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ECO-INNOVATIVE AWARENESS OF YOUNG WOMEN AND MEN AS AN ELEMENT OF ECO-INNOVATIVE MANAGEMENT OF REGION DEVELOPMENT

In the face of increasing environmental degradation, depletion of natural resources, as well as the lack of capacity for the waste, the paradigm of thinking shift seems to be a very important issue - always needed innovation should be replaced by eco-innovation, and innovative awareness should be developed towards awareness of eco-innovation. The main objective of the research, whose results have been presented in this article, was the current status of eco-innovative awareness of young women and men. In the context of the issues relevant to the subject of this work, a systematic review of domestic and foreign literature has been carried out, which has become one of the inspirations to undertake this study. The review review did not identify works on eco-innovation awareness in relation to gender, which in this context, justifies the need for further research. The research done in 2016, included 1,015 respondents, students from the Podkarpackie Province. Time range of research covered the period from January to April 2016. The responses of respondents support the conclusion that young people are characterized by a relatively high awareness of eco-innovation, although that do not define it in such a way. They can identify the needs and goals of creating eco-innovation. This awareness is higher in case of women, which determines their possible role in the creation and implementation of policies aimed at supporting eco-innovation, also at the regional level.
Keywords: awareness of eco-innovation, a quadruple helix, women, men, region management.

1. INTRODUCTION

Awareness, no matter what factor and context concerns, is essential. The negative image of the state of many societies, the environment as well, has many causes, but one of them is still too low environmental awareness. Also there is the lack of holistic thinking, which would combine many spheres of human activity, including the economy with ecology, but in the right way.

Not all innovations implemented so far have been successful. Some deepened social and environmental problems, because they lacked the purposes others than just market (economic). However, awareness of these problems increases. Its result is an increasingly common trend to support eco-innovation, characterized by pro-environmental objectives and characteristics. However, their rapid implementation requires many complex actions, including the creation of eco-innovative awareness of the whole society, as a basis.

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In this publication the results of the research on eco-innovative awareness of young women and men are presented. The modern model of the innovation system evolves in the direction of the helix which consists of five elements, in addition to the public in the model the quadruple helix has been included, and the need for inclusion of the natural environment in the system has been pointed out. This imposes the need for research and awareness of eco-innovation as one of the foundations of the proper implementation of the assumptions of the innovation system based on the quadruple helix model. An example of practical use of this system is the regional innovation system of the Podkarpackie Province, designed for 2014-2020, it has been described in detail in *the Regional Innovation Strategy for the Podkarpackie Province for the years 2014-2020 for smart specialization (RIS3)*[2].

2. TOWARDS THE ECO-INNOVATION AWARENESS

Understanding of the importance of innovation in socio-economic development has become common as many scientific analyzes are devoted to this subject. In theory and practice on innovation a number of concepts have emerged. However, innovations (also, and perhaps especially in the context of the dominant theory and model innovation awareness) have not solved a number of global and regional problems, and some of them have even become their cause. Many new ideas, technologies and products can be used in different ways – with the positive but also negative effects on society and the environment, even though they may gain market success.

The question of innovation awareness in the scientific interpretation involves the ability to use existing resources (the so-called innovative maturity). The results of the innovation unit are determined by the innovative motivation which indicates the individual's attitude towards innovation and innovative capacity, which determines the internal and acquired predisposition to the development, implementation and adaptation of the innovation environment, and the individual's vulnerability to the influence of external factors determining such behawior[3].

A person with developed innovation awareness should, inter alia, be convinced that the changes make sense and are possible; should have determination and optimism, inspire innovative initiatives in the place of residence or work, and represent the right innovative attitude, must skillfully combine three inseparable elements: knowledge, emotion and behavior[4]. This understanding of innovation awareness allows to take into consideration the outlined above aspects in creating a definition of awareness of eco-innovation to be developed on the important issues of the natural environment, its condition, prospects and the need to preserve it as an absolute basis (base) for sustainable development of societies and their economies.

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[2] Woźniak L., Sobkowiak A., Dziedzic S., Kąkol W., Kud K., Woźniak M., Wyrwa D., *Regionalna Strategia Innowacji Województwa Podkarpackiego na lata 2014-2020 na rzecz inteligentnej specjalizacji (RIS3)*, Rzeszów 2015, p. 1-81.

[3] Niedzielski P., *Innowacyjność (Innovativeness)*, [w:] Matusiak K.B (red.), *Innowacje i transfer technologii. Słownik pojęć*, Wydawnictwo PARP, Warszawa 2008, p. 150-151.

[4] Werner E., *Świadomość innowacyjna społeczeństwa*, [w:] Białoń L. (red.), *Zarządzanie świadomością innowacyjną*, Wydawnictwo Placet, Warszawa 2010, p. 432.

Białoń and Werner[5] define innovative awareness claiming that it should include a broad opinions and beliefs about the need to implement innovative activities as it is essential for the proper functioning of the human, company, region and country. According to this definition an interesting, important opportunity to approach the consciousness of eco-innovative aspects of the proper relation of man to the broader context of their place of residence and work appears, taking into account environmental issues at least as very important. The same authors[6] give the most popular definition of innovation as the ability to create and implement innovation. In this way , of course in very general terms, eco-innovation can be defined as the ability to create and implement eco-innovation. This ability has a lot of conditions, out of that the most important original meaning has eco-innovative need of purposes and methods of creating eco-innovation.

Environmental awareness can be considered as the basis for defining (one of the elements at the same time) eco-innovation awareness. The analysis of this concept was introduced by Papuziński[7], on the assumption that most authors emphasize its ambiguity. According to the author's views, in the narrow sense, the environmental awareness is knowledge, views and ideas about the environment, but in the wider sense the author refers to the definition by Cottages, according to which these are the recognized values, opinions and ideas about the environment, which is a place of life and human development, as well as society.

In the opinion of the author of this article, the eco-innovation awareness is a conviction about the need for the creation and implementation of eco-innovation, it is also an expression of environmental values recognized opinions and ideas. Its result is eco-innovation understood as an ability to create and implement eco-innovation.

Figure 1 illustrates the eco-innovation awareness, which is the result of environmental awareness and innovation awareness.

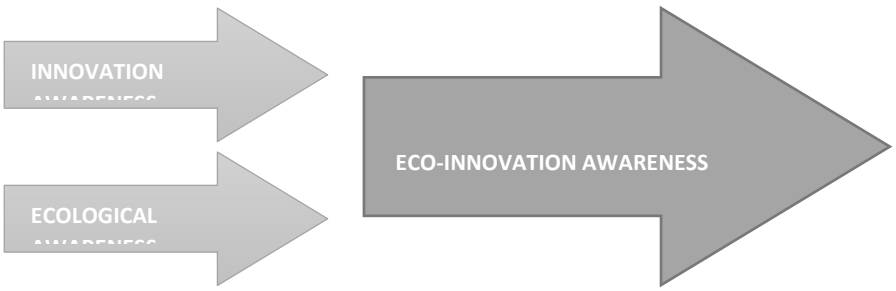

Fig. 1. Evolution of innovation awareness in eco-innovative consciousness

Source: own research.

