmeat	Production	39 879.45	41 870.98	42 660.70	42 873.34	43 676.12
	Imports	4 069.31	4 837.46	5 006.09	5 286.89	5 578.29
	Exports	6 597.11	7 437.91	8 169.31	8 218.64	8 413.52
Poultry meat	Production	42 420.81	47 354.36	48 865.22	49 884.58	51 223.06
	Imports	3 262.42	3 877.43	4 032.10	4 001.56	4 097.39
	Exports	5 802.70	6 244.04	6 594.36	6 849.47	7 125.10
Butter	Production	3 902.02	4 444.58	4 591.11	4 579.49	4 619.42
	Imports	236.91	249.76	294.09	280.06	296.68
	Exports	809.16	861.12	931.36	837.98	831.07
Cheese	Production	16 199.11	17 654.86	18 167.80	18 771.90	19 045.97
	Imports	1 253.15	1 526.62	1 553.01	1 628.37	1 689.81
	Exports	1 921.58	2 282.37	2 472.05	2 459.62	2 471.06

Source: the authors' calculations based on FAO database.

globalization generates a 'speed pulse' of technology transfer among countries with developed infrastructure. Therefore, low-income countries that do not spend significant funds on scientific research and distribution technologies, do not upgrade agricultural infrastructure, do not make efforts to reduce operating costs will be permanently held hostage to 'price collapses' of agricultural goods, but without compensation for reduced production costs.

In this context, high-income countries can likely facilitate this process by liberalizing trade in agricultural products, preventing dumping of agricultural products on world markets and in domestic support programs for national agriculture, increasing demand for agricultural products by financing public works programs to reduce operating costs in rural (including depressed) areas. In low-income countries, especially in Africa, authorities and government agencies need to reorient public spending on agricultural production, rural infrastructure development programs in the context of reducing trade restrictions, reducing customs barriers, and so on.

That the volatility of agro exporting has encouraged farmers, close to dynamic urban markets, to shift into 'fast crop' production (fruits and vegetables) to regularize cash income as a matter of sustainability (Ponte, 2002).

Most Eastern European countries, due to peculiarities of their historical development, faced an urgent need to make decisive institutional changes aimed at ensuring the economic growth of the agricultural business. However, the institutional environment that can ensure the agrarian business growth is developing slowly, with considerable deformations caused by certain negative phenomena. The existing structure of the institutional environment of the agricultural sector in these countries testifies to the need for revising strategic priorities of institutional transformation in the agricultural sector (Jiggins and Hunter, 1979; Wise and Murphy, 2012; Tucker, Haupt and Stanley, 2015). Specific features of institutional changes in the agricultural sector in conditions of constant imbalances and tectonic changes lead to the destruction of domestic and foreign markets for agricultural products and have a huge impact on the development of the domestic economy (Adelman and Morris, 1979; Dalrymple, 2006; Jansson et al., 2013). At the same time, peculiarities of institution establishment can be understood and evaluated only in the context of the whole set of institutional changes of the national economy. The transformation of the agrarian economy into the market one took place against the backdrop of fundamental institutional changes: emergence of various forms of ownership and patterns, complex interaction between old and new economic institutions, revival of economic traditions and emergence of new technologies, changes in the traditional role of the state in current processes (Polanyi, 2001). Consequently, development agricultural production requires creating special conditions. Such conditions can be supported by two main driving forces: (1) based on active interest of agricultural producers themselves; (2) through appropriate measures of state institutional policy (Putsenteilo et al., 2020).

It is worth taking into account the experience of the EU countries, the USA, Canada, Brazil, China, which have achieved the best results in solving the food problem and have become world leaders in food production and export. Each country pursued its food policy, but they had much in common. Their achievement is ensured by implementing an active and effective agricultural policy, the main tools of which are the introduction of state support for agricultural producers, promoting technological modernization of the agricultural sector, implementing a balanced foreign trade policy to maintain the national priority of ensuring the country's food independence.

The EU's achievements in solving the food problem are due to the implementation of the common agricultural policy, which is based on the following principles:

- freedom of movement of agricultural products throughout the territory of EU member states;
- giving preference to agricultural products produced in EU countries;
- protection of the EU internal market from the receipt of cheap products from third countries;
- application of uniform prices for agri-food products and a mechanism that contributes to their stabilization, financial solidarity in the costs of implementing the common agricultural policy.

India and China are the world's largest producers of several major agricultural commodities. Countries' accession to the WTO has played an important role in this. This was facilitated by:

- development and implementation of state programs for the development of agriculture, the social infrastructure of rural areas, and the formation of human capital for the agricultural sector of the economy;
- active support of agricultural producers, mostly small farmers, by providing state subsidies for the purchase of resources, premium subsidies, and other forms of financial support for agricultural insurance (Klapkiv, 2016; 2020), support of domestic prices, and the implementation of environmental measures;
- introduction of intensive methods of agricultural development through the use of innovative technologies;
- active participation in international trade in agricultural products and food, a significant increase in imports to meet domestic needs;
- conducting a balanced policy of customs regulation aimed at protecting the interests of domestic producers and consumers of food, and supporting exporters of agricultural products, provided that the national priority of food independence of the country.

Globalization puts the environmental dimensions of the economic activity of agricultural enterprises in one of the leading places. In this aspect, export-oriented enterprises need to consider key theses:

- strengthening global requirements for various aspects of environmental impact in the implementation of production activities;
- expansion of potential market segments due to the promotion of organic food.

World trade in organic food over decades of active development has acquired characteristics and features that are uncharacteristic of the sectors of genetically modified and traditional goods. Since the effective demand for higher-value organic food is mainly concentrated in highly developed countries (EU, USA), the flows of world trade in organic food are directed here. That is, organic products fall mainly in countries with a high degree of food security. Developing countries, seduced by the high price of organic products, also export high-quality products to developed countries, although they have significant domestic food problems.

A feature of the organic market is high prices for goods, which take into account several factors that do not play a role in shaping the price of traditional goods, namely: environmental protection and improvement of environmental conditions (the desire to avoid future costs of combating environmental pollution); higher requirements for cattle breeding; combating the risks to farmers' health associated with the misuse of pesticides (as well as the desire to avoid future medical costs); rural development by creating additional jobs on farms and ensuring high incomes of producers.

The high price of organic goods has several reasons: demand far exceeds their production; they have a limited shelf life, require special processing and transportation; marketing and delivery are more expensive due to their small volumes and long chains of intermediaries. In addition, there is a natural fluctuation in prices during the year, primarily due to seasonal harvests. The price also includes the cost of certification, inspection. The production costs of organic agriculture are much lower than in traditional production.

Organic agricultural products have lower yields than traditional ones, but this fact is offset by the fact that the prices of organic goods are much higher. Excluding the difference in prices for organic and traditional goods, organic farms earn more than traditional ones due to lower variable costs. Taking into account the high level of prices and state aid to organic agricultural farms leads to a significant increase in profits.

Organic agricultural production significantly affects the social component of rural areas through the creation of additional jobs. Organic farms are often forced to compensate for the impossibility of using synthetic fertilizers and chemicals by hiring more workers. The amount of such additional labor varies for different regions, farms, and crops, but in general, the workforce for organic farms is usually 10–20% larger than for traditional ones. Also positive is the fact that organic producers use the method of crop

rotation of grain crops, plan their sowing and cultivation throughout the year to preserve the integrity of the ecosystem and soil health. And this creates all the conditions for permanent employment, not seasonal, as in traditional agriculture.

Thus, organic production of agricultural goods is a stimulus to economic development, rural development, creates additional jobs, and increases the income of the rural population. In addition, the organic type of production does not remain outside the solution of the problem of food shortages. Given the lack of need for significant expenditures on agrochemicals, it is considered more affordable for small farms and makes them self-sustaining and independent. The priority of traditional agriculture is high yields, but without taking into account the impact on the environment. This leads to climate change, soil and water pollution, negative impact on the biodiversity of the area. In contrast, organic agriculture uses an approach to soil management that preserves the integrity of the ecosystem. Soil conservation is the basis of organic agriculture, which promotes the development of soil flora and fauna, improves soil composition and structure, creates more stable ecosystems.

Thus, organic agriculture also affects food security. Organic production improves access to food by reducing the risk of various diseases. The issue of yield, in the long run, is decided in favor of the organic producer. This type of economy is a more stable system because it ensures the health of the environment.

CONCLUSIONS

The main trends in the development of the global food problem and ways to solve it are identified, in particular:

- aggravation of the problem of food shortage in the world;
- strengthening global imbalances in food production and consumption, increasing instability in world food markets;
- the role of international food trade is growing in the solution of the world food system. At present, almost 30% of the world's food and raw materials go to consumers through foreign markets;
- cereals play a key role in shaping food market trends, as their share in the value structure of world exports is 18%;
- one of the main trends in the functioning of the world food system of the 21st century is the penetration of genetic modifications (agricultural biotechnology) into the industry of new products.

A characteristic feature of the modern development of the world food system is its greening, which is expressed in the formation and implementation of special regional programs of organic farming, development of organic nutrition standards, development of educational and training projects to protect the environment of agricultural production.

Thus, the modern world food system is formed under the influence of natural, economic, technological, trade, and political, social, environmental parameters. There is a significant gap in the level of development of food systems in highly developed and developing countries. The priority of the effective functioning of the global food system is to provide the world's population with food, which requires equalization of the development of national agricultural sectors, their integrated interaction with the natural environment, ensuring the conservation of biological diversity and food resources of the earth.

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DRIVING FORCE OF ORGANIC FARMING IN THE CZECH REPUBLIC – MARKET DEMAND OR FINANCIAL SUPPORT?

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ABSTRACT

In the Czech Republic, and possibly in many other eastern European countries, organic production still has potential for further growth. Over the past three decades, organic farming has become an essential alternative to farming practices. An increase was observed among acreage, the number of farms, and also consumer spending on organic production. After the EU accession, organic farming became part of the agricultural policy related to other than production function and therefore supported by EU finance. The contribution aimed to derive which of the two factors was more important for organic farming expansion – the pull factor (market demand) or the push factor (financial support). Using Pearson's correlation coefficient stronger relationship was observed for financial aid, which was a driving force for the organic agriculture spread in the Czech Republic.

Key words: correlation, Czech Republic, organic agriculture, financial support, organic market
JEL codes: Q13, Q14, Q18

INTRODUCTION

Sustainability is a crucial topic in today's agricultural policy discussion. The agrarian sector struggles to follow the growing global population and rising global demand. Besides, agriculture must reduce negative environmental impact (Thematic Group on Sustainable Agriculture and Food Systems, 2015). Increased demand for food triggered innovations in agriculture. The development of science and new technologies supported the production of high-yielding varieties. The use of chemical fertilisers and pesticides stabilised yields (Savari Ebrahimi-Maymand and Mohammadi-Kanigolzar, 2013); however, problems occurred alongside innovations applied. Namely, the farming sector contributes significantly to Green House Gasses pollutants (Johnson et al., 2007). All segments of agriculture have management options that can reduce agriculture's environmental footprint (Johnson et al., 2007). Organic production systems are closer than other low-input methods to the definition of a sustainable system (Hall et al., 1989). At the same time, there are socio-economic and environmental benefits related to organic farming (for ecological benefits, see Häring et al., 2001; Reganold and Wachter, 2016; Smith et al., 2019).

Socio-economic benefits include higher labour intensity resulting in a higher number of employees (Green and Maynard, 2006). Häring et al. (2001) concluded that organic and conventional farms have

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comparable income. Vlašicová and Náglová (2015) concluded that organic winemaking enterprises have higher profitability and higher solvency. On the contrary, according to Offermann and Nieberg (2010), profitability per hectare is generally lower on organic farms and material, energy, fertilisers, and pesticides costs (Mäder et al., 2002). Charges related to wages and salaries are higher in organic farms (Offermann and Nieberg, 2010; Aulová and Frýdlová, 2012).

In the European Union, about 10 million farms are employing more than 22 million people. In the countryside, many more jobs are linked to farming in upstream and downstream sectors. Farming specifics and expectations to produce public goods contributed to the specially designed policy targeted on the multifunctionality of agriculture, implementing the number of Community objectives beyond the traditional concept of agriculture related to food production (Weiss and Bitkowska, 2014).

The European Union supports organic farming as part of its environmentally oriented agricultural policy. The EU allows farms to make their own decision on transformation related to organic agriculture. Total acreage under organic practices has constantly been growing over the last three decades (Willer and Lernoud, 2015; Willer et al., 2020). In 2018, organic agriculture was represented by about 330 thousand producers and covered 7.7% of total EU farmland. Total EU organic sales exceeded 37 billion EUR in 2018. The average spending of the EU consumer for organic products was counted to be about 76 EUR, compared to 43.8 EUR in 2013. The EU accounted for about 37% of the global organic food and drink market (Willer et al., 2020).

