

Gender equality and innovation – towards sustainable development and social innovation using the example of activities undertaken by the European Union

Leszek Kwieciński, *University of Wrocław (Wrocław, Poland)*

E-mail: leszek.kwiecinski2@uwr.edu.pl

ORCID ID: 0000-0003-3678-6132

Abstract

The main aim of the article is to analyse the importance of gender equality in the context of implementing social innovations and the principles of sustainable development. These processes will be shown in the context of activities undertaken at the European level and by European institutions. The main research problem of the article is to present arguments relating to the growing importance of the concept of sustainable development and social innovation, for which social order and gender equality are of key importance. Such identification of the concept of sustainable socio-economic development with social order and gender equality in the creation of contemporary innovations can be analysed in a scientific perspective with the functional theory of social change by A.R. Redcliffe-Brown and B. Malinowski. On the other hand, in practical terms it is entwined with all types of activities, strategies or programmes undertaken and implemented in the pragmatics of European Union activities (eg. *Commission Work Programme 2020: A Union that strives for more*, the Ljubljana Declaration, the Programme *Horizon Europe*, including *Women TechEU*). The author uses both traditional research methods as a middle-order system analysis and institutional-legal method, as well as new methods, including sociological neoinstitutionalism and network analysis. The research techniques used in the analysis are mainly quantitative techniques, i.e. desk research or analysis of existing data from databases *She Figures*, GEM, Statista.com.

Keywords: sustainable development, social innovation, European Union, gender equality

Równość płci a innowacyjność – w kierunku zrównoważonego rozwoju i innowacji społecznych na przykładzie działań podejmowanych przez Unię Europejską

Streszczenie

Głównym celem artykułu jest analiza znaczenia równości płci w kontekście wdrażania innowacji społecznych i zasad zrównoważonego rozwoju. Owe procesy zostaną ukazane w kontekście działań podejmowanych na poziomie europejskim oraz przez instytucje europejskie. Głównym problemem badawczym artykułu jest przedstawienie argumentów odnoszących się do wzrastającego znaczenia koncepcji zrównoważonego rozwoju i innowacji społecznych, dla których to ład społeczny i równość płci mają kluczowe znaczenie. Takie utożsamienie koncepcji zrównoważonego rozwoju społeczno-gospodarczego z ładem społecznym i równością płci w kreowaniu współczesnych innowacji można zbadać w ujęciu naukowym na podstawie funkcjonalnej teorii zmiany społecznej A.R. Redcliffe-Browna i B. Malinowskiego. Natomiast w ujęciu praktycznym – z wszelkiego typu działaniami, strategiami czy programami podejmowanymi i realizowanymi w pragmatyce działań Unii Europejskiej (np. Program roboczy KE pt. *Unia, która mierzy wyżej*, Deklaracja z Lublany, Program *Horyzont Europa*, w tym *Women TechEU*). W odniesieniu do metod badawczych, w artykule wykorzystano tradycyjne metody badawcze (jak analiza systemowa średniego rzędu oraz metoda instytucjonalno-prawna), a także nowe metody, w tym neoinstytucjonalizm socjologiczny oraz analiza sieci. Technikami badawczymi, jakimi posłużono się w analizie, są głównie techniki ilościowe, tj. analiza typu *desk research* czy analiza danych zastanych, zawartych w bazach *She Figures*, GEM, Statista.com.

Słowa kluczowe: zrównoważony rozwój, innowacje społeczne, Unia Europejska, równość płci

A review of the innovation literature suggests that research on gender issues has increased significantly over the past few years. These studies address issues such as women on corporate boards, which can affect a company's financial performance and social impact (Campbell, Minguez-Vera 2008; Carter et al. 2010; Boulouta 2013; Solakoglu 2013), gender and corporate governance (Carter et al. 2003; Francoeur et al. 2008; Adams, Ferreira 2009), gender identification as a company asset (Hillman et al. 2000), networking (Westphal, Milton 2000; Arfken et al. 2004; Hillman et al. 2007), types and dimensions of innovation (Turner 2009; Díaz-García et al. 2013). In many articles, authors argue that gender as the new determinant of the modern description of innovation has not been sufficiently studied (Blake, Hanson 2005; Fagerberg 2005; Alsos et al. 2016; Smith 2020; Trauth 2023).