[5] Białoń L., Werner E., *Świadomość innowacyjności – wyniki badań studentów I roku zarządzania WSM w Warszawie*, Zarządzanie. Teoria i praktyka, 2012, nr 2(6), p. 36.

[6] Białoń L., Werner E., *Świadomość innowacyjności*…, op. cit., p. 24.

[7] Papuziński A., *Świadomość ekologiczna w świetle teorii i praktyki (zarys politologiczny modelu świadomości ekologicznej)*, Problemy Ekorozwoju, 2006, vol. 1, no. 1, p. 33-40.

3. ECO-INNOVATION AWARENESS VS. QUADRUPLE HELIX

Contemporary, described extensively in the literature, the innovation system evolves in the direction of the helix which consists of five elements and their inter-relationships, which is a special kind of a system of eco-innovation (ecosystem), which will be discussed below.

In the originally presented model of the triple helix, its authors has taken into account three types of entities, elements of the innovation system: universities, industry and government[8]. This concept evolved, through the quadruple helix model, where the public was considered until the helix model contains an additional factor, which is the environment[9]. This five-element model is the latest model of the innovation system which directly alludes to take into account the natural environment, its needs and capabilities in the creation of eco-innovation[10], in line with the concept of sustainable development. It should be noted that some authors have drawn attention to the possibility and the need also for the triple helix model, treating the environment as a fourth, additional bonding element[11].

Figure 2 shows the evolution of approaches to the quadruple helix model.

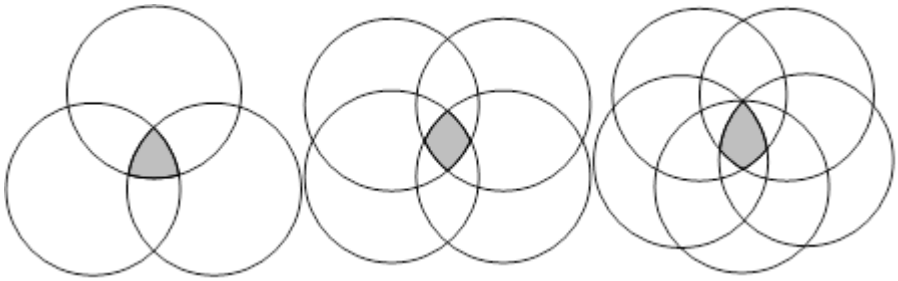

Fig. 2. Evolution of the approach from the triple helix to the quadruple helix model

Source: own research.

Including the fourth element into the model of the triple helix there has been emphasized the importance of society as a user of innovation, whose needs and expectations should be reckoned with, as well as a provider of ideas for innovation (e.g. crowdsourcing or crowdfunding), or an important element in the process of public

[8] Etzkowitz H., Leydesdorff L., *The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations*, Research policy 29.2, 2000, p. 111.

[9] Carayannis E.G., Campbell D.F.J., *'Mode 3' and 'quadruple helix': Toward a 21st century fractal innovation ecosystem*. International Journal of Technology Management, 2009, 46(3-4), p. 201-234.

[10] Carayannis E.G., Campbell D.F.J., *Triple helix, Quadruple helix and Quintuple helix and how do Knowledge, Innovation and the Environment relate to Each other? a proposed framework for a trans-disciplinary analysis of sustainable development and social ecology*, International Journal of Social Ecology and Sustainable Development, 2010, 1 (1), p. 41-69.

[11] Yang Y., Holgaard J.E., Remmen A., *What can triple helix frameworks offer to the analysis of eco-innovation dynamics? Theoretical and methodological considerations*, Science and Public Policy, 2012, 39 (3), p. 373-385.

consultation at the stage of creating strategic documents of innovation for specific regions or countries.

The fifth element introduces a system of innovation to a higher level of the world perception of the world, possible to implement most of all among the nations (societies) which are characterized by a high environmental awareness. The strategy EUROPE 2020[12] draws attention to the progressive degradation of the environment and global warming. The answer to the diagnosed negative environmental trends may be creating innovation systems aimed at minimizing the negative impact of the economy on the environment and creating new areas to create eco-innovative solutions.

Adding the fourth element, the public, to the innovation system and the fifth: the environment, makes this model more full. Its effectiveness depends largely on the level of awareness of eco-innovative society. Therefore, the analysis and evaluation of the level of awareness of eco-innovation society appears to be interesting, not explored until now field of research.

Each of these evolving models of the innovation system contains in itself, as an important factor, education (colleges and universities regarded not only as a direct source of supply innovation). Okoń-Horodyńska[13] strongly emphasizes the priority of education in taking abilities to create innovation, applying it to the need for proper education of society, conscious importance of innovation. The effectiveness of creating and implementing innovations in relation to the region and the country needs to take into account the need to create a network of relationships that make up the innovation system. Scientific approach to this issue is constantly evolving, as the evidence may be to support actions aimed at raising awareness of eco-innovative societies.

4. OBJECTIVE, RANGE AND RESEARCH METHODOLOGY

The main aim of the research was to identify the main factors influencing the eco-innovation awareness among young men and women, as an important pro-environment management model in the region (under the new theory helix, taking into account five elements). The specific objectives of the research are: the emergence of the factors influencing the eco-innovation consciousness; determination of the environmental threats that in the respondents' opinion will decide about the eco-innovation development; an assessment of the state of the environment in the place of residence of the respondents; the opinions of the respondents regarding the prospects for the development and use of the theory of "green economy" and "green growth"; recognition of relevant factors in deciding the choice of eco-innovation in the place of existing and innovative solutions; the emergence of elements of EU policy, which in the opinion of the respondents are the greatest influence on the creation and implementation of eco-innovation; knowledge of the preferred locations of eco-innovative solutions; recognizing the importance of energy in the development of eco-innovation; the emergence of the sectors of economy of the most demanding eco-innovation; the opinions of the respondents on the importance of

[12] Europa 2020. *Strategia na rzecz inteligentnego i zrównoważonego rozwoju sprzyjającego włączeniu społecznemu*. Komisja Europejska, Bruksela, 3.3.2010, KOM (2010) 2020 wersja ostateczna, p. 1-37.

[13] Okoń-Horodyńska E., *Edukacja dla innowacji (Czy tylko wybrani skazani są na sukces innowacyjny?)*, Nauka i Szkolnictwo Wyższe, 2008, nr 1/31, p. 34-54.

a return to natural solutions, forgotten or ignored, as a promising source of eco-innovation, with particular attention to the gender of the respondents.

The research was of quantitative nature, the survey form was sent to the population of 1015 students of the Rzeszów University of Technology, men and women, representing - in terms of permanent residence - the entire area of the Podkarpackie Province (spatial extent of research). Time range of research covered the period from January to April 2016. The number of respondents for each question, is a bit different, because not all responded to every question.

In the context of the issues relevant to the subject of this work, a systematic review of domestic and foreign literature has been carried out, which has become one of the inspirations to undertake this study. The review review did not identify works on eco-innovation awareness in relation to gender, which in this context, justifies the need for further research.