The main aim of the paper is to clarify which of the two factors is more critical for farms' transformation to organic production. The two factors targeted are (i) the push factor – financial support; and (ii) the pull factor – market demand.

MATERIALS AND METHODS

The article uses secondary data available related to organic farming. Most of the data were sourced from the Czech Ministry of Agriculture, Eurostat, and European Commission and reports of the Research Institute of Organic Agriculture (FiBL). Time series are related to data availability. The strength of factors affecting farmers' motivation to start with organic farming was measured by the correlation matrix. Following data were used (i) organic acreage (1990–2018); (ii) several farms (1990–2019); (iii) special and targeted financial support provided for organic entities sourced both from national and EU sources (1998–2019); (iv) organic products consumption (2005–2019). The data were processed using Pearson's correlation coefficient ($\alpha = 0.05$) using the MS Excel data analyses tool. To unify time series, correlation matrix analyses used 2005–2019 data ($df = 13$). Unfortunately, the total volume of support (incl. supportive measures available to conventional farms as 1st pillar of CAP; Areas facing natural or specific constraints – ACN; etc.) provided to farms was not reachable.

Corporate farms were not included, as they have a particular position related to size. Average Annual Growth Rate (AAGR) was calculated as the geometric mean of individual annual growth rates. The yearly average CZK/EUR exchange rate was used, published by the Czech National Bank.

RESULTS AND DISCUSSION

First organic farms operating in the Czech Republic/Czechoslovakia were observed in 1990. Just after the Velvet Revolution (1989) and market orientation first three farms acreage under Organic farming reached 480 ha. Since then the positive development has been observed (Fig. 1). In 2018, 4 606 organic farms managed almost 540 thousand ha, i.e. 14% of utilised agricultural land. The increase of land converted into organic is highly correlated to support provided. Initial financial support measures were released between 1990 and 1992. However, the first comprehensive subsidy program helped non-productive functions being in force between 1998 and 2003. The first comprehensive support resulted in a significant increase in acreage. Between 1997 and 1998, the acreage of farmland under Organic agriculture more than tripled from 20 to 71 thousand ha. After joining the European Union in 2004, support for organic farming mainly was provided from CAP resources.

Total support for organic farms increased over time. As seen in Table 1, in 1998, complete support sourced by organic farms exceeded 1 million EUR. After the EU accession, a continuous increase in farms and their acreage resulted in the increased value of support provided. In 2010 the total value of support exceeded 50 million EUR and since then has increased only slightly. Values expressed in Table 1 do not precisely present continuous increases, but the volatility of the Czech currency influences presented values. In 2019, the Ministry paid out special organic farm support of almost 57.3 million EUR.

Arable land and permanent grassland have an equal share in the EU. Both land categories cover about 40% of the land used under organic production (Willer et al., 2020). However, in the Czech Republic (Table 2), most organically managed land is permanent grassland representing more than 80%

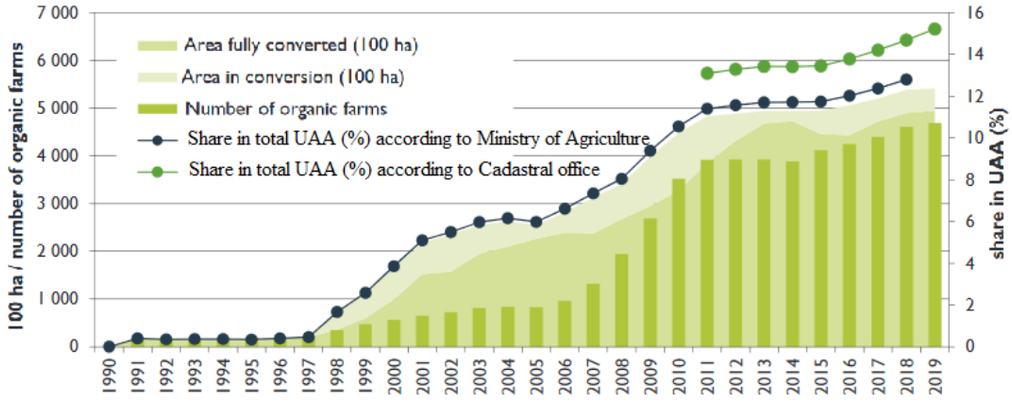

Figure 1. Development in total of acreage, number of organic farms and share of total agricultural land

Source: Ministry of Agriculture of the Czech Republic (2020).

Table 1. Total value of targeted support to organic farms, the Czech Republic

Support	Year										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Million EUR	1.30	2.28	2.50	4.93	6.85	7.26	9.75	10.24	10.59	19.45	27.75
Support	Year										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Million EUR	37.43	45.99	50.43	50.84	48.59	46.20	48.46	49.28	52.83	53.94	57.22

Source: the authors' elaboration based on the Ministry of Agriculture of the Czech Republic (2020).

Table 2. Land types under organic management, the Czech Republic

Land use	2005	2019	2005	2019
	ha		%	
Arable and crops	20 766	90 530	8.1	16.7
Permanent grassland	209 956	443 985	82.3	82.1
Permanent crops	820	6 265	0.3	1.2
Other	23 440	214	9.2	0.0
Total	254 982	540 994	100.0	100.0

Source: the authors' elaboration based on the Ministry of Agriculture of the Czech Republic (2020).

of organic acreage located mainly in mountainous border regions. Other land types under organic management have low significance. A positive trend is observed among arable land as its share increases slowly. Total acreage almost quadrupled between 2013 and 2018. Distribution of land types informs about farming management – organic farms are instead focused on extensive farming practices rather than on intensive production. However, an increasing share of arable land is a positive sign for other increased intensive farming practices. The average Organic farm managed about 115 ha in 2019 while continuously decreasing. In 2005, the average organic farm was operated on about 307 ha.

The share of organic food consumption in the Czech Republic is around 1.2%. In contrast, the market in Denmark was about 13.3%, Sweden and Austria close to 9%, France, Germany and the Netherlands close to 5%. This only presents the market potential for organic value-added production. As observed in Table 3, certain commodities do not have the potential yet to be sold as organic (goat, lamb, beef, grapes, leaf vegetable, oilseed, etc.). At the same time, others are already well accepted and demanded by the consumers (eggs, cow milk, honey). Also, as presented in Table 4, there is an increasing trend in organic fruits and vegetable consumption (+11% annually) and in bakery, confectionery and other flour products (about 15% annual increase). Also, the potential for further sales is observed in other marketing channels than supermarkets and hypermarkets. Although the market power of large retail chains is significant, over a decade, their importance declined (Table 4). The increasing importance of organic food outlets is observed among gastronomy, independent retail, e-commerce, and direct farm-gate sales.

In 2016, 96% and in 2017 95% of organic farms were profitable. The profitability of organic farms is mainly given by available support provided by Rural Development Funds (presented in Table 5). Those are being provided to farms certified as organic and farms being in the transition period from conventional to organic farming (2 years for arable lands, three years for permanent crops like hops, vineyards, orchards). The difference in supportive values is explained mainly by labour and technical requirements related to organic agriculture. Permanent crops are supported the most, while grasslands and fallow lands are supported the least. Other supportive measures are related to project calls and target innovations, diversification of activities, supporting rural tourism, young farmers, cooperation among farmers to share machines and facilities (Table 6). In all those cases, organic farmers are given a bonus for project evaluation. This bonus increases the chances of success in the project selection process. Financed projects submitted by organic farms were granted more than 28 million EUR (about 32% of all awarded projects).

When observing the great growth history of the organic market (growing over 10% annually – Table 4) and the increase of acreage and number of farms under organic management, the question

Table 3. The utilisation of organic food, the Czech Republic, 2019

Product	Sold as organic (%)	Product	Sold as organic (%)
Cereals	78	Pears	68
Legumes	71	Grapes	50
Potatoes	94	Beef meat	41
Oilseeds	73	Lamb	14
Herbs	61	Goat meat	2
Cruciferous vegetables	35	Pork	56
Leaf vegetables	53	Poultry	91
Fruit vegetable	84	Cow milk	83
Root vegetables	99	Eggs	98
Apples	81	Honey	100

Source: the authors' elaboration based on the Ministry of Agriculture of the Czech Republic (2020).

Table 4. Organic food – indicators (2007–2018), the Czech Republic

Specification	2007–2009 average	2010–2012 average	2013	2014	2015	2016	2017	2018	AAGR (%)
Total turnover with organic food, including exports (million EUR)	67.7	89.9	104.7	115.9	136.7	155.0	216.5	273.8	16.7
Organic food consumption in CZ (million EUR)	59.8	67.3	75.1	73.4	82.5	94.3	126.5	172.8	12.7
Consumption per person per year (EUR)	5.8	6.4	7.1	6.9	7.8	8.9	11.9	16.2	12.3
Share in organic food turnover									
Supermarkets/hypermarkets	70.2	68.6	67	57.4	60.9	61.8	58	51.1	–2.5
Independent retail	2.3	1.3	1.6	1.7	4.2	2.9	3.0	2.1	–1.6
Farm gate sale, direct sale	2.4	4.9	8.9	6.7	7.0	7.3	5.4	9.5	15.2
Gastronomy	0.6	0.8	1.4	2.9	3.2	3.4	3.0	4.7	22.6
e-Shops	N/A	N/A	N/A	3.4	7.8	6.7	14.1	8.0	23.9
Share of product category on total consumption									
Meet and meet products	7.0	8.4	6.9	8.2	6.9	5.1	5.9	4.6	–2.7
Fruit and vegetable	7.5	12.7	16.1	13.7	12.6	21.3	22.5	17.3	11.2
Milk and dairy products	21.4	21.5	18.2	22.0	20.0	23.0	17.5	20	–0.4
Mill and starch products	6.1	9.5	11.7	8.2	7.5	4.8	4.9	2.5	–7.7
Bakery, confectionery and other dairy products	4.9	9.0	9.2	9.4	7.3	6.2	5.9	7.6	15.2
Other processed foods	43.7	34.1	33	33	37.1	33.2	36.4	41.4	–1.6

*Growth rate of e-commerce measured between 2014 and 2017.

Source: the authors' elaboration based on the Ministry of Agriculture of the Czech Republic (2020).

Table 5. Supporting organic farming, per hectare values, the Czech Republic, 2019

Commodity type		Transitional period (EUR/ha)	Organic farming (EUR/ha)	2014
Permanent grassland		84	83	71 / 89
Arable land	Vegetables or herbs	536	466	564
	Strawberry	669	583	X
	Grass for seed	265	180	X
	Other crops	245	180	155
	Grassland	79	69	X
	Fallow land	34	29	X
Permanent crops	Orchard – intensive	825	779	849
	Orchard – other	419	417	510
	Vineyard	900	845	849
	Hops	900	845	849
Another permanent culture with an ecologically significant element of landscaping		165	165	X

Source: the authors' elaboration based on the Ministry of Agriculture of the Czech Republic (2020).

Table 6. Additional project support provided, the Czech Republic, 2018

Specification	Number of projects	Support (million EUR)
Investment in agricultural holdings	568	14.63
Processing and marketing of agricultural products	61	2.57
Aid for setting up of young farmers	100	4.68
Investments in non-agricultural activities	49	2.42
Support for rural tourism	27	2.68
Cooperation for development of new products, processes and technologies	1	0.98
Cooperation among small operators in organising joint work processes and sharing facilities	4	0.54
Total	810	28.48

Source: the authors' elaboration based on the Ministry of Agriculture of the Czech Republic (2019).

Table 7. Data input for the correlation analyses, the Czech Republic

Year	Support (million EUR)	Consumption (million EUR)	Number of farm	Acreage (ha)
2005	10.24	17.1	829	254 982
2006	10.59	26.8	963	281 535
2007	19.45	46.5	1 318	312 890
2008	27.75	72.2	1 946	341 632
2009	37.43	60.9	2 689	398 407
2010	45.99	63.3	3 517	448 202
2011	50.43	67.9	3 920	482 927
2012	50.84	70.8	3 923	488 483
2013	48.59	75.1	3 926	493 896
2014	46.2	73.4	3 885	493 971
2015	48.46	82.5	4 115	494 661
2016	49.28	94.3	4 243	506 070
2017	52.83	126.5	4 399	520 032
2018	53.94	172.8	4 606	538 223
2019	57.22	200*	4 690	540 993

*Own estimations.