Three perspectives of innovation concerning gender can be distinguished in the analysed literature. The first is the so-called "person-centred" or "gender-centred" (Horner 1972; Terborg 1977; Riger, Galligan 1980; Adler, Israeli 1988). This perspective has been used since the 1970s, when women gained access to master's degrees, meaning they were involved in organisational management of companies focusing on innovation. This approach attributes the limited representation of women in senior positions to factors that are internal to women (behavioural aspects), e.g., their ill-suited characteristics, beliefs, attitudes and behaviours (Fagenson 1990).

The second perspective, called the "situational or structural approach" (Kanter 1988; Freeman 1990), asserts that the behaviour of people is strongly related to the positions they hold in organisational hierarchies and the structures of the studied organisations. In other words, instead of behavioural (gender-related) factors, organisational structure shapes and determines women's behaviour in the workplace as well as in career progression (Fagenson 1990). Taking this fact into account, the limited percentage of women in innovative organisations is not only due to gender, but, above all, to organisational structures. Moreover, both of these factors interact with culture and shape women's behaviour in the workplace.

The third approach, the "Gender–Organisation–System" (GOS), argues that women's behaviour and the difficulties they encounter in innovation processes cannot be attributed solely to gender, because individuals differ from each other not only in terms of gender (Fagenson 1990, 1993), but also in terms of their national, social and institutional system locations, and the cultural context as a whole (Biscione et al. 2022). Moreover, it is noted that specific classifications and concepts relating to innovation, such as the knowledge-based economy, the *Oslo Manual* (see: OECD/Eurostat 2018), and the STEM approach, are widely accepted as the standard for innovation and are implemented in industries and sectors led mainly by men. Therefore, gender in relation to innovation processes has been and continues to be relevant (Blake, Hanson 2005; Beede et al. 2011; Belghiti-Mahut et al. 2016). It is assumed that the GOS approach is systemic, in the sense that it accounts for the interactions between individuals, organisations and society.

This article fits into the latter area of analysis related to the GOS approach. The author intends to present innovation and gender in the context of sustainable socio-economic development paradigm. The main aim of the article is to analyse the importance of gender in the context of implementing social innovations and the principles of sustainable development. These processes will be shown in the context of activities undertaken at the European level and by European institutions.

The essence of sustainable development is anthropocentrism, which is centred on values, and can be considered in relation to the categories of justice, or equality, of access to diverse environmental, social, and economic resources, etc. Such understanding of sustainable development is carried out through the integrity and implementation of five orders (arenas): social, institutional-political, environmental, spatial and economic. In this article, the scope of social order and the inherent gender equality associated with it will be analysed in detail.

Such identification of sustainable socio-economic development concept with social order and gender equality in creating contemporary innovations can be scientifically analysed by the application of Radcliffe-Brown's and Malinowski's theory of structural functionalism (see: Radcliffe-Brown 1940; Malinowski 1945). However, in practical terms it is entwined with all types of activities, strategies or programmes undertaken and implemented pragmatically by the European Union's activities, for example: *Commission Work Programme 2020: A Union that strives for more* (see: European Commission 2020a), *Ljubljana Declaration on Gender Equality in Research and Innovation* (see: Ljubljana Dec-

laration 2021), the *Framework Programme for Research and Innovation "Horizon Europe"* (see: Regulation (EU) 2021/695), including *Women TechEU* – the EU's scheme supporting deep-tech start-ups led by women. This is practical dimension, and the analysis of actions undertaken at the EU level for gender equality in research, development and innovation (R&D&I), is the goal of the article. Therefore, the article will discuss the theoretical and cognitive contexts of the concepts of sustainable development and social innovations, which are closely linked to gender equality. This will allow the analysis of the R&D&I structures of/in the EU Member States and the actions undertaken by the European Commission to strengthen the position and role of women in real participation in contemporary development processes. The most important structural conditions analysed in the article include degree subjects and graduates, the market and working conditions in the R&D&I sector, presence in decision-making positions in the R&D&I sector, the results of research and development activities, and the start-up market conditions.

The presented data demonstrate the increased activity of the EU institutions in terms of strengthening the participation of women in the R&D&I sector, which is based precisely on the paradigm of sustainable socio-economic development. It should be noted, however, that deficits related to the participation of women in R&D&I sector are still visible. As a result, it can be argued that we are dealing with a short-term emergence level, which is the third of the five stages that lead to permanent social change described in the model of social emergence (Praszkier, Nowak 2012; Sztompka 2007).