5. THE RESULTS OF A SYSTEMATIC REVIEW OF THE LITERATURE

The subject of eco-innovative awareness (very differently understood by the authors of many of the cited works, most often equated with environmental awareness), has been the subject of scientific works in many countries, although the number of publications in this field, even in the broadest sense of the term, is very small - in the scientific bases of Scopus and Web of Science, based on bibliometric analysis performed by the word "awareness of eco-innovation" have been identified over the years 2006 (the first publication) - 2015, only a few scientific articles, some of which in fact only indirectly alluded to this problem.

The research done at Yale University[14] - the publication with the largest number of quotes – was related to consumer eco-innovation awareness in the context of the Life Cycle Cost, LCC. The authors emphasize that this type of thinking works in organizations and private consumers do not carry out such analyzes. The article points to the need to categorize the cost of eco-innovation – with the division into initial costs (those for the client appearing in the time of purchase), and operating costs. The authors also present a positive effect of LCC information on the probability of purchase of eco-innovative products.

In studies conducted in Europe the attention was drawn to the use of information and communication technologies in lowering or elimination of barriers to the creation and implementation of eco-innovation, and one of them is the lack of eco-innovation awareness of (concerning the purpose of creation and the effects of the introduction of new solutions).

Small and medium-sized enterprises are the key of implementation and dissipation of eco-innovation in the market. In the works of the listed below authors the attention was also drawn to the importance of user-friendly, free-of-charge Internet platform (currently it Ecosmes.net), whose aim is to support all stages of the creating and marketing of eco-innovation process[15]. By providing information, the platform also creates awareness.

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[14] Kaenzig J., Wüstenhagen R., *The effect of life cycle cost information on consumer investment decisions regarding eco-innovation*. Journal of Industrial Ecology, 2010, 14(1), p. 121-136.

[15] Buttol P., Buonamici R., Naldesi L., Rinaldi C., Zamagni A., Masoni P., *Integrating services and tools in an ICT platform to support eco-innovation in SMEs*. Clean Technologies and Environmental Policy, 2012, 14(2), p. 211-221.

The studies done in Germany concerned the importance of eco-innovation in creating an effective model of waste management in accordance with the win-win thinking. Also in this work the authors drew attention to the learning outcomes in innovative pro-environmental solutions, which is a simple way to increase eco-innovation awareness[16].

Eco-innovation awareness is of utmost importance at the design stage. Companies are under increasing public pressure concerning human and environmental friendly solutions, but most of them focus on the parts of business, and even pretending of environmentally conscious attitude. The research done in France were mainly related to the integration of environmental awareness of design processes in small and medium-sized enterprises, particularly in terms of building needs and the results of the creation of eco-innovation through the development of ecological awareness of the whole design team[17].

Cooperation between universities and small companies is considered to be the primary mechanism of mutual creation of eco-innovative public awareness and political and strategic partnership between policy makers, entrepreneurs, scientists and citizens, and the leading role is assigned in the implementation and application of eco-innovation necessary to build a competitive green economy. Also the importance of supply and demand of eco-innovation (strategy push-pull), and the regulatory framework have been emphasized. An example of a well-understood cooperation is the European eco-innovative partnership, presented in the EcoAP strategy[18].

Research carried out in Slovakia was related to the importance of basic moral and spiritual values (the reference has been made to the Holy Bible), especially in the context of the rejection of the consumer lifestyle, promotion of mutual trust, solidarity and commitment to the environment - as the foundation of creating eco-innovative personal awareness understood as responsibility for their actions[19].

The increase in environmental awareness, concerning, for example, global warming and CO2, emissions, was used as an example of the possibilities of creating eco-innovation by engineers[20].

Policies and laws have a positive and significant impact on the level of information and consumer awareness. The evidence quoted in the publication suggested to its authors the need to develop research in this field. It was also pointed - as a kind of case study - for

[16] Wilts H., Dehoust G., Jepsen D., Knappe F., *Eco-innovations for waste prevention - best practices, drivers and barriers*. Science of the Total Environment, 2013.

[17] Reyes T., Rohmer S., *The trojan horse method as a vector of ecodesign integration: A case study at a french SME*. Paper presented at the DS 58-7: Proceedings of ICED 09, the 17th International Conference on Engineering Design, 2009, p. 173-184.

[18] Sáez-Martínez F.J., González-Moreno Á., Hogan T., *The role of university in eco-entrepreneurship: Evidence from the eurobarometer survey on attitudes of european entrepreneurs towards eco-innovation*. Environmental Engineering and Management Journal, 2014, 13(10), p. 2541-2549.

[19] Zaušková A., Miklenčičová R., Madleňák A., Bezáková Z., Mendelová D., *Environmental protection and sustainable development in the Slovak Republic*. European Journal of Science and Theology, 2013, 9(6), p. 153-159.

[20] Yang C.J., Chen J.L., *Energy-saving eco-innovation using eco-product cases with CBR and TRIZ tools*. Journal of the Chinese Society of Mechanical Engineers, Transactions of the Chinese Institute of Engineers, Series C/Chung-Kuo Chi Hsueh Kung Ch'Eng Hsuebo Pao, 2012, 33(4), p. 305-313.

eco-innovative technologies, energy efficiency, especially important in the housing sector[21].

The importance of eco-innovation awareness can be particularly important in the food economy. In other authors' research the sustainable agriculture has been treated as a case study because in food production and food processing dissemination of eco-innovative practices and awareness of the benefits of such proceedings is transferred to all participants in the supply chain, supply and consumption[22].

Other studies have confirmed the stimulating effect of diffusion of eco-products in the consumer awareness within environment. An increase of environmental awareness of consumers can encourage companies to take a broader pro-environmental actions. Eco-labels allow consumers to identify such products and services that have less impact on the environment in their life cycle[23]. The research done in Spain allowed to determine the common characteristics of most eco-innovative companies, as well as the need to promote environmentally friendly behavior of enterprises, as important source of information for the customers, shaping their awareness of the company product[24]. Research done in various industrial sectors in the Basque Country has shown that the social environmental awareness has a very important impact on the efficiency of environmental management in companies[25].

Researchers from Spain emphasize the need to promote pro-ecological corporate behavior in order to raise consumer awareness[26]. The results of the same studies have been also discussed in another paper[27].

An important place to create eco-innovation is the tourism sector, which should develop into a model combining profitability with sustainability. Adaptation of this model will require the creation of eco-innovation, enabling the necessary increase of environmental awareness among tourists and organizers of the tourism business[28].

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[21] Costantini V., Crespi F., Orsatti G., Palma A., *Policy inducement effects in energy efficiency technologies. An empirical analysis of the residential sector*, 2015, p. 201-232.

[22] Blasi E., Monotti C., Ruini L., Landi C., Avolio G., Meriggi P., *Eco-innovation as a driver in the agri-food value chain: An empirical study on durum wheat in italy*. Journal on Chain and Network Science, 2015, 15(1), p. 1-15.

[23] Kijek T., *Modelling of eco-innovation diffusion: The EU eco-label*. Comparative Economic Research, 2015, 18(1), p. 65-79.

[24] Peiró-Signes A., Segarra-Oña M., Mondéjar-Jiménez J., *What to do to Improve our Eco-Innovative Aptitudes? An Empirical Study on the Variables Affecting the Environmental Awareness of Firms While Innovating*. International Journal of Environmental Research, 2014, 8(3), p. 831-838.