Source: the authors' elaboration based on the Ministry of Agriculture of the Czech Republic (2020).

remains – was the market demand driving a transformation of farms from conventional farming to organic? A combination of information from Tables 3 and 4 provides a partial answer. As mentioned above, organic agriculture is extensive, employing a lot of pastures for grazing livestock (cattle, sheep, goat) production. However, produced meat is not sold afterward as organic. Only 41%, 14%, and 2% of beef, lamb, and goat meat produced were sold as organic in 2019. A better situation is observed among intensive crops.

The processed correlation analyses support that financial support was a more important driving force for organic expansion than increasing demand (Tables 7 and 8). Although time series was not as long as desired, the push factor (supportive financial measure available) had a higher impact on the growth of farms number ($r = 0.989$)

Table 8. Correlation for data range 2005–2019, the Czech Republic

Relationship	*r*	*t*-statistics	*p*-value (2tail)	Statistical sign.
support (x_1) – number of farms (y_1)	0.9895	24.7260837	2.57512e-12	yes
support (x_1) – acreage (y_2)	0.9864	21.65880074	1.38669e-11	yes
consumption (x_2) – number of farms (y_1)	0.7494	4.080825231	1.30e-03	yes
consumption (x_2) – acreage (y_2)	0.7521	4.114764682	1.22e-03	yes

Source: own calculations.

and acreage ($r = 0.986$) than the market had itself on farm number ($r = 0.795$) and acreage ($r = 0.752$). All values are statistically significant at $\alpha = 0.05$.

CONCLUSIONS

In the Czech Republic, and possibly in many other eastern European countries, organic production still has potential for further growth. As proven above, the farming transformation was mainly driven by available funds rather than market demand. Extensive farming focused on pastures and cattle production is possibly not the perfect path – from the viability point of view. A lot of produced beef is not sold as organic due to market oversupply. On the contrary, we observed slow but increasing total acreage dedicated to crop production.

For the next multiannual financial framework of the EU (2021–2027), the total amount of funds dedicated to the Common Agriculture Policy will be lowered. The share of organic food consumption in the Czech Republic is around 1.2%. It is evident that Czech consumers still do not spend as much on organic produce as consumers in western European countries. Still, a rapid future increase is expected (historically, there was about a 10% average growth rate). Farming newcomers still can find their niche market and success. In the past, the transformation from conventional to organic practices was simplified by available subsidies and grants. The situation is expected to remain, but the pull factor (market demand) importance is expected to play a more critical role as farm-gate sales, e-commerce and hotel, restaurant, and coffee outlets are the future drivers of organic market development. As those expectations are not supported by any data or research, there exists a possible niche for further investigation.

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FORMATION OF THE DEVELOPMENT STRATEGY FOR THE BIOECONOMY IN UKRAINE

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ABSTRACT

The article examines the role of the bioeconomy in the formation of priorities for the economic development of Ukraine. It is determined that the primary goal of the bioeconomy is the optimal use of renewable biological resources and the creation of sustainable manufacturing systems for new products. It is noted that Ukraine belongs to the countries with high bioeconomic potential, the source of which is the production of biomass of agricultural origin that creates favorable conditions for the development of the bioeconomy. The dynamics of biomass production potential are characterized by a stable increase in the amount of biomass available for use, and its energy capacity is analysed. Using the methodology of 'smart specialization', a model of strategy formation was developed, which defines the priorities, goals, and objectives of the bioeconomic development of Ukraine's economy.

Key words: bioeconomy, agriculture, biotechnologies, bioresources, strategies
JEL code: Q570

INTRODUCTION

The issue of the development of the bioeconomy is one of the most relevant scientific studies of socio-economic policies throughout the world. The emergence of a bio-oriented economy is crucial for the modern agricultural sector.

For Ukraine, the implementation of bioeconomic measures remains relevant, as it helps create a more innovative, resource-efficient, and competitive economy. It involves shifting production to the rational use of natural resources, organic farming, and energy-saving technologies while reducing the industrial impact on the environment and improving its quality. The strategy based on the principles for utilizing renewable bioresources using modern innovative technologies aims to reach a compromise among the economy, society, and nature protection in the long run.

The purpose of the study is to determine the priorities and detect strategic directions for implementing the strategy for the bioeconomic development of Ukraine. The main task of this study is to outline the possibilities for the development of core sectors of the economy on a bioeconomic basis.

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THEORETICAL BACKGROUND

The modern market economy is characterized by innovative methods of production and distribution of goods and services. Today it can be stated that new knowledge and innovation significantly influence the economy and society. One of the modern trends demonstrating the impact of innovation is the emergence and rapid development of bioeconomics (OECD, 2009).

In the EU strategy for development, the bioeconomy is presented as a strategic, integrative, intersectoral form of activity corresponding to an interdisciplinary approach to principles of research planning and funding. The scope of the bioeconomy refers to energy obtained from renewable sources and production processes in industries such as textiles, paper, chemical, cosmetic, and pharmaceutical (Wicki and Wicka, 2016). The concept of bioeconomy does not imply the development of new industries in the global and European economies. Its essence boils down to creating efficient systems of use of renewable biological resources based on a combination of existing sectors of primary production and processing. These systems should allow not only for the better use of what we already can produce but also for the efficient use of those resources, which we currently cannot use efficiently. It is assumed that the development of the bioeconomy in the coming years will be an important factor stimulating the growth of the European and global economy (Gołębiewski, 2016).

The bioeconomy forms the basis for modern directions in economic development. It is grounded in the widespread use of biotechnology and biologically renewable resources for production (Rogach, 2019). In 2012, the European Commission adopted the new, extended, and more sophisticated definition of bioeconomy, published in the 'Innovating for sustainable growth: A bioeconomy for Europe' strategy. That document defines a bioeconomy as 'an economy using biological resources from the land and sea as well as waste, including food wastes, as inputs to industry and energy production, it also covers the use of bio-based processes to green industries' (Łuczka, 2018).

The main goal of the bioeconomy is the optimal use of renewable biological resources, creating the fundamentals for sustainable manufacturing and processing systems that will allow to produce food and non-food products at a lower cost, reduce a negative impact on the environment, and establish waste-free production. The main components of the bioeconomy refer to the use of renewable biomass sources (Kravchuk, Kilnitska and Tarasovich, 2018).

MATERIALS AND METHODS

The purpose of the study is to analyse the possibilities for the implementation of the bioeconomy in Ukraine. The study was conducted using various international and national sources of information such as:

– The State Strategy for the Regional Development of Ukraine for 2021–2027;
– research devoted to the international experience in the implementation of development strategies for the bioeconomy;
– research related to the scientific, legislative, and resource base for the bioeconomy development in Ukraine;
– statistical yearbooks on agriculture in Ukraine 2018–2019;
– materials of the Bioenergy Association of Ukraine.

The following methodological approaches were used in the course of this study:

1. The system analysis method helped to study the dynamics of the energy capacity of biomass in Ukraine and analyse strategies for bioeconomy development in the G7 and the EU countries.
2. The modelling method that was used to describe a strategy for the development of the bioeconomy in Ukraine.

RESULTS AND DISCUSSION

The main components of the bioeconomy are based on the use of renewable biomass sources for sustainable production, environmental protection, and the integration of biotechnological knowledge in different sectors of the economy. The bioeconomy establishes interrelations between industries due to technological innovations that enable the broad conversion of inputs and production waste management. As a result, the bioeconomy integrates diverse elements,

including processes, ecosystems, industries, innovations and technologies, raw materials, and finished goods to meet the consumers' growing expectations (Kravchuk, Kilnitska and Tarasovich, 2018).

The bioeconomy of agricultural systems comprises agricultural biomass and biotechnology. The source of biomass is crop production, and Ukraine is one of the countries with high bioenergy potential. According to statistics, since 2015, Ukraine has produced more than 60 million tons of grain annually, and in 2019 it exceeded 70 million tons. During the same period, the annual gross harvest of sunflowers amounted to more than 10 million tons, and in 2019 it reached over 15 million tons. The production of other crops, which are also a source of biomass, is increasing. Moreover, Ukrainian grain resources are basic bioproducts that are used as raw materials for the production of ethanol and bioethanol (State Statistics Service of Ukraine, 2019).

The life cycle of biofuels from agricultural biomass begins in the field. Therefore for the sustainable operation of bioenergy projects, it is vital to encourage agricultural producers and create appropriate conditions for the procurement and supply of specified volumes of energy raw materials (Kucher, 2019).

Analysis of the dynamics of growth of theoretical and energy potential of biomass and calculations (Fig. 1) showed an increase in the amount of biomass available for use for bioenergy purposes from 106.4 million tons in 2015 to 131.1 million tons in 2018, which is 23.2%. The energy potential for the corresponding period increased by 3.46 million tons of oil equivalent (toe), which is equal to 32.8%. It indicates a substantial increase in opportunities to implement bioeconomic principles in the economy of Ukraine.

Various strategies for the development of the bioeconomy are utilized throughout the world. The bioeconomy strategies in the European Union (EU) are based on three pillars:

1. Investments of the EU, national and private funds in the research devoted to the bioeconomy, innovation, and skills as well as strengthening synergies with other actions.
2. Policy interaction and coordination with stakeholders through the monitoring of the bioeconomy.
3. Market development and increasing the competitiveness of the bioeconomy sectors through sustainable development of primary production; by converting waste into value-added products, and through mutual learning mechanisms (Łuczka, 2018).

An analysis of the G7 bioeconomic policy has shown that in recent years the bioeconomy has become an essential component for innovation and economic policy in developed countries. Most of them involve measures to promote technological innova-

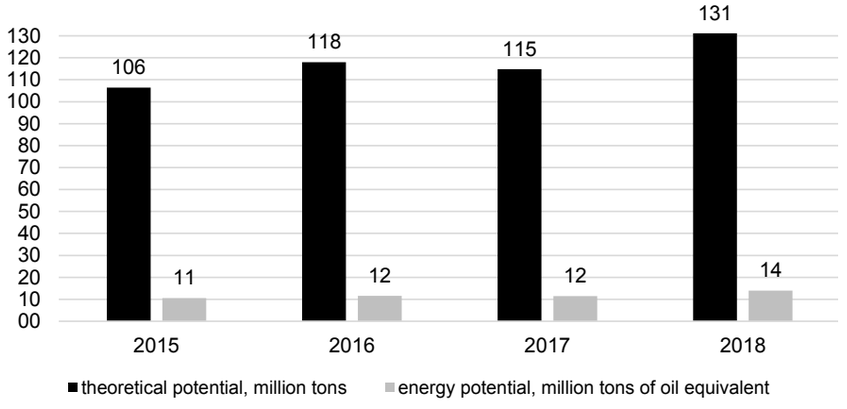

Figure 1. Theoretical and energy potential of biomass in Ukraine

Source: formed by the authors based on Geletukha, Dragnev and Kucheruk (2017); Vinikaytis and Geletukha (2018); UABIO (2018), Geletukha, Zhelezna and Dragnev (2019).

tion, economic growth, environmental sustainability, and productive efficiency.

However, the main differences in approaches to bioeconomic policy among the G7 members should be revealed. For example, the United States, Germany, and Japan have developed strategies with detailed plans to promote the use of biomass and life sciences for various purposes. Other countries, such as Italy and Canada, are pragmatic and seek to use the existing private and public research initiatives (German Bioeconomy Council, 2020). The bioeconomic strategy of Poland focuses on three areas: investment in research and innovation, strengthening the role of government policy, bolstering markets, and the competitiveness of the bioeconomy (Gołębiewski, 2016).

The proposed model of forming the strategy of the bioeconomy development in Ukraine is aimed at creating an innovative, resource-efficient, and competitive economy that combines food security with the sustainable use of renewable energy sources and resources for industrial purposes (Fig. 2).