In terms of research methods, the article uses both traditional research methods such as medium-order systemic analysis and institutional-legal method, as well as new methods, including sociological neo-institutionalism, as well as network analysis (Lowndes 2006). Using the medium-order system analysis method, the author aims to demonstrate how social innovations affect existing innovation systems and policies. To this end, the institutional and legal method will also be helpful, because it enables the analysis of the key formal and legal solutions adopted at the supranational level in the EU. Sociological neo-institutionalism and network analysis, in turn, help to determine the impact of social innovations on the effects, and scale, of social changes. Thus, to determine to what extent the introduced programmes, and tools, contribute to permanent transformations of the targeted audience of such activities. The research techniques used in the analysis are quantitative, i.e., desk research or secondary analysis of databases, such as *She Figures* (see: European Commission 2021a), GEM, and Statista.com (see: Statista.com W/W/W).

Gender and the notions of sustainable socio-economic development and social innovation

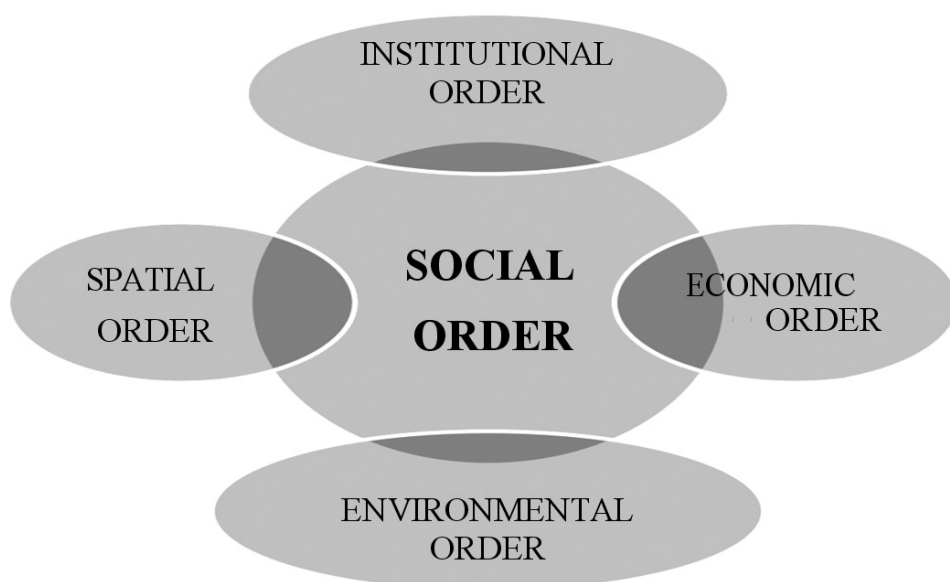
Scientific and technological development, as well as innovation, are processes that since the beginning of the twentieth century have become dynamic and are associated with new challenges. The concept of sustainable socio-economic development has become a common denominator for the development of competitiveness and innovation, in micro-, meso- and macro- structural terms. This is based on the notion of a knowledge-

based economy, the measures of which are presented in the *Oslo Manual* (see: OECD/Eurostat 2018) or *Frascati Manual* (see: OECD 2015). However, these classifications refer to the so-called traditional innovations such as product, process, marketing and market innovations. They barely take into account new types of innovation, such as social innovation, which enables a more precise grasp of the issue of real social changes and related values, such as justice or equality.

This new approach to understanding development and innovation concepts allows us not only to consider the context of gender more broadly and precisely, but offers an alternative to the negative consequences of technological development (Gawor 2006). In this sense, the concept of sustainable socio-economic development and social differences enable a wide inclusion both in terms of subjectivity (gender, social change) and objectivity (technological and non-technological innovations) and should lead to the legitimisation of activities and expenditure on scientific, research and development or innovative policies.

The core of sustainable development is fulfilling the aim of establishing a state of integrated order, which arises from the combination of social, institutional-political, economic, environmental and spatial orders.

Figure 1: Five-element structure of integrated order.¹



Source: author's own work, on the basis of the publication: Borys 2011: p. 78.

¹ At the centre of the flowchart is social order, which is the most capacious category. It consists of the remaining four equivalent orders – institutional, spatial, environmental and economic, which have a more functional (sectoral) meaning.

Each of these orders can be assigned a kind of capital, as a factor with a certain value that shapes each order. Human capital is linked to the social order, the natural capital is linked to the environmental order, the economic capital creates and influences the development of the economic order, and the system of social institutions is created by social capital, which is shaped by the institutional order (Borys 2011).