[25] Ormazábal M., Sarriegi J.M., *Environmental management evolution through maturity states*. [Evolución de la gestión ambiental a través de estados de madurez] Direccion y Organizacion, 2013, 49, p. 17-26.

[26] Peiró-Signes A., Segarra-Oña M., Mondéjar-Jiménez J., *What to do*…, op. cit.

[27] Peiró Signes A., Segarra Oña M.D.V., Maroto Álvarez M., *Why do services and manufacturing firms envision environmental innovation differently? A path-model comparison*. In Polish Journal of Environmental Studies, 2014, vol. 23, no. 5, p. 1691-1697.

[28] Miret-Pastor L., Segarra-Oña M.D.V., Peiró-Signes A., *Environmental certification as a tool to measure and promote eco-innovation in the tourist sector*. Research studies on tourism and environment, 2013, p. 13-26.

Romanian scientists emphasize the lack of environmental awareness, both in the business and political at the same time analyzing the opportunities for change in their country[29].

Also the research in the context of the use of recycled materials in the production has been done, as a response to an increase in public awareness within the environmental degradation[30].

In studies on consumer behavior, some authors have focused on understanding the factors relevant to the environment in the context of the previously identified low involvement of environmentally conscious consumers. Eco-innovation consciousness can arise from recognized ecological values, beliefs and personal norms[31]. The same authors have also pointed to the importance (force) of previous habits as a barrier to the implementation of eco-innovation - the so-called negative consciousness[32]. In such cases, an important role in creating awareness of eco-innovation can be eco-innovation marketing based on modern methods of communication strategy, which is able to build environmental awareness of a customer[33].

On the way to eco-innovative economy, pro-ecological awareness of researchers is of great importance, as well as the use of eco-innovative training methods, which is emphasized by the authors cited[34].

In general, raising awareness of the need for environmental protection is regarded as a key factor to support eco-innovation, as in the case of management (or owners) of small and medium-sized businesses, and consumers[35]. Knowledge of the needs and opportunities associated with the need to save energy (as a consciousness), can and should be developed and strengthened also by promoting examples of successful energy-efficient practices[36] - this is a particularly important field of implementation of eco-innovation.

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[29] Niță V., *A threefold assessment of the romanian economy's eco-efficiency*. Romanian Journal of European Affairs, 2012, 12(4), p. 59-77.

[30] Estrada G., López-Mesa B., Vidal R., Mulet E., *Avoidance of design errors in ecoinnovation with recycled materials*. Paper presented at the 9th International Design Conference, DESIGN 2006, p. 1383-1390.

[31] Jansson J., Marell A., Nordlund A., *Exploring consumer adoption of a high involvement eco-innovation using value-belief-norm theory*. Journal of Consumer Behaviour 10.1, 2011, p. 51-60.

[32] Jansson J., Marell A., Nordlund A., *Green consumer behavior: determinants of curtailment and eco-innovation adoption*. Journal of consumer marketing, 2010, 27(4), p. 358-369.

[33] Grib L., Zauskova A., *Support of green innovation through online communication tools*. Edited by: Matus, J., Petranova, D., International Scientific Conference on Marketing Identity: Explosion of Innovations Location: Slovak Acad Sci, Smolenice, Slovakia 2014, p. 455-469.

[34] De Medeiros J.F., Ribeiro J.L.D., Cortimiglia M.N., *Success factors for environmentally sustainable product innovation: a systematic literature review*. Journal of Cleaner Production, 2014, 65, p. 76-88.

[35] Zaušková A., Bezáková Z., *Green innovations and their implementation in the Slovak smes*. Edited by: Matus J., Petranova D., International Scientific Conference on Marketing Identity: Explosion of Innovations Location: Slovak Acad. Sci., Smolenice, Slovakia 2014, p. 442-454.

[36] Yang C.J., Chen J.L., *Energy-saving eco-innovation using eco-product cases with CBR and TRIZ tools*. Journal of the Chinese Society of Mechanical Engineers, Transactions of the Chinese Institute of Engineers, Series C/Chung-Kuo Chi Hsueh Kung Ch'Eng Hsuebo Pao, 2013, 33(4), p. 305-313.

The bibliometric analysis has shown no presence of the two bases of publications relating to eco-innovation consciousness of students, also related to the interpretation of gender. The author's own research also have a pioneering character.

6. THE RESULTS OF OWN RESEARCH

The research was conducted in 2016, and the research population covered 1,015 full-time and part-time students.

The results of the research in fig. 3 show a considerable variation of answers among male and female respondents. The respondents could choose - from the given - three in their opinion the most important factors influencing their eco-innovation awareness (the need to create, accept or selection of eco-innovative solutions). Among women, the most important factor was the knowledge of the state of the global environment (18,37% respondents), as well as the problem of global warming, the need to reduce CO2 emissions (16,07%), respectively awareness of the health risks (13,28%). Among male respondents the variation in responses was lower.

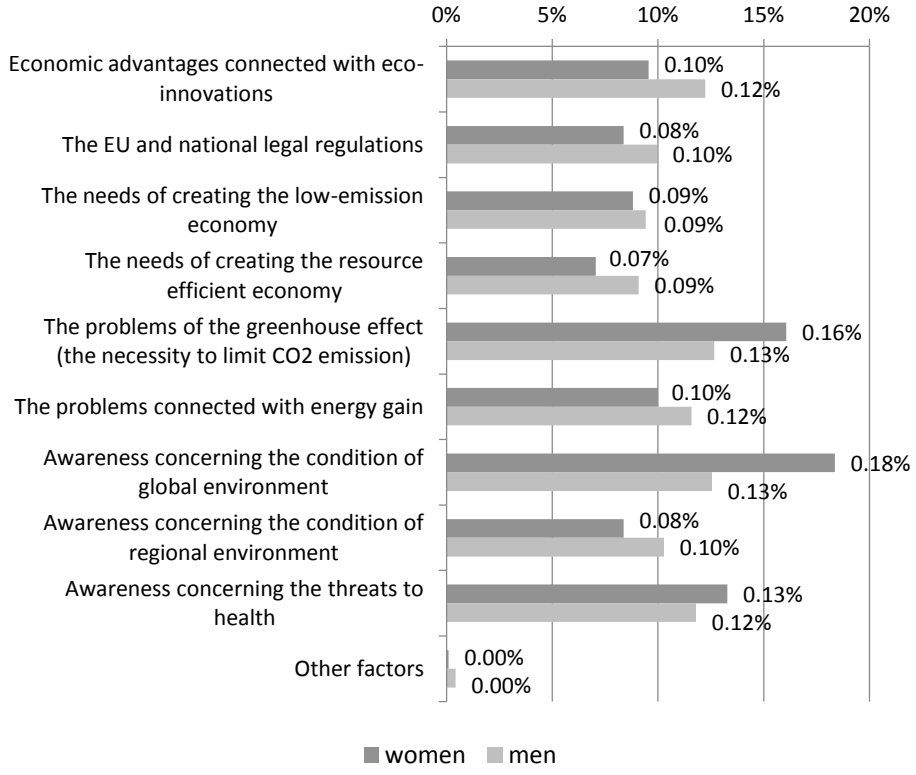

Figure 3. Factors shaping eco-innovative awareness in the respondents' opinion (n = 1002)

Source: own research.