The model defines priorities of bioeconomic development, particularly eco-innovation, ecological development, ecological agriculture, renewable energy,

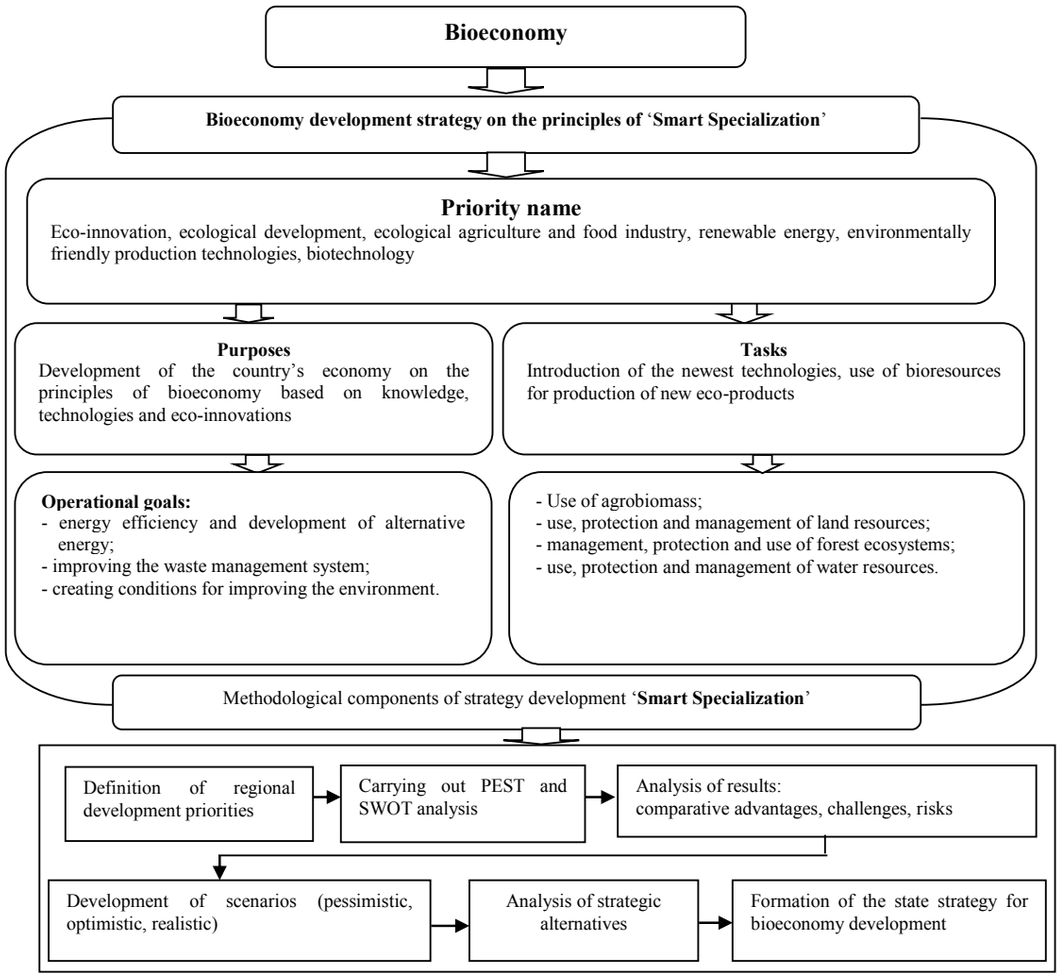

Figure 2. Model of formation of the state strategy for the bioeconomy development in Ukraine

Source: developed by the authors.

environmentally friendly production technologies, biotechnology. The 'smart specialization' method was used in the development of the strategy model. Among the priorities presented in the model, Ukraine already achieved the steadily growing energy potential for renewable energy, started organic production, and thermal energy production from biomass, which is favourable for the development of the bioeconomy.

Improving the system of strategic planning of regional development is one of the main tasks of state regional policy. The methodology of regional development planning in Ukraine using the smart specialization approach is a tool for developing regional development strategies and action plans for their implementation. Smart specialization is a strategic planning approach that provides for the definition of individual goals and objectives within the regional strategy, taking into account the competitive advantages of the region for the development of economic activities that have innovative potential. These are plans developed at the regional and national levels, which determine the priorities of regional development in the field of research and innovation, as well as those sectors of the economy that may become the most promising in the future.

The main principle of the smart specialization strategy is a local approach, which means that it draws on the assets and resources available to the regions and their specific socio-economic challenges, to identify unique opportunities for development and growth. So, the smart specialization strategy integrates key aspects of life and development of regions, in particular, economic, social, environmental, and technological, supporting their continuous interaction and promoting innovation and regional development (Ministry of Communities and Territories Development of Ukraine, 2018).

The rapid development of the bioeconomy will be facilitated by the implementation of a set of measures provided by the State Strategy for Regional Development for 2021–2027, which determines the general vector of sustainable development of regions and the economy as a whole (Kabinet Ministriv Ukrayiny Postanova vid 5 serpnya 2020 r. No 695). Hence, it is essential to ensure financial support, provide technical regulation, create incentives for the formation of branches of the bioeconomy, construct the necessary technological infrastructure, and revive demand for production.

CONCLUSIONS

The European Commission's 2012 Strategy 'Innovation for Sustainable Bioeconomy for Europe' defines the bioeconomy as an economy that uses biological resources as an investment in the industry to produce food and non-food products and energy. The main components of the bioeconomy are the use of renewable biomass sources. In Ukraine, the accelerated development of the bioeconomy will be facilitated by the implementation of a set of measures envisaged by the State Strategy for Regional Development for 2021–2027, which determines the general vector of sustainable development of regions and the economy as a whole.

The results of the study indicate that the goals of the bioeconomy include the following: the optimal use of renewable biological resources and creation of sustainable production systems based on them; the assistance in re-equipment of production referring to modern, energy-efficient, resource-saving, and ecologically safe technologies; the creation of an innovative economy that combines food security with the sustainable use of renewable energy sources and resources to produce new products.

The proposed model of the development strategy for the bioeconomy will ensure the development of all regions of Ukraine in terms of the optimal use of available renewable biological resources and the application of innovative production methods that balance the interests of the economy, society, and nature protection because the basic principle of smart specialization strategy is a local approach, which means that it relies on the assets and resources available to the regions and their specific socio-economic challenges to identify unique opportunities for development and growth.

Further research should be related to the establishment of mechanisms and recommendations for the development of the bioeconomy in Ukraine.

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THE ROLE OF BIOMASS IN THE BIOECONOMIC POLICY OF UKRAINE AND ITS LEGAL REGULATION

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ABSTRACT

The article examines the need and possibility of introducing bioeconomy in the management system of the national economy, in the context of the focus on sustainable development through the use of the most modern techniques and technologies for the use of biomass. It is determined that the key role in the development of a new direction of the country's economy is played by the agricultural sector, as the bioeconomy of agricultural systems is based on agricultural biomass and biotechnology. Optimization of agricultural biomass flows is one of the components of bioeconomy development. It is noted that, given the significant natural and economic, raw material research and production potential and state support, Ukraine has great opportunities for bioeconomy development based on the production of environmentally friendly bioenergy products through the efficient use of agricultural biomass. The legal bases of the state management of the bioeconomic development of Ukraine are stated.

Key words: bioeconomy, biotechnologies, innovations, agricultural biomass
JEL code: Q570

INTRODUCTION

The issues of formation and development of the bioeconomy have recently become one of the most relevant in the programs of a social-economic policy of countries around the world. The place and role of the bioeconomy in solving the global problems of mankind are outlined in the strategic programs of the transition to the bioeconomic direction of national economies of the EU and other countries (German Bioeconomy Council, 2020).

The priority areas of the bioeconomy are the creation of preconditions for the economic use of natural resources, minimization of environmental risks, the

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spread of organic farming, and the use of energy-saving technologies. The development of the bioeconomy is an extremely important direction for Ukraine, which has significant relevant potential and state support.

The purpose of the study is to analyse the current state and prospects of biomass production and determine its role in the development of the bioeconomy.

THEORETICAL FOUNDATIONS

The concept of bioeconomy as a new paradigm of economic development is a field of study of domestic and foreign scientists.

Bioeconomy is a new direction of economic development, which re-uses and recycles secondary raw materials, including waste, creates conditions for multiple, cyclical use of resources, ensuring the social-economic development of the country. The use of biotechnology creates the basis for the formation of the bioeconomy as a system that creates biological resources for the production of high-tech products (Buhaichuk and Hrabchuk, 2018).

The potential for more biomass from agriculture for various biological activities can be enhanced by stimulating the development of rural areas in Central and Eastern Europe, where small semi-enterprises still predominate in some regions. In addition, double pruning can significantly increase biomass yield (Ronzon and M'Barek, 2018).

The concept of bioeconomy demonstrates how to pave the way for economic transition, which will create conditions for optimal use of renewable biological resources and enable the development of sustainable production and processing systems. This will allow for a wider range of products, using fewer resources and providing a less negative impact on ecosystems (Gołębiewski, 2016).

MATERIALS AND METHODS

Analysis and assessment of the state of development of the agricultural biomass market, as one of the important components of the bioeconomy, were aimed at studying the possibilities of implementing the bioeconomy direction of economic development in Ukraine.

The following documents and materials were used in the research process:

- Directive (EU) 2018/2001 of the European Parliament and of the Council;
- documents of the Verkhovna Rada and the Cabinet of Ministers of Ukraine on supporting the development of bioenergy potential of the agricultural sector;
- materials of the Bioenergy Association of Ukraine;
- statistical collections of the Ministry of Agrarian Policy and Food of Ukraine.

In the course of this research the method of system analysis was used, which allowed:

- to study the scientific and legal principles of bioeconomy development;
- analyse the dynamics of production and use of agricultural biomass and its energy potential;
- determine the potential of agricultural biomass available for use in the future.

RESULTS AND DISCUSSION

The modern market economy is characterized by the active use of new innovative methods of production and the expansion of its range. New knowledge and results of innovative activity have found their application in various spheres of economics and social life. Many countries around the world are creating new models of innovative development, one of which is the bioeconomy. Bioeconomy defines the economics associated with the production and processing of biological resources, based on the use of biotechnology.

Bioeconomy is an evolving paradigm in which the creation, development, and revitalization of economic systems based on the sustainable use of renewable biological resources are spreading rapidly around the world in a balanced way. Bioeconomy builds bridges between biotechnology and economics, as well as between science, industry, and society, and underpins science and innovation policies developed in many countries (Aguilar, Twardowski and Wohlgemuth 2019).

Agriculture plays the role of the core of the bioeconomy, as it is the main raw material base. Bioeconomy is based on biomass and biotechnology

where the main components are renewable sources of biomass, in particular of agricultural origin.

The EU Directive defines biomass as a biodegradable fraction of products, waste, or residues of biological origin from agriculture, including plant and animal substances, forestry and related industries, including fisheries and aquaculture, and a biodegradable fraction of waste, including and municipal waste of biological origin. Agricultural biomass means biomass produced from agriculture (Directive (EU) 2018/2001).

The European Union's bioeconomy strategy, developed in 2012, placed a strong emphasis on investment in research, innovation, and skills. Optimization of biomass flows is one of the components of bioeconomy development (Ronzon and M'Barek, 2018).

Given that the agro-industrial resource is becoming a leading strategic bioresource, biomass from products produced in the agricultural sector can give Ukraine new opportunities for sustainable development through the production of cheap, environmentally friendly bioenergy products through efficient use of agricultural biomass.

To stimulate the production and use of biological fuels, the development of the national fuel market in Ukraine based on biomass as a renewable raw material for the production of biological fuels, the legal, social, economic, environmental, and organizational principles of production and use of alternative fuels stimulating an increase in the share of their use to 20% of total fuel consumption in Ukraine by 2020 (Zakon Ukrayiny vid 28 chervnya 2015 r. No 1391-VI).

The analysis for the period 2015–2019 shows that the economic potential of agricultural biomass available for energy production is characterized by an upward trend. According to the Bioenergy Association of Ukraine, in 2015 the energy potential from agricultural biomass was 8.12 million tons of oil equivalent (toe) or 40% of the total biomass potential, in 2018 it was already 10.15 million tons of oil equivalent, which was equal to 44% (Table 1).

Table 1. Energy potential of agricultural biomass for 2015–2019

Type of biomass	Theoretical potential (M tons)	Potential is available for energy (M toe)	Theoretical potential (M tons)	Potential is available for energy (M toe)	Theoretical potential (M tons)	Potential is available for energy (M toe)	Theoretical potential (M tons)	Potential is available for energy (M toe)	Theoretical potential (M tons)	Potential is available for energy (M toe)
	2015[a]		2016[b]		2017[c]		2018[d]		2019[e]	
Straw of cereals	35.1	3.65	36.1	3.75	35.6	3.65	32.8	3.36	37.5	3.84
Rapeseed straw	3.1	0.43	2.1	0.29	3.9	0.54	4.9	0.68	5.9	0.81
By-products of corn production on grain (stalks, cores)	30.3	2.32	36.5	2.79	32.1	2.45	46.5	3.56	46.6	3.57
By-products of sunflower production (stems, baskets)	21.2	1.22	25.9	1.48	23.2	1.33	26.9	1.54	29.0	1.66
Secondary agricultural waste (sunflower husk, pulp)	1.9	0.5	2.0	0.71	2.4	0.99	2.4	1.01	2.6	1.08
Total agricultural biomass	91.6	8.12	102.6	9.02	97.2	8.96	113.5	10.15	121.6	10.96
Total biomass potential		20.19		21.0		20.91		23		23.63
The share of agricultural biomass in total potentials (%)		40		43		43		44		46

Source: formed by the authors based on [a]Geletukha, Dragnev and Kucheruk (2017); [b]Vinikaytis and Geletukha (2018); [c]Geletukha, Zhelezna and Dragnev (2019); [d]UABIO (2018); [e]UABIO (2020a, b), Zhelezna (2020).