The central value of sustainable development is anthropocentrism (social order) concentrated on values, which can be considered in terms of, *inter alia*, the category of justice, or equality in access to diverse resources:

- environmental,
- institutional-political,
- economic,
- spatial.

Anthropocentrism, which is focused on human interests, emphasises the need to improve relations with other people, to eliminate problems that are social in nature, as well as to take into account the needs of present and future generations. Additionally, it emphasises the unique potential of such issues as quality of life, justice, equality, progress and social change (Soltys 2014).

The GOS approach informs us that the cultural context is responsible for the differences in innovation policies and systems. However, the innovation system is by its nature a social system, because it has three inherent properties: differentiation (diversity), dynamics and complexity. Like any social system, or perhaps by its very nature, the innovation system is an adaptive system with a triple adaptation (Radcliffe-Brown 1965):

- ecological adaptation (adaptation to a constantly changing environment),
- institutional adaptation (adaptation to changing patterns of behaviour),
- cultural adaptation (adaptation to changing norms and value systems).

As a result, the concept of sustainable socio-economic development, emphasising anthropocentrism and adaptation, adds social innovation to the existing traditional types of innovations. Social innovations, unlike technological innovations (*i.e.*, traditionally understood and described innovations linked to the research and development sector, companies or complex economic systems), do not have to be framed by:

- individual profit,
- taking a risk,
- radical innovation (Olejniczuk-Merta 2014).

Such innovations must be related to the use of knowledge, ideas, concepts and actions of consumers, as well as users and potential users of various goods and services, who know their own needs and the needs of groups they belong to, and have a vision and ideas how to meet them satisfactorily. They may also be promoted by various social groups.

Social innovation should lead to:

- institutional change (activities within organisations and institutions, technology and technology, as well as networking, and openness), which should translate into:

- socio-axiological change (actions towards stakeholders, society, values, ways of solving complex social problems).

The convergence of these two processes should result in a modernisation and civilisational effect in the form of social emergence (scope, durability, and depth of changes). In the literature on the subject, there are five levels of social emergence:

- 1) Individual – individual experiences, attitudes, cognitive processes.
- 2) Interaction – cooperation, negotiations, discourse patterns, symbolic interactions.
- 3) Short-term emergence – participatory structures, first roles and statuses, common goals, interaction framework.
- 4) Stable emergence – emerging group structures, stable principles of dialogue, structuring of leadership, a strategy of action, and team building.
- 5) Emergence (social change) – the emergence of procedures, laws, and the emergence of integrated, complex social systems.

The essence of social change is linked with cultural diffusion. This diffusion should concern the change in the arrangement of positions occupied by individuals in the social structure, and in the case discussed here, it is about increasing the importance of women in innovation processes (Malinowski 1945).

To sum up, social innovation, which is appropriate for the concept of sustainable socio-economic development, allows for non-technical and non-technological contexts of innovative processes to be considered. This broader perspective allows us to connect contemporary policies and innovative systems with social change. However, in order to consider the scope and depth of this change, it becomes necessary to take into account the gender factor, which includes the wide spectrum of behavioural-structural-process dependencies as noted in the GOS approach.

One of the key conditions for successfully implementing sustainable socio-economic development is to build a community of interests or have appropriate legal, organisational, social or financial resources. Real changes, beneficial for society and resulting in positive social changes, require the genuine involvement of many international participants (Sztumski 2006). Thus, the role of collective actors, such as international organisations, who have the appropriate resources to initiate and implement such changes, is growing. The European Union is one of the key international actors that uses sustainable development and social innovation concepts to emphasise gender equality.

Gender equality in the context of social innovation in the activities of the European Union

For years, the EU has been actively involved in promoting sustainable development, both among Member States and internationally. Positive and lasting change in this area is associated with much broader support for social innovation, which the European Commission defines as „the development and implementation of new ideas to meet social needs and create new social relationships and cooperation" (European Commission 2013). Such understanding, and – more important – the implementation of innovations, leads

to the expected social change. The process of implementing the idea of gender equality as one of the key principles of sustainable development in the social innovation field requires a long-term perspective and remains *in statu nascendi*. At this point, it should be highlighted that gender equality is one of the fundamental principles of the political and axiological system of the EU, as stated in Article 8 of the Treaty on the Functioning of the EU: „In all its activities, the Union shall aim to eliminate inequalities and to promote equality, between men and women.” (TFEU: art. 8).