The issues considered in the questions presented in figure 3, concerning the definition of the factors shaping the eco-innovation awareness, were developed in the next question concerning the most important in the opinion of respondents threat to the environment.

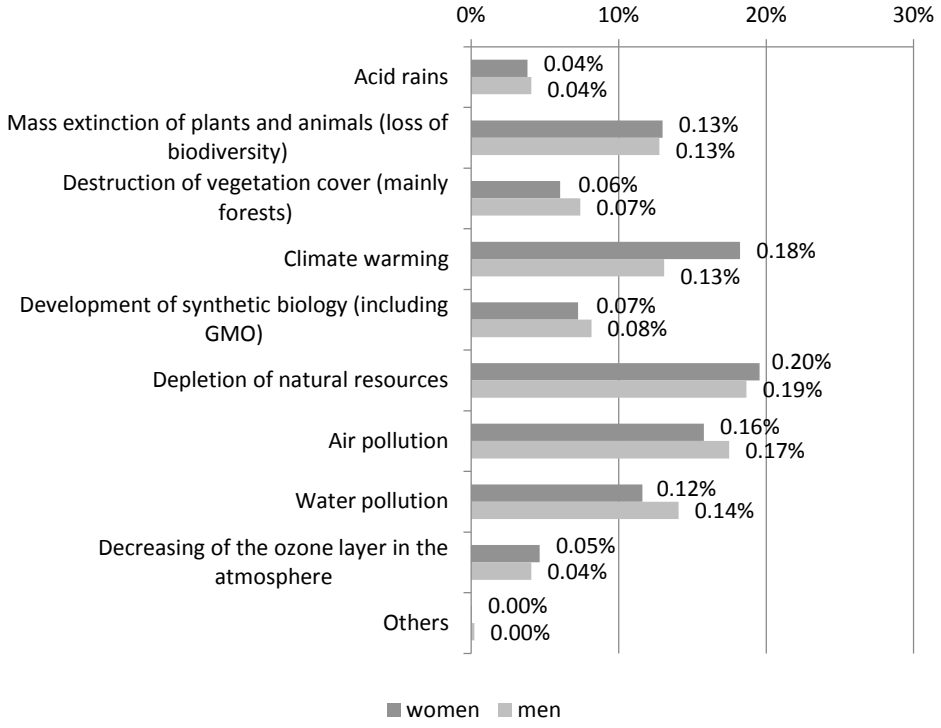

Figure 4. The most important threat to the environment globally, which in the opinion of the respondents largely determined the development of eco-innovation (n = 1002)

Source: own research.

Respondents selected the most important threats to the environment (fig. 4), which can determine the need for the creation of eco-innovation (respondents could choose three of the mentioned threats). Variation in responses was high among both women and men. The women participating in the survey recognized the problem of depletion of many natural resources (and therefore the necessity to use of technology and manufacturing of more resource-efficient or environmentally friendly substitutes) – 19,56% of the respondents as a potential source of the greatest needs of creating eco-innovations. Important in the evaluation and selection was also warming (18,24% female students). Among men the answers about the problem of depletion of many natural resources (18,67%), and air pollution (17,49%) dominated.

The majority of respondents, both women and men found that they inhabited areas that are particularly at risk in terms of environmental quality (definitely the response "rather not" dominated – 43,94% men and 39,43% women, or not - 32,26% of women and 29,65% of men (fig. 5).

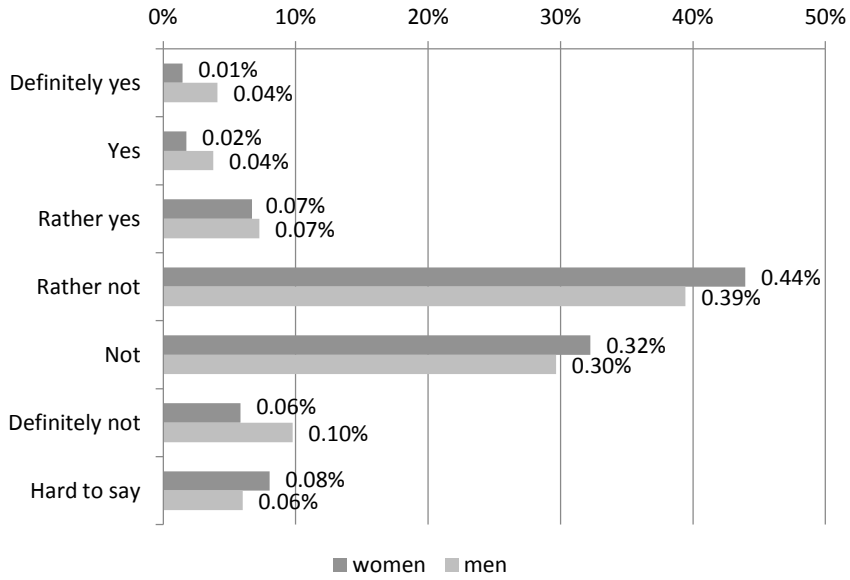

Figure 5. Evaluation of environmental conditions of the place of living inhabited by the respondent in the context of being a an area of vulnerable environment that requires the active creation of eco-innovation in order to repair (n = 1002)

Source: own research.

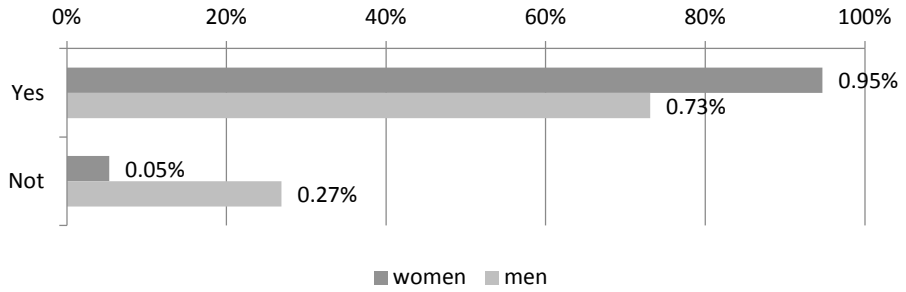

Figure 6. The opinion of respondents on the need to support the global economic system on the principles of "green" economy and "green" growth (n = 995)

Source: own research.

The vast majority of people participating in the study acknowledged that the global economic system should be based on the principles of "green" economy and "green" growth (fig. 6), and the proportion of such responses was significantly higher among women (94,70% of respondents) than among men (73,10% of respondents). Probably not directly, but one can suggest that women are more conducive to the "green" models of the economy, which could also indicate to their higher environmental awareness, both higher eco-innovative potential.