Analysis of the use of agricultural biomass for energy purposes showed that the current level of use of energy potential of biomass in the country is very low – from 0 to 2–3% depending on the specific species, and only sunflower husk showed 73.1% (Table 2).

Structural analysis of the energy potential of biomass revealed that the most frequent raw material used is sunflower husk and the least frequent are cereals and rapeseed straw. Therefore, a beneficial long-term decision would be the intensification of energy production of this type of biomass. The highest percent of biomass potential exploitation was gained by burning the straw bales (Table 3).

The main form of energy from biomass is thermal energy, which is used for energy purposes by producing thermal energy for heating and hot water supply. During 2014–2018, the share of thermal energy from biomass was within 97% of all renewable thermal energy.

Electricity from biomass is used to provide consumers with electricity. It is mainly produced at thermal power plants and biogas complexes. As of 2018, wood biomass, agricultural waste, and livestock waste were used as raw materials for the production of electricity from biomass in Ukraine. The share of electricity from biomass was about 2.2% of total renewable electricity and about 2% of the total final energy consumption of the country in 2018. The market for electricity from biomass produced by thermal power plants is the wholesale electricity market. That is, the entire amount

Table 2. The state of use of the energy potential of agricultural biomass

Type of biomass	Potential available for energy (thous. tons)			Volume already used for energy needs						Share of total potential use (%)		
				thous. tons	thous. toe	thous. tons	thous. toe	thous. tons	thous. toe			
	2015[a]	2017[b]	2019[c]	2015[a]			2017[b]	2019[c]		2015[a]	2017[b]	2019[c]
Cereal / rapeseed straw	10 540	12 258	13 604	256	95	371	130	455	157	2.4	3.0	3.3
Stems, corn cobs	12 120	12 828	18 660	3.7	1.2	15	5.0	15	5.0	0.0	0.1	0.1
Stems, baskets of sunflower	8 480	9 299	11 590	0	0	0	0	0	0	0	0	0
Sunflower husk	1 410	2 374	2 585	1 166	462	1 500	626	1 890	789	82.7	63.2	73.1

Source: formed by the authors on the basis of [a]Antonenko et al. (2017); [b]Geletukha, Zhelezna and Dragnev (2019), [c]Zhelezna (2020).

Table 3. Structure of biomass energy potential exploitation for 2017 and 2019

Type of biomass and exploitation vector	Energy potential of biomass (thous. tons)		Already used for energy exploitation (thous. tons)		Energy potential used (%)	
	2017[a]	2019[b]	2017[a]	2019[b]	2017[a]	2019[b]
Cereal/rapeseed straw:	12 258	13 604	371	455	3.0	3.3
burning (bales)	–	–	200	350	1.6	2.6
production and burning of granules/briquettes	–	–	155	100	1.3	0.7
production and export of granules	–	–	0.97	4.9	0.01	0.0
production and burning of briquettes	–	–	15	–	0.1	–
Sunflower husk:	2 374	2 585	1 500	1 890	63.2	73.1
burning (bales)	–	–	650	1 280	27.4	49.5
production and burning of granules/briquettes	–	–	300	400	12.6	15.5
production and burning of briquettes	–	–	450	210	19.0	8.1

Source: the authors' interpretation based on [a]Geletukha, Zhelezna and Dragnev (2019), [b]Zhelezna (2020).

of electricity produced from biomass, except for the own needs of thermal power plants, must be purchased by the state enterprise 'Energorynok'.

Biomass can also be used to make a variety of fuels for use in heating systems. Fuel made from biomass is a biofuel. It can be used as a fuel or a component of other fuels. Biofuels can be solid (granules, briquettes, etc.), gaseous (generator gas of gasification processes, biogas in the process of fermentation, etc.), and liquid (combustible liquids and oils in the process of pyrolysis, liquid motor biofuels in the process of hydrolysis or fermentation, etc.). All of these fuels are biological fuels. In the studied period, solid biofuel has a stable upward trend and its production in 2018 compared to 2014 increased by 54.2%. Biogas production increased 3.3 times compared to 2015 (Table 4).

The processes of transition of the national economics to bioeconomy principles should be based on the restoration of the biological value of natural resources, their rational use, the introduction of new technologies and innovations, and the use of the energy potential of agricultural biomass (Martusenko, 2017).

The amendments to the State Targeted Economic Program for Energy Efficiency and Development of Energy Production from Renewable Energy Sources and Alternative Fuels for 2010–2020 approved the amount and sources of funding in the amount of 346.73 billion UAH, including 8.42 billion UAH at the expense of state budget, 15 billion from local budgets and 323.31 billion UAH from other sources (Kabinet Ministriv Ukrayiny Postanova vid 19 chervnya 2019 r. No 556).

Reliable assessment of the potential of agricultural biomass is an important indicator of creating conditions for the implementation of bioeconomic standards in the economics of Ukraine.

Dynamics of agricultural biomass volume and the prospect thereof have been composed based on statistical data and growth rate factor (K_B):

$$K_B = \frac{B_1 - B_0}{B_0},$$

where:
K_B – growth rate factor,
B_0 – statistical indicator of previous year,
B_1 – statistical indicator of current year.

By substituting the variables with data that correspond to a certain period (Table 1) we receive the indicators that demonstrate growth or decrease of agricultural biomass volume (Table 5).

Volumes of agricultural biomass production for the future were determined using the technique of calculating the materials of previous studies of the authors (Kucher and Prokopchuk, 2019) and statistical data (State Statistics Service of Ukraine, 2019b). Based on the obtained results, the average growth rate of crop biomass for the study period 2015–2018 is 0.08 or 8%. According to the

Table 4. Dynamics of energy production and biofuels from biomass for 2014–2018

Indicator	2014	2015	2016	2017	2018
Heat energy					
Produced (thous. toe)	1 407	1 533	2 170	2 429	2 676
Share of thermal energy from biomass from all renewable thermal energy (%)	96.5	96.6	97.4	97.5	97.6
Electricity					
Produced (thous. toe)	11.0	12.0	12.0	18.0	25.0
Share of electricity from biomass from all renewable electricity (%)	1.1	1.2	1.1	1.7	2.2
Biofuels					
Solid biofuels (kJ)	99 773	108 081	138 667	147 400	153 886
Liquid biofuel (thous. tons)	26	16	6	21	4
Biogas (kJ)	–	600	1 267	1 601	1 995

Source: systematized by the authors according to the official data of the State Statistics Service of Ukraine (2016, 2018, 2019a).

Table 5. Growth rate factor of agricultural biomass growth

Year	Variable	Theoretical capacity (million tons)	Growth rate factor	Average growth rate factor
2015	B_0	91.6	–	$(K_{B1} + K_{B2} + K_{B3}) / 3 = 0.08$
2016	B_1	102.6	$K_{B1} = (102.6 – 91.6) \div 91.6 = 0.12$	
2017	B_2	97.2	$K_{B2} = (97.2 – 102.6) \div 102.6 = –0.05$	
2018	B_3	113.5	$K_{B3} = (113.5 – 97.2) \div 97.2 = 0.17$	

Source: own calculations based on Table 1.

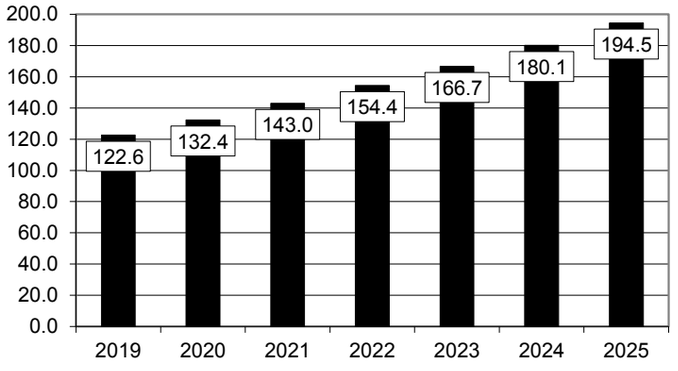

Figure 1. Potential of agricultural biomass available for use (million tons)

Source: own calculations.

results obtained in 2025, the amount of biomass for use in bioenergy may be about 194.5 million tons (Fig. 1).

CONCLUSIONS

The results of the study suggest that Ukraine has significant natural and economic, research and production, raw material potential, and legal support of the state for the development of the bioeconomy through the development of innovative technologies.

In the context of the above, for the implementation of the bioeconomic format of Ukraine's economic development, it is first necessary:

- create conditions for increasing agricultural biomass production through the development of innovative technologies;
- concentrate the efforts of scientists and practitioners on the development of basic technologies and approaches to the organization of this process;
- provide support for the development of the bioeconomy at the state level;
- based on the analysis of the components of the bioeconomy that determine its implementation, develop a concept and national strategy for the development of the bioeconomy.

Further research will focus on the experience of countries that use innovative biotechnology in agricultural production and their strategic programs for the development of the bioeconomy.

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CHANGES IN THE ECONOMIC SIZE AND PRODUCTION DIRECTION IN FARMS AS A RESULT OF INVESTMENTS IN FIXED ASSETS

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ABSTRACT

The research aimed to identify the impact of the implemented projects on the change in the economic size and direction of farms. The research used studies of the literature on the subject and data from 4 803 farms that kept continuous accounting under the FADN system in 2005–2013. The analysed economy was grouped according to the value of investment outlays in funds, economic size, and production type. Research shows that the increase in the level of investment is conducive to increasing the economic strength of farms. However, these investments must be high enough to ensure the appropriate level of difficulty. For the lower average level of questions, smaller languages are less and very small. Moreover, investments favour and accelerate the processing of farms, which may also improve their economic effects. In the analysed group of mixed-type farms, they changed the destination for the cultivation of cereals and the place of milk.

Key words: investments, farms, economic size, type of farming, farm migrations
JEL codes: E22, Q12

INTRODUCTION

Equipping farms with production fixed assets affects their economic situation. The possession of modern machinery and technical devices enables the use of new technologies, which in turn contribute to an increase in work efficiency, quality improvement, or an increase in the production scale (Gołębiewska, 2010). Undertaking investment activities in farms proves that their owners have a market orientation, increase the size of production and modernize farms (Józwiak and Kagan, 2008; Zając, 2012). The rationale for increasing the resources of machinery and equipment is the existence of potentially profitable opportunities to increase the scale of production and reduce costs by choosing more capital-intensive production methods (Begg 1998). According to Czubak (2012), investments in farms enable the renewal of fixed assets, which translates into an improvement of production processes, animal welfare, farm development, and, consequently, an increase in farm income.

The investment activity undertaken by farmers is particularly important and necessary in the modernization and restructuring of farms. The scale of undertaken investments determines the survival, development, and competitiveness of a farm in the conditions of a market economy (Hüttel, Muβhoff and Odening, 2010). Investments in fixed assets indicate

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that the farmer increases them or improves their quality, which is to contribute to increasing the farm's potential in the future. The improvement of technical means of work, as well as the introduction of modern machines and devices in agricultural production, lead to an increase in productivity in both plant and animal production.

The types of investments in farms are often determined by natural conditions and the preferred direction of production. It is related to the necessary equipment with appropriate machinery and equipment needed to conduct agricultural activity under certain conditions. Differences in equipping with production factors affect the economic strength and competitiveness of farms (Czudec, 2008). An important issue is therefore the appropriate adjustment of farm equipment to the type of production and the needs reported by farmers in this regard. Due to the importance of investments, it becomes important to determine their consequences on the development and direction of production. The research aimed to identify the impact of the implemented investments on the change in the economic size and production direction in farms.

THEORETICAL BACKGROUND

In a globalized economy that increasingly affects agriculture, to strengthen (or only to maintain) their agricultural market position and to meet the demand of buyers of agricultural primary products, the farms must take intensive investment activities that enhance the competitiveness of their products as regards both cost and quality aspects. Usually, this implies the use of an adequate process of investments in productive fixed assets, which generally are an essential way of conveying progress and innovation to the relevant manufacturing methods of agricultural primary products (Woś, 2004; Zwolak, 2010). Farm investment in agriculture is crucial to improve farm competitiveness, sustainability, and resilience (EC & EIB, 2016). The investment allows farmers to adapt to changes in economic conditions (e.g. price variations, policy reform, climate change) and to adjust to public regulations (e.g. environmental or animal welfare regulations).