The first document at the supranational level that equated sustainable growth with social innovation and social change was the EU's first sustainable development strategy document – *A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development* (see: European Commission 2001). According to it, sustainable development should be the overriding goal of all policies: common agricultural policy, common fisheries policy, transport policy, research and technological development policy, and cohesion policies. Investment in social innovation, science and technology, work for dialogue and openness in the decision-making process were considered as key priorities (see: European Commission 2001). The role of social innovation and social change in sustainable development was even more clearly stated in the *EU Sustainable Development Strategy*, which was renewed in 2006 (see: European Council 2006). This document is explicit that social innovation leading to social change aimed at sustainable development has to be intrinsically linked to the principles of solidarity, as well as social and intergenerational equality, and also to the ideas of an open and democratic society that can engage directly in the decision-making process.

Gender equality in the context of the implementation of the principles of sustainable development was directly included for the first time in the EU document COM(2019) 22 final titled *Reflection Paper: Towards a Sustainable Europe 2030* (see: European Commission 2019), which was the EU's direct response to the commitments made in 2015 at the UN forum, i.e. the *Millennium Development Goals*. According to the *Reflection Paper*, one of the key challenges of sustainable development is the need to eliminate income and access to education inequalities by ensuring equal treatment of women and men (European Commission 2019).

In the same year, 2019, the new European Commission led by Ursula von der Leyen made gender equality an absolute priority, including it later in the *Commission Working Programme 2020: A Union that strives for more*, which sets out the EU's priorities for 2030 (see: von der Leyen 2019; European Commission 2020a). Gender equality, as a key factor in sustainable development, social change and innovation, is addressed in Priority II titled *An economy that works for people*, and particularly in subtitle *A Union of equality* of the political guidelines for the next European Commission 2019-2024: *The Union that strives for more. My agenda for Europe* by candidate for President of the EC Ursula von der Leyen (see: von der Leyen 2019: p. 8, 11). Gender equality is directly linked to innovation, as it has been noted: „In business, politics and society as a whole, we can only reach our full potential if we use all of our talent and diversity. Diverse teams produce better results. Innovation happens when people from different backgrounds and perspectives blend

together." (von der Leyen 2019: p. 11). Gender equality and innovation are further linked to economic development: „Gender equality is a critical component of economic growth. The European Gender Strategy will systematically address the way laws impact the decisions women take throughout their lives..." (von der Leyen 2019: p. 11).

The *Ljubljana Declaration on Gender Equality in Research and Innovation* of June 2021 is confirmation of the future political direction of the European Commission. The document stresses the importance of maintaining the value of gender equality in research and innovation to unleash new and inclusive ways of living for all, as well as new opportunities for work and research. The Declaration sets out priority actions for the new *European Research Area* (ERA), meaning:

- "Ensure fair, open, inclusive and gender equal career paths in research" by changing outdated promotion rules in the scientific and academic community;
- "Employ existing and newly developed tools, such as Gender Equality Plans, to facilitate systemic institutional change and remove institutional barriers" to science, research and innovation;
- Combating gender-based violence;
- "Leverage synergies to enhance gender equality achievements within the European Research Area, but also within complementary fields such as the European Higher Education Area, Cohesion policy funds, innovation ecosystems, as well as in international cooperation." (Ljubljana Declaration 2021: p. 1).

Moreover, the Council of the EU, highlighted gender equality as an area "requiring priority actions to be developed and implemented under the ERA and the *Pact for Research and Innovation in Europe*" (Council Recommendation (EU) 2021/2122), as the foundation of the "new ERA", as well as a new governance framework for its implementation. The *Pact for Research and Innovation in Europe* underlines gender equality as the core of the Union's values and identifies gender equality and equal opportunities as the basis for research and innovation in the European Union.

Therefore, it can be said that in their political declarations both the Commission and the Council of the EU reaffirmed the need to focus policy on gender equality, particularly in the area of research and innovation, which will contribute to the process of increasing the resilience and quality of democratic institutions, but also to the sustainable development and competitiveness of the EU.