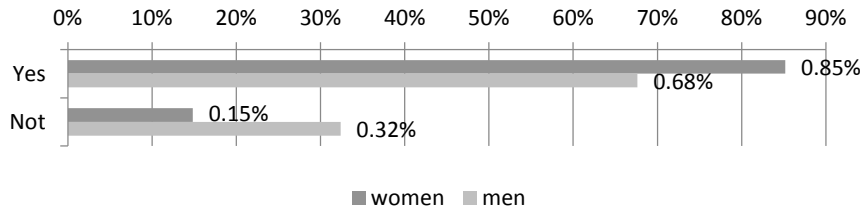

Figure 7. The opinion of the respondents concerning the decision on the selection of eco-innovation in place of existing innovative solutions that have a negative impact on the environment (n = 996)

Source: own research

Just as in figure 6, also in the context of the importance of the choice of eco-innovation in place of existing innovative solutions (not showing the pro-environmental characteristics) - fig. 7, the percentage of respondents recognizing the need to create eco-innovation and its choice was higher (85,17%) than men (67,62%). Also (although not directly), but this the picture of more eco-innovative awareness of women, their understanding of the role of eco-innovation.

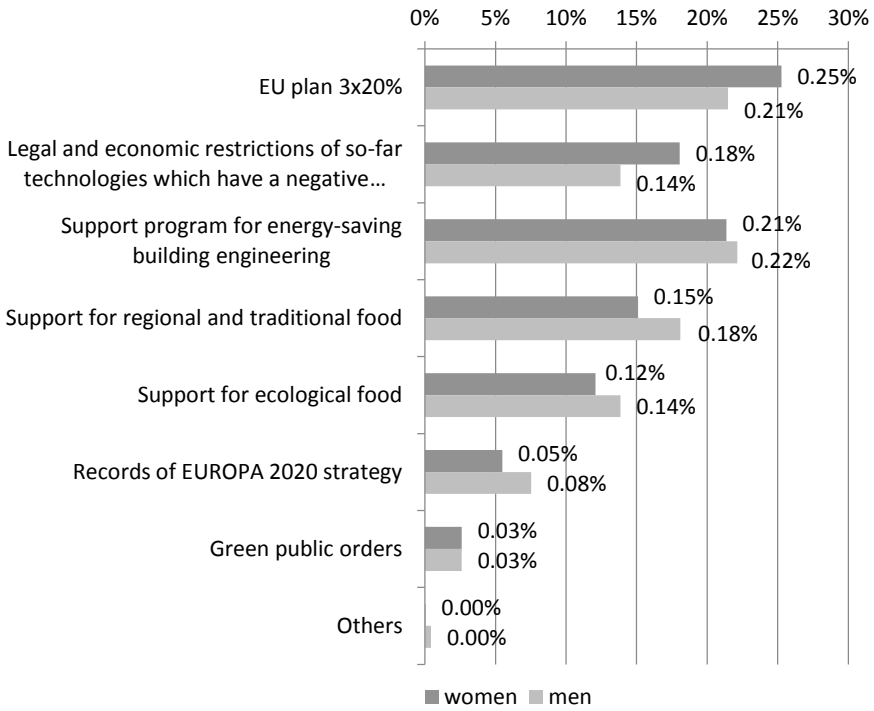

Figure 8. Elements of EU policy which could, in the opinion of respondents, have the greatest influence on the creation and implementation of eco-innovation (n = 996)

Source: own research.

When assessing the elements of European Union policy which could have the greatest impact on the creation and implementation of eco-innovation, respondents could choose three of the given answers (fig. 8). The highest percentage of women surveyed (25,26%) considered an EU plan for energy as the most important factor and CO2 - 3x20%, respectively support program for energy-efficient construction (European legal system until 2020) - 21,36% of the respondents. Most of the responses by males were similar.

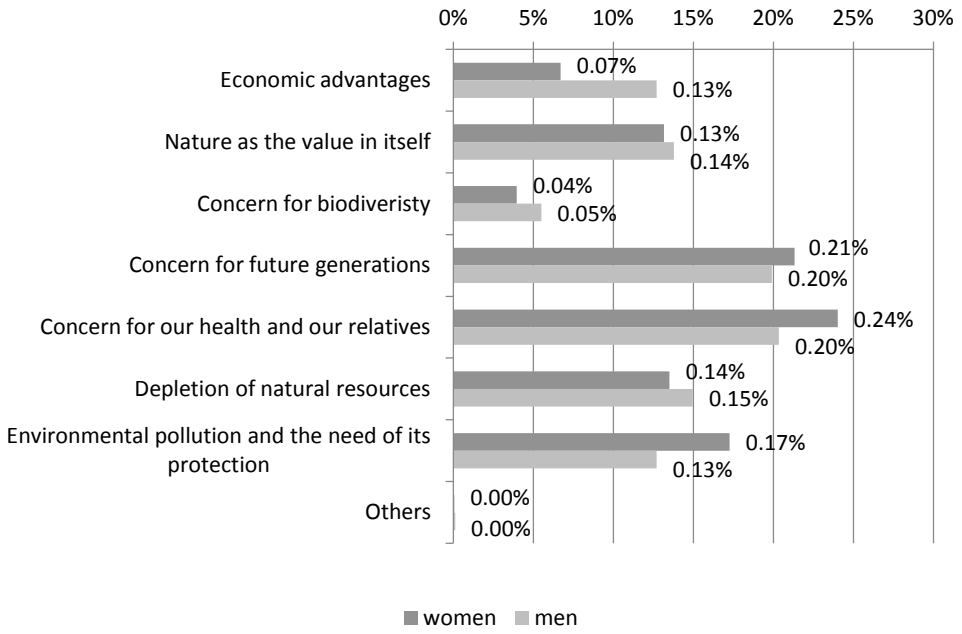

Figure 9. The reasons why, according to the respondents, it is worth to create and implement eco-innovation (n = 1004)

Source: own research.

The most often selected reasons why one should create and implement eco-innovative solutions (respondents could choose up to 3 answers) were: concern for their own health and their relatives (24,02% women and 20,34% men), and concern for future generations (21,33% of women and 19,91% of respondents), so the ratio of men and women to this issue was very similar (fig. 9), it also indicates a high level of environmental awareness and social responsibility in this intergenerational high proportion of individuals.

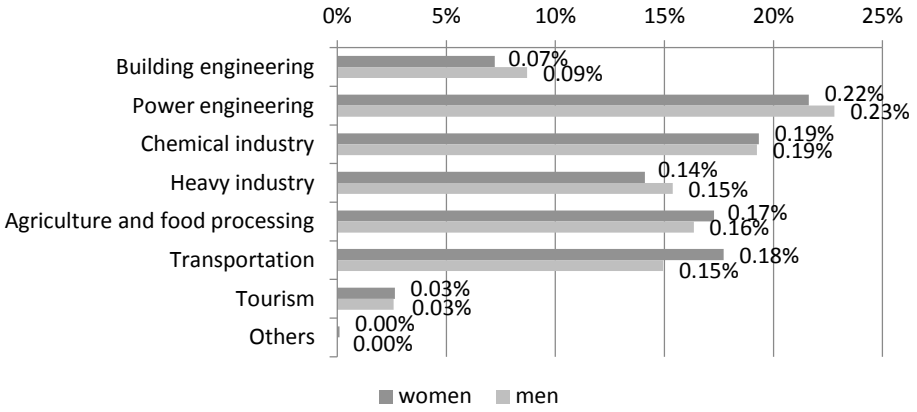

Figure 10. Areas (including sectors), where the respondents see the biggest needs to create eco-innovation (n = 1005)

Source: own research.