According to Józwiak and Kagan (2008), the investment activities are evidence of the commercial, farm modernization, and expansion of production scale. Undertaken productive investments decide about development opportunities of farms. They show that a farmer increases assets or raises their quality, which contributes to increasing the farm capacity in the future. Improving technical work, as well as the introduction of new machinery and equipment for agricultural production leads to increased productivity in both crop production and livestock. On the other hand, lack of these actions may lead to processes that rely on reducing resource inputs, or reduce the number (or range) conducted activities (Kalinowski and Kiełbasa, 2010; Mikołajczyk, 2012). Investment in infrastructure has been cited as an important source of growth in agriculture (Jayne et al., 1994). Nelson (1964 and 1981) recognized that there are important interactions between capital formation, labour allocation, technical progress, and productivity.

The objectives of the investment measures implemented in agricultural holdings should be in line with the adopted directions of structural changes in agriculture. They involve, among others, the provision of adequate size and structure of food production, improvement of living and working conditions of the rural population, or environmental protection. The last of these issues matter to the growing importance of the concept of sustainable agriculture, strongly accentuating the model of agricultural production that is goal-oriented in terms of production and equally in the implementation of environmental and social objectives (Kowalski, 1997).

Farmers' investment decisions are influenced by investment prices (lower prices would encourage investment), as well as output prices (higher prices would encourage investment to produce more). There exist public policies directly targeting investment, e.g. subsidies for implementing specific investment projects or tax policies linked to investment. Those policies aim at decreasing investment costs. Other policies may influence farmers' investment decisions indirectly, through their impacts on market prices. It should however be noticed that in most developed countries and in particular the EU, direct intervention on output market prices has been progressively replaced by payments decoupled from production and prices.

In the agricultural economics literature dealing with farm investment, no consensus seems to emerge on the relative impacts of investment price and output price on farmers' investment decisions. Thijssen (1996), considering Dutch farms observed from 1970 to 1982, finds significant responses of investment to both investment and output prices and concludes that investment subsidies are good policy incentives to agricultural investment. On the other hand, the results obtained by Vassavada and Chambers (1986) in the case of U.S. agriculture show no response of quasi-fixed factors to their prices and a negative response to the price of output. Oude Lansink and Stefanou (1997) obtain the same puzzling effect of output price on investment in the case of Dutch cash crop farms between 1971 and 1992. Serra et al. (2009), using data for Kansas farms from 1997 and 2001, compare the sensitivity of investment to output price to its sensitivity to public payments, and find investment to be more sensitive to output price in periods of the favourable economic situation (i.e. increase in capital stocks) and more sensitive to government support in the case of the difficult economic situation.

Research in the French cultivation sector suggests that during periods of stable output prices, the level of expected output prices strongly affects farmers' behaviour, more than the level of the investment price. However, this is not the case anymore when prices become volatile. The production and investment choices are based on expected future profit. To make his/her decisions, the farmer observes input prices and investment cost in the current period and has to forecast the output price, as well as the future evolution of input prices and investment cost in the next periods (Femenia, Latruffe and Chavas, 2017).

Changes in the economic situation on agricultural markets have a significant impact on the strategic decisions of farms in terms of the amount of investment outlays. Favourable conditions in the environment of farms largely contribute to the fact that farmers undertake investment activities (Zając, 2012), while the agricultural products reduce the willingness to invest in agricultural activity (Musiał, 2009). Market conditions, on the one hand, contribute to the specialization of farms. On the other hand investment processes largely shape the economic situation of agriculture. Their scope and nature determine the directions of development of this sector.

MATERIALS AND METHODS

The research used studies of the subject literature as well as data from 4 803 farms that kept continuous accounting under the FADN system in 2005–2013. The selection of such a time range resulted from three premises:

a) in the analysed period, the most dynamic changes in the level of investments in the Polish agricultural sector took place, which allows for a reliable assessment of changes in the property of farms after Poland acceded to the EU,
b) the adopted scope covers the implementation of two support programs important for co-financing investments in agriculture, such as the Sectoral Operational Program 2004–2006 and RDP 2007––2013,
c) the condition of continuing accounting under the FADN system significantly reduces the size of the surveyed sample. To optimize the correctness of inference, it was limited to the 9-year research period.

The analysed farms were grouped according to the value of investment outlays in fixed assets in total in the analysed period, economic size, and production type.

Investment outlays include the value of purchased and manufactured fixed assets on the farm. According to this criterion, farms were divided into three quartile groups.

– Q1 – 25% of farms with the lowest level of investment outlays;
– Q2–Q3 – 50% with an average level of capital expenditure;
– Q4 – 25% of farms with the highest level of investment outlays.

In the division of farms into groups of economic size, the classification in relation to the Standard Output index (SO – Standard Output) from 2007 (Bocian and Cholewa, 2013) was used. The economic value determined on the basis of SO means the possible value of production that a farmer is able to achieve

with the possessed potential and running a business in a given region. The study identified six groups of farms: 1 – very small (2 000 ≤ 8 000 EUR), 2 – small (8 000 ≤ 25 000 EUR), 3 – medium small (25 000 ≤ ≤ 50 000 EUR), 4 – medium large (50 000 ≤ 100 000 EUR), 5 – large (100 000 ≤ 500 000 EUR), 6 – very large (≥ 500 000 EUR).

The type of farming, following the FADN methodology, was determined based on the share of individual agricultural activities in the creation of the total value of Standard Output on a farm (Florianczyk, Osuch and Płonka, 2016). The following types of farming were distinguished under this criterion: field crops, horticultural crops, permanent crops, dairy cows, herbivores, granivores, and mixed animals.

RESEARCH RESULTS AND DISCUSSION

The average economic size of the researched farms in 2005 was 45 thousand EUR SO (Table 1). The share of plant and animal production in the total production value was similar and accounted for 44% and 46% respectively. The structure of the herd was dominated by pigs with a share of 58%. The average farm in the sample generated income at the level of 46.5 thousand PLN and the share of subsidies to operating activities in the income was 34%.

The data show that with the increase in the value of investment outlays, the average economic size of a farm, the area of arable land, and the value of assets increased. Farms with higher investment levels were characterized by a lower share of payments in agricultural income. In the first group, it was 45% and in the third 32%. It resulted from a higher level of agricultural income on farms with higher investment inputs. In the first group, it amounted to 17.5 thousand PLN, and in the third – 93.3 thousand PLN per farm. Similarly, when calculated per full-time employee, the differences in average income between the analysed groups were large, from 11.4 thousand PLN up to 54.4 thousand PLN. At the same time, in entities investing more funds, the overall debt ratio of the farm was higher. In the first group, it was 5% and in the third – 18%.

In the studied group of farms, the investment activity of farmers was associated with an increase in the economic size of farms. In 2013, in the third group (Q4), as many as 31% of entities were classified into groups with greater economic strength than in 2005 (Table 2). In the second group (Q2–Q3), slightly more than 17% of the examined objects changed the economic size class to a higher one, and in the first group – only 7%. This was because investments in farms are usually associated with the expansion of the farm's production resources, mainly land and capital in the form of fixed assets. Therefore, the conducted research confirms the thesis that a higher level of economic size has a positive effect on the investment activity of farmers (Dziwulski, 2013).

Table 1. General characteristics of farms in the research sample in 2005

Description	UoM	Q1	Q2–Q3	Q4	Total
Number of farms	number	1 200	2 402	1 201	4 803
Economic size	EUR SO	20.9	37.4	85.0	45.2
Agricultural land area	ha	15.0	26.4	59.1	31.8
Total labour inputs (AWU)	AWU	1.7	2.0	2.6	2.1
Income from activity	thous. PLN	17.5	37.7	93.3	46.5
Share of subsidies in income	%	45	34	32	34
Income per full-time employee (own work – FWU)	thous. PLN / FWU	11.0	21.9	54.4	27.3
Asset value	thous. PLN	248.6	401.1	879.5	482.6
Overall debt ratio	%	5	9	18	13

Source: own study based on FADN data.

Table 2. Farm migrations within separate economic size groups in individual investment groups in 2005 and 2013

	Number of farms in relation to the economic size in selected investment groups																	
	Group	Q1					Q2–Q3						Q4					
	ES	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6
Number of farms in 2013	1	**54**	133	3			**6**	31	2		2							
	2	20	**649**	96	6	1	17	**563**	200	13	1			**15**	9	3		
	3		48	**120**	18			193	**746**	125	3		3	39	**142**	34	2	
	4		6	8	**31**	1		16	140	**247**	18			11	157	**328**	38	
	5				4	**2**	2	2	6	38	**30**	1		4	20	139	**247**	2
	6																2	**6**
	Total	**74**	**836**	**227**	**59**	**4**	**25**	**805**	**1094**	**423**	**54**	**1**	**3**	**69**	**328**	**504**	**289**	**8**
% of farms in 2013 as compared to 2005	1	**73%**	16%	1%	0%	0%	**24%**	4%	0%	0%	4%	0%	**0%**	0%	0%	0%	0%	0%
	2	27%	**78%**	42%	10%	25%	68%	**70%**	18%	3%	2%	0%	0%	**22%**	3%	1%	0%	0%
	3	0%	6%	**53%**	31%	0%	0%	24%	**68%**	30%	6%	0%	100%	57%	**43%**	7%	1%	0%
	4	0%	1%	4%	**53%**	25%	0%	2%	13%	**58%**	33%	0%	0%	16%	48%	**65%**	13%	0%
	5	0%	0%	0%	7%	**50%**	8%	0%	1%	9%	**56%**	100%	0%	6%	6%	28%	**85%**	25%
	6	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	1%	**75%**

Explanation: 1 – very small, 2 – small, 3 – medium-small, 4 – medium large, 5 – large, 6 – very large.

Source: own study based on FADN data.

Most entities (21.5%) that decreased their economic size in the analysed period were in the group with the lowest level of investment (Q1). Among them, however, a significant percentage was occupied by large and very large farms (50%). Perhaps it was because these farms achieved maximum values due to the scale effects. However, the reason for low investment activity among large farms may be not only economic but also non-economic conditions, e.g. the lack of the possibility of maintaining business continuity resulting from the lack of a successor.

The data show that in 2005 the vast majority of farms (76%) in the first group (Q1) were very small and small farms (with an economic size below 25 thousand EUR). Among them, 92% in 2005–2013 remained in the group or moved to a group with a smaller economic size. At the same time, a significant part of very small and small farms, which in 2007–2013 were in the group with the highest level of investment (Q4), showed quite a clear potential for development. The data show that as many as 58% of entities, which in 2005 were classified as 'very small', 'small' and 'medium-small', increased the economic size group to a larger one. In 2005, small and very small farms constituted only 6% of investing entities.

The majority of this group were medium-sized farms (medium-small and medium-large) – nearly 70%. Therefore, this confirms the conclusions of the research by Zalewski, Bórawski, and Bełdycka-Bórawska (2017), who stated that the level of investment in small farms indicates that only some of them try to stay on the market by carrying out investments. The remaining ones, in conditions of strong competition, are forced to shut down their production. In this situation, it seems unjustified to support investments in small farms, of which only a few have a chance for development. Nevertheless, the issue of small farms is an important aspect from the point of view of shaping agricultural policy. The assessment of the development potential of farms should not only focus on the level of generated revenues but also take into account their environmental and social significance. These aspects have been largely taken into account in the EU agricultural policy for 2014–2020.

In the analysed group of farms, the dynamics of the change in the type of farming was even greater than in the case of the change in the economic size. It intensified along with the increase in the investment activity of farmers. The research shows that in 2005–2013 the number of farms with the 'mixed' type of farming decreased by 39%, of which by 49% in the group with the highest level of investment (Q4), by 41% in the group with an average level of investment (Q2–Q3) and 31% in the group with the highest level of investment expenditure (Q1). On this basis, it can be concluded that agricultural investments in fixed assets made after 2004 were conducive to the processes of specialization. At the same time, 22% of specialized farms from the first group (Q1) changed the farming type to mixed, while in the third group it was only 10% of entities. The relatively large scale of the growth of specialization in farms in this group may prove that this phenomenon is common, but the investments made in the analysed period were conducive to accelerating this process.