The aforementioned political declarations have become the basis for concrete actions related to gender equality in science, research and innovation in the policies of the EU institutions and Member States. The first decision that strengthened gender equality in long-term solutions that lead to innovation at the level of more than European research consortia were the regulations contained in the European Commission's Communication *A New ERA for Research and Innovation* (see: European Commission 2020b). The Commission implemented new criteria of financing under the Programme *Horizon Europe*. The mandatory conditions have been defined and must be met by both, entities and individual projects that are submitted under the EU's main instrument of its research and technological development policy (European Commission 2021a):

- all applicants, i.e., public authorities, research organisations and higher education institutions, must have a gender equality plan;
- gender mainstreaming has become an implicit requirement when defining the content of research and innovation calls across the programme;
- measures and actions to promote gender equality within the European Innovation Council (EIC) are defined and ensure the implementation of the gender equality principle in research teams, with the aim that women account for 50% of board members, expert groups and evaluation committees which are part of *Horizon Europe*;
- gender balance has become a deciding criterion for funding research teams for proposals with the same result.

In addition, *Horizon Europe* has established five new thematic areas (see: European Commission 2022):

- 1) Work-life balance and organisational culture;
- 2) Gender balance in leadership and decision-making;
- 3) Gender equality in recruitment and career development;
- 4) Integrating the gender dimension into research and teaching content;
- 5) Measures against gender-based violence, including sexual harassment.

Further actions taken at the supranational level to support gender equality in innovation, understood as market-focused rather than scientific and research endeavours, are the initiatives of the EIC, i.e., *Women TechEU* and the *European Award for Innovators*.

The new programme *Women TechEU* is aimed at close the gender innovation deficit by supporting women-led high-tech companies at the early, riskiest stage of their business. Through this programme, the EU's aim is to increase the number of women-led start-ups and to create a fairer and more prosperous European high-tech ecosystem. Advanced technologies are more than a quarter of Europe's start-up ecosystem, and European start-ups are currently valued at a total of €700 billion and are growing in value. However, women are largely under-represented in the most advanced technology field. Focusing on engineering innovations, high-tech start-ups typically have longer R&D cycles and often require more time and capital to build than other start-ups. Most of such projects might fail in the first years of operation if they do not receive adequate support and investment at the early stage. Women in the high-tech sector often face additional obstacles resulting from gender prejudices and stereotypes, especially in sectors such as technology.

Therefore, the programme *Women TechEU* offers grants with individual value of EUR 75,000 to support the initial stages of the innovation and development process (see: European Commission WWW). Mentoring and coaching are also provided on the basis of the EIC's *Women's Leadership Programme* and networking opportunities across the EU. In the first competition, which was decided in the spring of 2022, the Commission provided support to a group of 50 companies led by women from 15 countries. More than 40 of them are based in EU Member States, with 1/5 in countries with wider participation in *Horizon Europe*. In addition, around 1/5 of companies are based in countries associated with *Horizon Europe*. Companies that submitted funding tenders have developed innova-

tions in a wide range of areas, from early diagnosis and treatment of cancer to reducing the negative impact of methane emissions. They refer to the Sustainable Development Goals, such as combating climate change, reducing food waste, protecting health, as well as increasing access to education and empowering women. All funded initiatives meet the requirements of social innovation (see: EISMEA 2022).

The demand for initiatives such as *Women TechEU* is confirmed by the results of the call for proposals for the second edition of this programme. In October 2022, the EC received 467 applications from 35 countries: EU Member States and countries associated with Horizon Europe. Most of the applications, as in the pilot edition, were submitted by Spanish women managing start-ups. Companies from Germany and France once again took second and third place in terms of the number of submitted projects. The *Women TechEU* competition also attracted applications from countries associated with *Horizon Europe* – most of these applications came from Turkish and Norwegian start-ups, but companies from Israel, Albania, Moldova, Serbia and Ukraine also entered the competition. The proposals cover a wide range of high-tech areas, including, as in the previous edition, technologies, such as artificial intelligence, biotechnology, health technologies, clean technologies and ICT (see: EISMEA 2022).

In the second edition of *Women TechEU*, as many as 130 promising deep-tech start-ups from the EU Member States and associated countries will receive financial support in the form of grants of €75,000 as well as coaching and mentoring under the EIC's *Women Leadership Programme* (see: EISMEA 2022).

A separate initiative focused on the promotion of innovation activities amongst women innovators, is the possibility of applying for the *European Award for Female Innovators*. This award recognises women, who are the authors of breakthrough innovations in Europe. It is aimed at the creation of the role models for women and girls across Europe. In 2022, a record number of 277 applications were submitted so far. This fact demonstrates the rapidly growing number of women-led start-ups in Europe. In the previous three editions, the number of applications was as follows: 155 – in 2019, 197 – in 2020, and 264 – in 2021. One of the three main evaluation criteria in this competition is the social significance of innovation (impact), which must be a product or service that responds to specific social need or challenge, bringing significant benefits to people and/or the planet (see: European Innovation Council WWW).