The choice of areas (sectors, industries), characterized by the respondents' opinion by the greatest need for the creation of eco-innovation, had a similar structure when comparing responses of men and women (fig. 10). Also in this case, the participants of the survey could select up to three responses. Women as the most important in this regard acknowledged: energy (21,62% respondents), chemical industry (19,33%), transportation (17,72%), and agriculture and food processing (17,28%). Men power engineering (22,80% of respondents), chemical industry (19,25%), agriculture and food processing (16,34%) and heavy industry (15,38%).

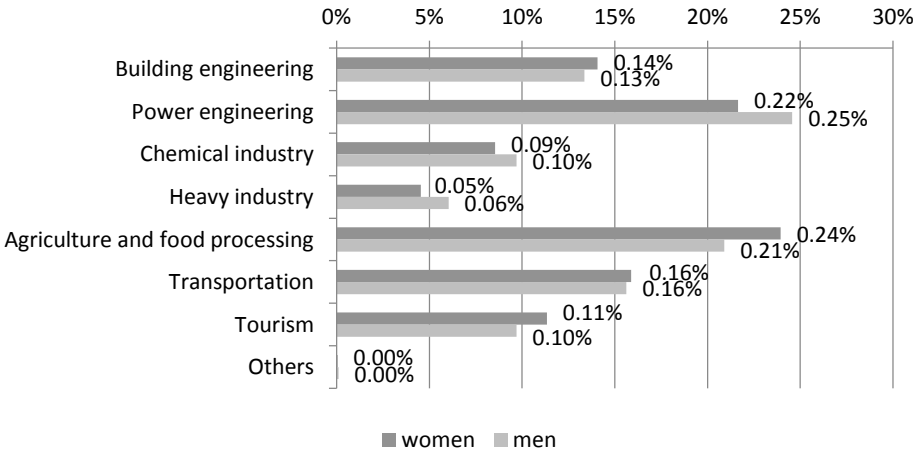

Figure 11. Areas (including sectors), where, in the opinion of the respondents, there are the greatest opportunities to create eco-innovation (n = 1004)

Source: own research.

The choice of areas (sectors, industries), where there is the greatest potential for creating eco-innovation (fig. 11) has a slightly different characteristics (as compared with the results shown in figure 8). Also in this case, the respondents could choose three answers. Women can perceive the greatest potential for creating eco-innovation in agriculture and food processing (23,94% of respondents), followed by power engineering (21,64%), transportation (15,88%) and building engineering, (14,07%). Men placed in the first place power engineering (24,57% of respondents), respectively agriculture and food processing (20,91%), transportation (15,63%) and building engineering (13,36%).

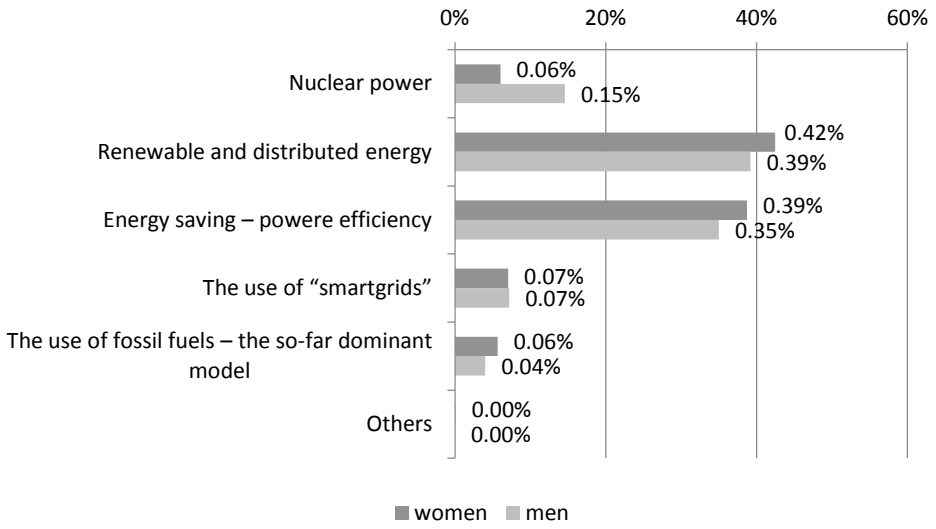

Figure 12. The types of energy policy, most conducive to create innovation according to respondents (n = 955)

Source: own research.

Respondents also made the type (or elements) selection types of energy policy, the most conducive to the creation of eco-innovation (research results - fig. 12). Each participant of the surveys could in this case choose up to two answers. The choice of types or elements of the policy was similar, there was a large diversity of responses between both sexes. Both women and me, recognized as the most important the (not just European) policy preference for renewable energy and distributed energy (42,45% of women and 39,20% of male respondents), followed by programs to save energy and increase energy efficiency (38,73% women and 35,01% men). The percentage of other answers was small.

Among the important issues of modern times, the respondents made the selection of types of distributed and renewable energy, which, in their opinion, contain the greatest potential for the creation of eco-innovation (fig. 13). Both women and men can see the greatest potential for eco-innovation in the methods of utilization of solar energy (photovoltaic panels and solar panels), 35,66% of women and 32,37% of the male respondents. Women also pointed at wind energy (21,16%) and the production and use of

biofuels (e.g. biodiesel) – 18,34%. Men also placed as the second the wind energy (22,71%), and then geothermal energy (16,95%).

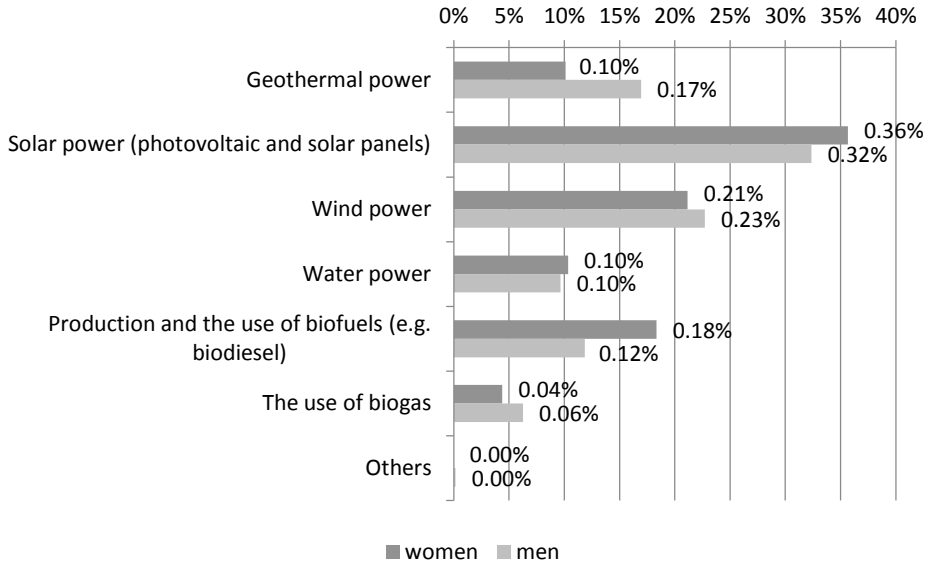

Figure 13. The types of distributed and renewable energy containing, in the opinion of respondents, the greatest potential for eco-innovation (n = 946)

Source: own research.