The mixed-type farms focused their production mainly on the cultivation of cereals and dairy cows. Almost 42% of farms from the studied group, which in 2005–2013 changed the type of farming from 'mixed' to 'cereal' and 31% to 'dairy cows'. When analysing the selected groups in terms of the level of investment outlays, differences in the directions of specialization were also observed. The farms that invested the most often decided to specialize in dairy cows, which is related to the greater capital consumption of such production. In farms with an average (Q2–Q3) and high (Q4) level of investment, the share of such farms amounted to 34% and 33%, respectively, and on farms investing the least (Q1) – less than 23%.

There was also a significant decrease in the number of farms of the 'granivorous animals' type. However, this phenomenon is structural and is associated with quite large changes in the pig market. According to the Statistic Poland, the pig population in 2005–2013 decreased by 41% to 10.99 million units. In terms of the dynamics of changes in the structure, however, a relationship inversely proportional to the value of investments was observed. Mainly farms that invested relatively less were leaving pigs in the analysed period. Among farms classified to the first group (Q1), as many as 47% of entities in 2005–2013 resigned from this production direction. The percentage of such farms in the last group (Q4) was 30% (Table 3).

One of the possibilities of mitigating the consequences of the described changes in the pig market is the improvement and modernization of pig farms through an intensive investment process. Modern farms with high production intensity can counteract strong competition from other producers from the European Union on the pig market, e.g. in Germany or Denmark.

The farms which in 2005, following the FADN typology, were classified as farming type 'granivorous animals' most often changed the farming type to mixed (51%) and a lesser extent to cereal crops (20%). The first of these types of farming was a transitional phase in the search for a more profitable production direction. In turn, the choice of cereal crops was determined by the earlier connection with the production of pigs and the knowledge and less labour-consumption of production technology.

Table 3. Farm migrations within the selected types of farming in individual investment groups in 2005 and 2013

	Number of farms by type of farming in selected investment groups																				
	Group	Q1							Q2–Q3							Q4						
	Type	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**4**	**5**	**6**	**7**	**8**
Number of farms in 2013	**1**	**101**			5		5	121	295			9		14	200	241			1		9	77
	2	2	**26**	1			1	12	5	32	1				12	2	35					3
	4			28				9	2		63				29	1		44				11
	5				108			56				450	6	1	172				252			69
	6				10	**9**		26				19	11		36	2			4	2		7
	7						**39**	21	2					119	54	1					116	40
	8	17	4	2	16	1	29	**551**	26	5	5	27	4	69	734	17	2		7	1	41	**216**
	Total	**120**	**30**	**31**	**139**	**10**	**74**	**796**	**330**	**37**	**69**	**505**	**21**	**203**	**1,237**	**264**	**37**	**44**	**264**	**3**	**166**	**423**
% of farms in 2013 as compared to 2005	**1**	**84%**	0%	0%	4%	0%	7%	15%	**89%**	0%	0%	2%	0%	7%	16%	**91%**	0%	0 %	0%	0%	5%	18%
	2	2%	**87%**	3%	0%	0%	1%	2%	2%	**86%**	1%	0%	0%	0%	1%	1%	**95%**	0 %	0%	0%	0%	1%
	4	0%	0%	**90%**	0%	0%	0%	1%	1%	0%	**91%**	0%	0%	0%	2%	0%	0%	**100%**	0%	0%	0%	3%
	5	0%	0%	0%	**78%**	0%	0%	7%	0%	0%	0%	**89%**	29%	0%	14%	0%	0%	0 %	**95%**	0%	0%	16%
	6	0%	0%	0%	7%	**90%**	0%	3%	0%	0%	0%	4%	**52%**	0%	3%	1%	0%	0 %	2%	**67%**	0%	2%
	7	0%	0%	0%	0%	0%	**53%**	3%	1%	0%	0%	0%	0%	**59%**	4%	0%	0%	0 %	0%	0%	**70%**	9%
	8	14%	13%	6%	12%	10%	39%	**69%**	8%	14%	7%	5%	19%	34%	**59%**	6%	5%	0 %	3%	33%	25%	**51%**

Explanation: 1 – field crops, 2 – horticultural crops, 4 – permanent crops, 5 – dairy cows, 6 – herbivores, 7 – granivores, 8 – mixed.

Source: own study based on FADN data.

CONCLUSIONS

The conducted analysis of changes in the number of farms in individual groups of economic size and the type of farming does not exhaust the subject of the research. On its basis, however, two conclusions can be drawn.

1. The lack of an adequate level of investment leads to a reduction in the economic size of farms. In the studied group, the lower average level of investment was attributed mainly to small and very small farms. However, there is a group of small development farms that have the potential to increase their economic size through investment development.
2. The increase in the level of investment outlays favours the specialization of farms. In the examined group, the number of farms with the agricultural type 'mixed' decreased in 2005–2013 by 39%, including by 49% in the group with the highest level of investment. The research shows that mixed farms focused their production mainly on the cultivation of cereals and milk production.

The conducted research may constitute the basis for broader considerations on the sensitivity of farms to changes in the economic situation on given agricultural markets and the development of farms in connection with the conducted investment activity.

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ABSTRACTS

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THERE IS MORE THAN ONE INTERPRETATION OF BIOECONOMY

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ABSTRACT

The OECD book of 2009, 'The bioeconomy to 2030 – Designing a Policy Agenda' foresaw a bioeconomy in which biotechnologies could contribute to economic growth. From around 2012, nations (and the EU) started drafting bioeconomy strategies. It became clear that biotechnology was only a part of the way countries were thinking about the bioeconomy. Belgium, France, Germany and others with diversified bioeconomies (multiple feedstocks) see the main sectors as: energy, agriculture, food, water, chemistry, forestry, construction, bioeconomy services, others. Finland has, unsurprisingly, a strong emphasis on its forest bioeconomy. South Africa and the United States also includes human health, which broadens the bioeconomy a great deal as most private investment in biotechnology is directed towards health. The United Kingdom and the United States set out the bioeconomy case firmly with synthetic (or engineering) biology as a core platform for the future. A point that is often missed is that biotechnologies can and will contribute to future sustainability as it can be demonstrated that they can address more than half of the United Nations Sustainable Development Goals (SDGs). The bioeconomy is indeed a societal transition in which many sectors are involved, including those to which biotechnologies can add economic value. But the bioeconomy is much larger than just biotechnologies, and encompasses all sectors, activities and people that are involved with biological resources.

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BIOEASTsUP SUPPORT TO BIOEAST INITIATIVE FOR MACRO-REGIONAL BIOECONOMY STRATEGY ELABORATION: BIOECONOMY ASSESSMENT

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ABSTRACT

The development of bioeconomy in the Central and Eastern Europe depends on the cooperation of universities, public administration and entrepreneurs. This cooperation is still not at the highest level. Improvement of the situation is possible thanks to numerous actions taken by the countries of this region. One of such activities was the establishment of the BIOEAST initiative, with a mission to develop knowledge and cooperation -based circular bioeconomies, which helps to enhance their inclusive growth and to create new value-added jobs especially in rural areas, maintaining or even strengthening environmental sustainability. In 2019 the BIOEASTsUP project was supported by the H2020 RUR-18-2018 project with the main aim to support the BIOEAST initiative in the implementation of its Vision for 2030 and Action Plan. The projects is supporting the work of BIOEAST initiative which is composed of the Secretary General and National Contact Points, five BIOEAST Thematic Working Groups. The project will allow an analysis of the bioeconomy in the macro region which will help to prepare 'Strategic Research and Innovation Agenda' (SRIA) which is one of the most important outcome of the BIOEASTsUP project.

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MODELS AND TOOLS FOR BIOECONOMY STRATEGIES IN POLAND

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ABSTRACT

In order to support decision making on the paths to bioeconomy development, both ex post and ex ante assessment capacities are necessary at micro, meso, and macro levels. Traditional approaches approximate the bioeconomy as a share of the GDP and employment shares identified by the flow of products and services or the share of renewable bio-based content embedded in the economy's products and services (physical measurement). Due to the pervasive nature of bioeconomy prominent authors (J.H.H. Wesseler, inaugural speech, at the Wageningen University in 2016) describe it as a digitalization that calls for outcome measures like reduced carbon emissions and sustainability of water, soil, and biodiversity or even well--being improvements. The measurement of outcomes requires models able to grasp the polyvalent impacts of bio-based industries in terms of forward and backward relationships. Such capacity is necessary to evaluate not only the presence but also the sustainability of bio-based activities. In the course of the BIOECON project a battery of models have been built or adapted to serve to this purpose, thus supporting decision making on choices related to the design and evaluation of strategies for the bioeconomy deployment in Poland. These models encompass land use planning, agricultural sustainability assessment, partial equilibrium analysis for bio-based agro-industrial chains, and impact assessment at the meso and/or macro level of the economy. Synergy of the aforementioned models can be produced when they adapt to a specific case representing modules in the frame of an integrated model. Such exercise has been implemented in the case of biogas supporting both investment and policy making decisions.

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RISK PROGRAMMING FOR ARABLE AGRICULTURE IN POLAND TAKING ACCOUNT OF CLIMATE CHANGE

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ABSTRACT

Although mathematical programming (MP) has been widely used in the past in order to assess farmer risk, every year brings new challenges, e.g. climate change influence on arable agriculture production. Since climate change is likely to increase the variability of yields as well as probability of extreme occurrences of yields in various crops there is a need to program risk based on farm data and conduct portfolio analysis updating similar previous exercises for Polish agriculture. A database of 250 from a country-wise survey conducted by the Institute of Soil Science and Plant Cultivation (Instytut Uprawy Nawożenia i Gleboznawstwa Państwowy Instytut Badawczy – IUNG) scientist is used to provide detailed farm information organized by activities. The main aim and objective of this on-going study is to determine risk optimal farm plan under alternative CAP configurations and climate change scenarios for arable cropping farms. The expected relevant results are: calculated yields for sampled farms for arable crops based on climate change scenarios and time historical data, and efficient frontiers of risk-return spectrum for studied farms.

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SUSTAINABLE BIORESOURCE VALUE COMPLEX INDEX

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ABSTRACT

After rapid fossil economic development an estimation of resource insufficiency is evident. After global economic crisis in 2008, responsive actions by national governments rise, tightening credit markets lead to subsequent increase in borrowing costs that reduces the amount of capital available for investing in biotechnology research and development that could lead to high-risk start-up firms and cause another global economic crisis. Therefore, it has become a driver towards bioeconomy and necessity for research and infrastructure for alternative energy and sustainable agriculture. Combining resource depletion with climate change mitigation aims – bioeconomy share an exponential growth towards more sustainable economy all over the world. A global trend that bases on biological resource use is in the centre of scientific researchers', policy makers', different stakeholders' and society behaviour. However, bioeconomy cannot substitute fossil resources with bioresources to the same extent to ensure the consumption of existing demand. Initial aims towards sustainable European bioeconomy were largely diverted towards bioenergy direction. Updated European bioeconomy strategy emphasizes not only bioenergy, but also creation of products with higher added value. The transition to sustainable bioeconomy with a holistic approach on a global level would benefit national bioeconomy development, climate change mitigation and innovation transfer. There is still no common international method for determining, measuring, and comparing the extent of bioeconomy sustainability. Like the concept of sustainability, a sustainable bioeconomy must be assessed at several levels: resources, products, companies, industries, national and global based on main pillars of sustainability (environmental, social, and economic). Therefore, sustainable bioresource value complex index have been created.

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APPLICATION OF AN EU-WIDE FARM MODEL FOR CAP POST-2020 IMPACT ANALYSIS AND IMPLICATIONS FOR BIOECONOMY

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ABSTRACT

In this presentation we examine the role of agriculture and the Common Agricultural Policy (CAP) in bioeconomy. We demonstrate the coherence between the post-2020 CAP reform and the bioeconomy strategy both in terms of policy vision and policy implementation. We show that the tools for modelling the CAP are also relevant for informing decisions related to the biomass supply part of the bioeconomy value chains, and we describe the process and the models that the JRC is using for CAP economic impact assessment. We then focus on the farm model IFM-CAP and we argue that it is a necessary tool for meaningful policy modelling under the current and future CAP settings. Finally, we demonstrate the model's capacity to capture farm-specific responses to a hypothetical policy change scenario for Poland involving the voluntary adoption of ecoschemes.

Disclaimer: The views expressed in this presentation are purely those of the authors and may not in any circumstances be regarded as official position of the European Commission.

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BIO-BASED NATIONAL AND REGIONAL INPUT-OUTPUT TABLES IN POLAND

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ABSTRACT

The issue of bioeconomy under major global challenges has become important since 2012. When the first Bioeconomy Strategy was released by the European Union, countries started working on preparation of their national or regional strategies. In order to do so, there is a need to be aware of bio-based resources. From the economic point of view, it is essential to identify and monitor the role and significance of bioeconomy in the economy by assessing its potentials and intersectoral relationships-transactions. For doing so, Input-Output model was built in order to (1) identify and create the bioeconomy sectors (fully bio-based and mixed) for Poland and one of the agricultural regions of Poland, and to (2) estimate the linkage coefficients in order to capture their direct and indirect potentials for the Polish and regional economy.