The presented initiatives, as well as their implementation, are the response of EU countries and the EU itself to support the participation of women in the creation and implementation of innovations. These initiatives are to fit into the concept of sustainable development, and thus lead to social changes both through the implementation of innovative products or services and through much wider participation of women in these processes. The undertaken actions, which have intensified since 2019, are certainly desirable and valuable initiatives. The need to constantly create and support such initiatives is evidenced by the data presented in the reports published by the EC, titled *She Figures* (e.g. European Commission 2021b) and other documents on the subject matter, such as the *Global Entrepreneurship Monitor* (GEM), or Statista.com (see: Statista.com WWW).

Participation of women in processes supporting innovation on the example of the EU

In order to verify the theoretical assumptions of this article about the still insufficient participation of women in research, development and innovation (R&D&I) processes, the author shall use quantitative and qualitative lists illustrating the role of women in relation to the following structural areas:

- Studies and graduates;
- Market and working conditions in the R&D sector;
- Presence in decision-making positions in the R&D sector;
- Results of scientific and research activities, including the establishment and operation of start-ups.

Reports prepared by the EC, as well as other international institutions such as the *Global Entrepreneurship Monitor* or Statista.com, were used for the analysis. The main source of data, however, is the information contained in the reports *She Figures*, which have been published by the EC since 2003. The last report, published in 2021, covers the period from 2018 to 2021. This study monitors gender equality in research and innovation (see: European Commission 2021b).

The first of the analysed areas are the career development paths of women and men scientists in the period from the beginning of undergraduate and postgraduate degrees (first, second and third cycle degrees) to their completion. Analysing first- and second-cycle studies, on average, at the undergraduate and postgraduate (master's degree) level, female students account for 54% and at a graduate level, 59% are female students, and at the level of third-cycle female students account for 48%. However, differences between degree fields persist. For example, women still account for less than a quarter of ICT PhD graduates (22%). By contrast, in health and social care, and education, at least 60% of students are female (60% and 67% respectively). Similarly, visible disparities in favour of men are present in STEM (third cycle), i.e., production and processing (41% women), physical sciences (38%), architecture and construction (37%), mathematics and statistics (33%), engineering (27%), ICT (21%) (European Commission 2021b, p. 22–58).

One of the results of being a higher education graduate, in particular of the third cycle, is the possibility of women entering the labour market as a researcher. Analysing the most important data in this regard, it was noted that women made up around one-third (32.8%) of the total scientific population at European level. In 2018, women accounted for less than 25% of the population of self-employed science and engineering and ICT (STEM) professionals at European level. In the three main sectors of the economy (Higher Education Sector - HES, Government Sector - GOV, Business Enterprise Sector - BES), the largest percentage of female scientists were employed in HES, while the largest percentage of male scientists were employed in BES. In BES, the average annual growth rate for female researchers was higher than in the other two sectors (HES and GOV), which may reflect an increase in public finances support for R&D companies in the last decade (European Commission 2021b: p. 62–92).

In the context of the analysis of the R&D labour market, it is worth examining women's participation in decision-making positions, which is directly related to the process of professional

promotion. Gender diversity is closely linked to scientific positions A (professor), B (PhD), and C (young researcher). While women make up almost half of the academic teachers in C positions (47%), this number decreases in positions B (40%) and A (26%). In addition, at European level, in 2019, 23.6% of women were heads of institutes in higher education, an increase of 2.4% compared to 21.3% in 2016. When it comes to the management of universities and other higher education institutions (rector's function), in the EU, the ratio between men and women is 82% and 18%, respectively. Analysing data on women in managerial positions in the private R&D sector, gender disparity is also visible, because in 2019, just over three out of ten board members of private R&D institutes were women (31.1%) and less than a quarter were CEOs (24.5%) at European level (European Commission 2021b: p. 178–212).

The last area of gender differentiation analysed, is research and innovation, including the establishment and operation of start-ups. In this respect, the number of publications, being part of research teams, inventiveness, establishment and support of start-ups were analysed. At both European and national levels, between 2015 and 2019, women and men published at similar levels in the early stages of their careers. As authors get older, women publish less than men (European Commission 2021b: p. 219–220).