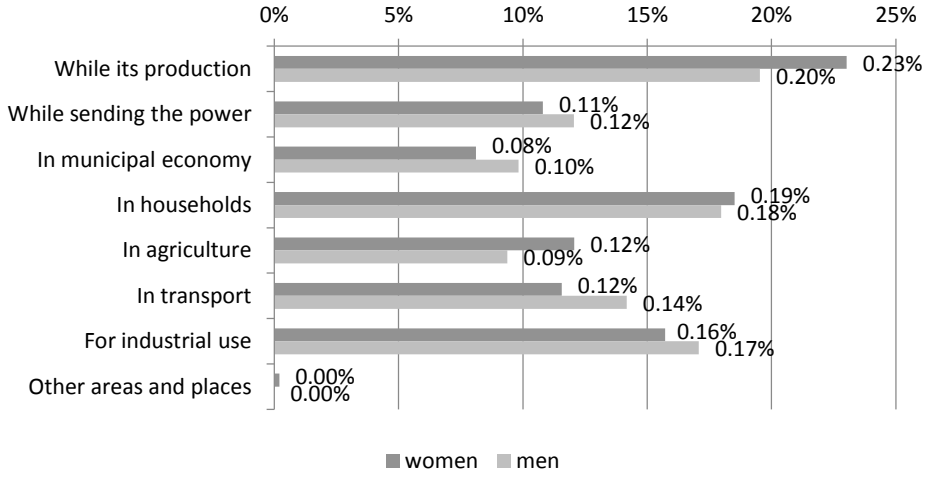

Figure 14. Stages and places of production and use of energy, where, in the opinion of the respondents, there are the greatest opportunities to create eco-innovation related to energy saving (n = 980)

Source: own research.

The need to save energy resources and to increase energy efficiency also indicate the need for exploration, creation and implementation of eco-innovation. Respondents, who had the opportunity to indicate a maximum of three answers, made the selection of the most important capabilities - the results are presented in fig. 14. Both women and men recognized the method of production (women – 23,02%, male respondents -19,53%) as the most important area for creation eco-innovation. Another area, identified as important in the opinion of research participants, are solutions for households (18,51% of women, 17,97% of men). Respondents also drew more attention to the possibility of using eco-innovation in industry (15,72% women and 17,08% men).

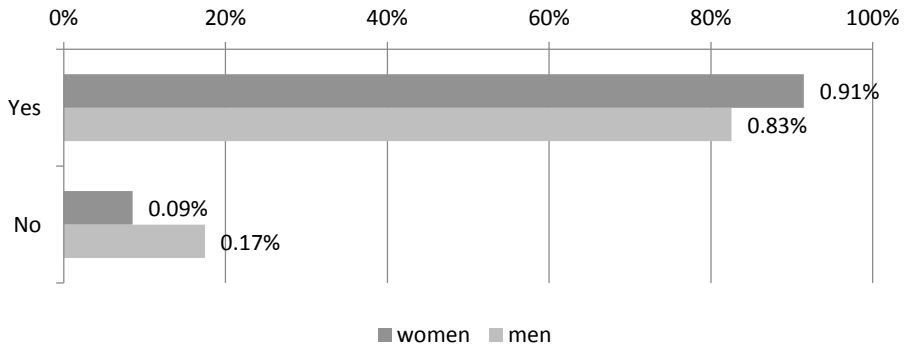

Figure 15. Respondents' opinions regarding innovation as a return to traditional solutions, natural (forgotten or ignored) (n = 980)

Source: own research.

The vast majority of female and male respondents considered (results in fig. 15) that a return to environmentally friendly, traditional, often forgotten or ignored solutions can be considered as eco-innovativeness, and the result of such thinking and acting as an eco-innovation (it is usually to give a new function, or other different possibilities). This issue has been analyzed on a global scale in only one publication[37]. Respondents highly appreciated such trends and opportunities (91,50% females, 82,56% males).

7. CONCLUSIONS

The research conducted are of theoretical importance as the generation of new knowledge, but they may also have practical significance, since it will be important to use the results in the process of implementation, evaluation and monitoring of the strategy of smart specialization (by supporting the practice of networking and innovation systems in the regions and in the country).

Consideration in the theoretical models of innovation systems (from the triple to the quadruple helix) of the importance of the ecosystem and the need for creating innovation

[37] Carmelo C., Piccioni V., *Traditiovations: Creating innovation from the past and antique techniques for rural areas*, Technovation 31, 2011, p. 689-699.

(eco-innovation), strongly influencing on the environment, means the already observed evolution of not only theory but also practice.

An implementation of the quadruple helix model requires ecological and eco-innovative public awareness (all stakeholders), but it also shapes it. The research carried out among students has confirmed the existence of a large potential which understands the environmental problems of the younger generation, and it has also shown higher awareness of eco-innovation of young women.

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ŚWIADOMOŚĆ EKOINNOWACYJNA MŁODYCH KOBIET I MĘŻCZYZN JAKO ELEMENT EKOINNOWACYJNEGO ZARZĄDZANIA ROZWOJEM REGIONU

W obliczu postępującej degradacji środowiska, wyczerpywania się naturalnych zasobów, a także stwierdzanego już braku pojemności środowiska na odpady, istotnym wydaje się zmiana paradygmatu myślenia – zawsze potrzebne innowacje powinny zostać zastąpione ekoinnowacjami, a świadomość innowacyjną należy rozwijać w kierunku świadomości ekoinnowacyjnej. Głównym celem badań, których wyniki przedstawiono w niniejszym artykule, było rozpoznanie aktualnego stanu ekoinnowacyjnej świadomości młodych kobiet i mężczyzn. W kontekście zagadnień istotnych dla tematyki tej pracy, wykonywano systematyczny przegląd literatury krajowej i zagranicznej, który stał się jedną z inspiracji podjęcia niniejszych badań. Wykonany przegląd nie wykazał prac poświęconych świadomości ekoinnowacyjnej w odniesieniu do płci, co w tym kontekście dodatkowo uzasadnia potrzebę wykonania takich badań. Badania miały charakter ilościowy, formularz ankietowy skierowano do populacji 1015 studentów Politechniki Rzeszowskiej, kobiet i mężczyzn, reprezentujących – pod względem stałego miejsca zamieszkania – cały obszar województwa podkarpackiego (zakres przestrzenny badań). Zakres czasowy badań objął okres od stycznia do kwietnia 2016 roku. Uzyskane w badaniach odpowiedzi ankietowanych pozwalają na stwierdzenie, że młodzi ludzie – uogólniając – charakteryzują się

stosunkowo wysoką świadomością ekoinnowacyjną, mimo iż tak jej nie definiują. Potrafią określić potrzeby i cele kreowania ekoinnowacji. Świadomość ta jest wyższa u kobiet, co wyznacza ich możliwą rolę w kreowaniu i realizacji polityki nakierowanej na wsparcie ekoinnowacji, także w wymiarze regionalnym.

Słowa kluczowe: świadomość ekoinnowacyjna, pięcioelementowa helisa, kobiety, mężczyźni, zarządzanie regionem.

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