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CAP SECOND PILLAR AND RURAL DEVELOPMENT IN THE CONTEXT OF BIOECONOMY AND FOOD SYSTEMS – THE CASE OF POLAND

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ABSTRACT

Growing environmental and climatic problems force the search for effective solutions in business activities, including agriculture. So far the sustainable development strategies or programmes have been successfully implemented but, despite initiating the desired direction of change in agriculture, are still insufficient to meet perceived needs. Since the beginning of the 1990s, successive reforms have been linked to the need for environmental protection and climate change mitigation. European Green Deal is the next step in the development of the CAP towards sustainable agriculture and rural development.

Statistics on the agricultural sector in Poland show significant changes in farming in terms of pro-environmental practices, including improvement in soil organic matter balancing, as a result of increased plant diversification and increased cultivation area of structure-forming plants. At the same time, the development of organic farming show the growing interest of agricultural producers in pro-environmental activities. An important factor encouraging pro-environmental changes were the conditions of subsidizing agriculture within the framework of CAP, related to the mechanism of greening, agri-environmental measures, including activities supporting organic farming. We observe a structural change in agriculture (the number of individual farms and total labour input in agriculture continues to decrease) and simplification of production at the farm level (i.e. liquidation of animal production) as well as increase in the level of specialization of production. These processes emphasize the need to seek and popularize various organizational solutions to reduce the absorption of environmental resources and reduce their impact on the changing climate.

However, food production has still a large impact on emissions and continues to reduce environmental resources, influences biodiversity loss and climate change. We observe the problem of food waste and low-quality food production (contributing to many health issues, which intensifies the need for systemic solutions). Developing such considerations requires the implementation of changes at individual links in the food chain.

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Farmers are the first link in the food chain, which determines their decisive role in the implementing of the 'from farm to fork' strategy. The need for empowering farmers in the food chain include influencing their attitude and farming practices that should lead to mitigation of climate change, preserving the environment and protecting the biodiversity.

In the new programming period 2021–2027, about 40% of the total CAP budget (Pillar I + II) and 30% of the Pillar II will focus on environmental and climate measures. It makes an opportunity also for rural areas to develop local and innovative bioeconomy systems and a high-quality place to live and work (incl. remote) in modern civil society. Therefore we need better governance (administration, public services, health system, education and research) to be equipped with skills (human resources) and improved knowledge and innovation systems.

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INSTITUTIONAL DIMENSION FOR BIOECONOMY STRATEGY IN THE CENTRAL AND EASTERN EUROPEAN COUNTRIES

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ABSTRACT

Although highly varied in their natural endowments, historical context, structural conditions and corresponding development pathways, bioeconomy sectors in Central and Eastern European Countries (CEECs) are characterised also by some common challenges. These challenges could be summarised as follows:

– agriculture largely prevails (65%) in the bioeconomy-related employment, while it contributes 38% to the region's bioeconomy value added, indicating a productivity gap in agriculture;

– comparably high employment multipliers (for each million euro invested in the national bioeconomy sector, up to 55 jobs could be created in these countries, mainly driven by primary agriculture activities);

– a significant drop of employment in primary sectors (agriculture, forestry, fishery) in the period 2008–2018, which is the main reason for productivity growth in these sectors;

– relatively densely distributed industry plants in 'conventional' bioeconomy sectors (food, wood, pulp & paper), but largely untapped potential of biomass side streams;

– relatively few biorefinery capacities, which is particularly pronounced for integrated biorefineries; in relation to EU27, 17% are located in CEECs, while integrated biorefineries in CEECs account for 10%;

– the structure of bioeconomy sectors is slowly adapting; the high employment and value-added growth is recorded in sectors, which are currently still at the limits of detection in CEEC's national economies (green energy, green chemistry).

In addition to the above challenges, there are two additional facts that stand out in relation with the challenges of the CEECs in the transition from linear, fossil-based economy to circular bioeconomy:

– the strong dependency of the region from fossil-based resources for energy production, and many related jobs;

– the role agriculture plays in rural areas and as an economic and social buffer is substantial and should be taken into account in policy planning.

The key gap between CEECs (and some other low-performing EU member states) and the leading bioeconomy performers in the EU is the labour productivity. Even more worrying, this gap has increased in the period 2008–2018. With respect to their status in the process of the transition to bioeconomy, the CEECs remain

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in the initial stage of the transition to the bioeconomy, characterized by the prevalence of primary sectors (agriculture, forestry, fisheries/aquaculture) in the structure of bioeconomy-related employment, low labour productivity in bioeconomy-related sectors and with a significant, yet underutilized potential for adding value to the biomass. Closing the gap with the leading bioeconomy regions in Europe will require from CEECs a coordinated effort of key actors and elements representing their respective bioeconomy institutional environment:

– Corporate sector; the presence of entrepreneurial culture (flexibility, risk-taking, innovativeness), together with strong investment capacity (from firms' own sources, venture capital and other financial institutions), can be seen as a critical success factor for a successful development of bioeconomy clusters.
– Governmental institutions; favourable policy environment willing to support the development of the bioeconomy is of crucial importance especially in starting stages, providing strategic guidance, coordination and catalysing processes with direct (e.g. supporting investments) and indirect support (e.g. public procurement, standards).
– Knowledge institutions. Organisations that provide technical know-how and innovation for the development of bio-products.
– Consumers; strong inclusion of consumers' perceptions and preferences in the development of bio-based technologies and products is crucial for a long-term and sustainable growth of the demand-side of the market.

Stable supply of biomass and efficient logistics is undoubtedly important as well, especially for industrial use of side streams (e.g. lignocellulose materials), where cost-efficient and constant inflow of inputs with homogenous quality parameters is required for efficient organization of business processes.

The course and effects of bioeconomic transformation processes largely build from the existing mix and technological level of bioeconomy sectors, efficient provision of biomass development level, and favourable institutional environment. Among the transformation pathways, which are relevant in the context of CEECs, priority still goes to the accelerated technological improvements in primary sectors (agriculture, forestry), and conventional bioeconomy sectors (food & feed, wood processing, paper and pulp). However, as boosts in productivity in land-based sectors (agriculture, forestry) have also been shown to increase demand for land in ecological sensitive areas, attention must be paid to prevent losses in ecosystem services. Another transformation pathway that should be pointed out with respect to the bioeconomy growth in CEECs, relates to the innovation in downstream sectors, which increase the efficiency of biomass use and waste stream recycling. Here, the impact depends on supply dynamics, consumer behaviour and the regulatory environment.

Only comparison of physical indicators (resources, primary production, transactions between sectors…) fails to explain why two regions with similar endowments may have very different pathways of organising economic activities. This is why we need to understand the role of different institutions and their interactions in the transition of CEECs towards circular bioeconomy.

With respect to the involvement and leadership of governmental actors, four different types of governance can be distinguished. Type 1, which stipulates transition to bioeconomy as centralised process with one ministry leading the process, is present in Slovakia and Hungary. Type 2 takes a more devolved approach, where one ministry is responsible for each particular sector of bioeconomy (e.g. agriculture/food; forestry (wood

processing), Czech Republic is following this approach. More countries in the region have organised the process in a more devolved manner, with two or more lead governmental institutions for each bioeconomy sector (Poland, Croatia, Romania). A strongly devolved structure with multiple actors is the situation in Latvia, Lithuania, Estonia and Slovenia.

Therefore, CEECs' bioeconomies have developed different governance models and institutional mixes in, and we can detect good and less good examples in all the above listed types. It is the quality of relations between actors and assets of bioeconomy that matters more than merely the institutional setup. This includes willingness for cross-sectoral cooperation of all bioeconomy actors involved, and integration beyond disciplinary boundaries (relevant in particular for industry and R&D institutions). Sufficient focus is also needed on the demand-side, requiring efforts to sensitize the general public and to promote a thriving bioeconomy market. Measures, such as green public procurement, and favourable standards for bio-based solutions can accelerate this process.

CEECs are also at different stages of preparation of their respective national bioeconomy strategies, with formaly adopted bioeconomy strategy in one country (Latvia), and five more with national strategies in development (Hungary, Poland, Slovakia, Czech Republic, Lithuania). Existence of national bioeconomy strategies reflects public consensus and long-term political commitment, but remains futile if not supported by corresponding instruments and measures.

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ASSESSING THE GREEN GROWTH TRAJECTORY THROUGH RESOURCE AND IMPACT DECOUPLING INDICES: THE CASE OF POLAND

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ABSTRACT

The paper applied the most appropriate decoupling indices in order to map the development trajectory of Polish economy. In the period between 1990 and 2016, Poland has achieved remarkable things. Primarily, growth seems that did not deteriorate the quality of the environment, since the human pressure on the environment, as captured by the resource and impact decoupling indices, was not associated with growth. Furthermore, from the cross-correlation analysis has emerged some rather interesting observations with profound policy implications. Precisely, there are evidence that economic growth will reduce both the ecological deficit and the greenhouse gases. Consequently, Poland can be seen a successful paradigm in terms of the ecological modernization theory. Growth seems to unfold without imposing significant pressure on the natural resources (a captured by the ecological deficit) and without causing environmental degradation (as captured by the GHG emissions).

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BIOENERGY PERSPECTIVES IN BIOECONOMY

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ABSTRACT

Bioenergy is a broad term for a different useful energy forms (electricity, heat and mechanical energy in transport biofuels) generated from different solid, gaseous and liquid biofuels. Bioenergy can be generated from 'traditional' and 'modern' biofuels. Traditional bioenergy is generated by burning wood or dung to generate heat, often connected with inefficient combustion. Modern bioenergy is related to biofuels of standardized quality with requirement of sustainably sourced biomass. Traditional bioenergy is still a dominant source of bioenergy in the world and the EU.

Modern bioenergy seldom achieves competitiveness to the alternative in a linear economy without market support. Biomass is sourced from different sectors, mostly as low or no value biomass, unless it is dedicated crop. Yet, biomass for bioenergy is linked with controversies on sustainability. As a response, the EU has been shifted the motivation to promote bioenergy from fossil fuel substitution to GHG emissions saved from that specific bioenergy final form.

Bioenergy perspectives in the bioeconomy are certain as (a) bioelectricity is needed to reduce the cost of grid balancing due to the intermittent renewable electricity sources, (b) bioheat with locally available, low value biomass is the least cost option to reduce fossil fuel dependency, (c) biofuels for transport are the at-hand part of the solution to reduce the GHG emissions from transport sector.

Improvements must be made to have a successful transition of bioenergy to circular and sustainable bioeconomy. Suggested transition pathways include embedding the existing bioenergy players into bioeconomy by creating circular bioeconomy business models either by valorising the by-products of bioenergy generation (ash, digestate, CO_2, sulphur…) or by creating industrial symbiosis (such as freshwater aquaculture with biogas production).

The strongest message from the bioenergy sector to the newly emerging bioeconomy sector is that biomass sustainability, availability, quality, quantity and price are crucial for bio-based market uptake.

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SYNERGIES AND TRADE-OFFS OF BIOENERGY ON THREE GLOBAL TRENDS IN EMERGING ECONOMIES: EVIDENCE FROM JIANGSU, CHINA

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ABSTRACT

While anthropogenic activities are widely and deeply shaping our world, urbanization, climate change, and energy transition have been gradually becoming prevailing global trends in the last decade, which demonstrate convincingly in emerging economies. Although intertwined with each other, there are few literatures dedicated to the clarification and coordination of the relationships among the three. Bioenergy, benign to revitalize rural areas, mitigate CO_2 emission and optimize energy mix, can naturally play a role in managing the three global trends. In this regard, using the evidence from Jiangsu, China, we clarify the relationships between the three global trends and discuss the possible synergies and trade-offs of bioenergy on them. This paper first qualitatively sorts out the characteristics, outcomes and linkages of the three global trends. Further, we apply the interpretative structure model to quantitatively identify the structure of the three global trends and find that constructing a bioenergy-centred bioeconomy could be helpful. Through the lens of environment, society, economy, technology, culture and institution, we analyse the synergies and trade-offs of bioenergy on urbanization, climate change, and energy transition. In the process of strengthening the synergies and limiting trade-offs, it is recommended to set up a three-tier governing system in China, where the central, provincial and municipal governments assume the responsibility of decision-making, management and execution, respectively.

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