At the European and national level, between 2015 and 2019, men outnumbered women in research teams. Women were under-represented in natural sciences, engineering and technology. With regard to the changes introduced by the EC to *Horizon Europe*, their legitimacy can be demonstrated by the fact that at European level only about 1.7% of all Horizon 2020 projects took into account the gender dimension (European Commission 2021b: p. 235–242).

Between 2015 and 2018, women were also under-represented among inventors at European level. For every 10 inventions submitted by men, only slightly more than one invention was submitted by women (European Commission 2021b: p. 246–255).

The last analysed area is the findings from R&D&I studies, setting up and running one's own company. According to the GEM 2021 study, only every twentieth woman sets up her own business, while every eighth man does so (Women's Entrepreneurship 2022).

This information is complemented by data published by the Statista.com portal, which demonstrates that since 2017 the percentage of start-ups in the world with at least one woman as a founder has not changed and amounts to 19–20%. These disparities increase when the scope of start-up support is analysed. In 2020, start-ups founded by women received only \$5 billion in support from VC funds, while start-ups co-founded by both men and women invested roughly \$20 billion. What is particularly important in this regard, is that entities led by women perform better statistically, i.e., the average revenue generated per \$1 of investments in start-ups run by women was \$ 1.12, while for companies founded by men (or men and women) – \$ 1.04 (Statista.com WWW).

Conclusions

Based on the discussed data, the most important findings are the following.

The concept of sustainable socio-economic development and the related to it concept of social innovation considerably take into account the impact and importance

of gender in innovation systems and policies. The implementation of social innovations, understood as solving complex socio-economic problems, requires broad participation, especially in the aspect of gender. The aim of social innovations is to improve the quality of life of people belonging to different social groups and representing different generations. In the literature on the subject, but above all in the activities undertaken at the European level, many processes take into account social innovations and are based on broadly understood equality. The following areas can be indicated here: social exclusion, development of social entrepreneurship, social inequalities, unemployment, the situation of refugees, climate change, engaging people in the activities of non-governmental organisations, supporting children and youth from dysfunctional families, educational activities for socially excluded people, social integration of minorities and nationalities, promoting diversity in civil society, combating violence, building an inclusive culture in society, facilitating the excluded people's access to new technologies, and improving the quality of health care institutions.

Since 2019, there has been a significant increase in organisational and financial activities at European level relating to the support and participation of women in innovation processes and activities. Actions undertaken by the European Commission within the programmes *Horizon Europe* or *Women TechEU* and by the European Research Area (ERA) are certainly valuable initiatives that help to strengthen the participation of women from the world of science and business in solving current and future social and technological challenges in Europe. Subsequent editions of these projects and the growing interest of women clearly confirm that these are activities that reduce gender inequalities in European business and science.

The main deficits related to the participation of women in the R&D&I sector concern: the number of ICT, engineering and STEM graduates, the low representation of women scientists in the high-tech industry, the low representation of women in A positions in science and managerial positions in research, too few women involved in invention processes, entrepreneurship and support for start-ups, as well as the low representation of gender equality in the programmes *Horizon 2020* and *Horizon Europe*.

In effect, at European level, we can talk about a level of short-term social emergence gender issues in the R&D&I sector. This means that although new rules and arenas of action have been established, we cannot talk about a social change that would produce economies of scale and, thus, be significantly noticeable in European official statistics. Certainly, in order to move from the current level of short-term social emergence to a stable level of emergence that will induce social change, further and broader actions are needed both in relation to science (issues of promotion rules, participation of women in managerial functions, leading research teams) and business (financial and organisational support for entrepreneurship and inventiveness of women's teams). Since 2019, there has been a significant intensification of this type of initiatives, which is supported by the changing perception of innovation and development principles. Their further continuation and induction of new ones is required, also at the level of individual EU Member States.

Leszek Kwiecieński – researcher at the Institute of International Studies (Chief of the European and Strategic Studies Section) of the University of Wrocław. He is the Proxy of the Rector of the University of Wrocław for innovation and knowledge transfer. Main research interests: national and regional innovation systems and politics, public management, public politics, European integration. Recent publications: *W kierunku nowej polityki przemysłowej Unii Europejskiej: rola mechanizmu IPCEI*, „Horyzonty Polityki”, vol. 13, no. 42; *Rola administracji publicznej w procesie europeizacji na przykładzie Polski i Niemiec*, „Przegląd Zachodni” 2020, no. 1(374).

Leszek Kwiecieński – pracownik naukowy Instytutu Studiów Międzynarodowych (Kierownik Zakładu Studiów Europejskich i Strategicznych) Uniwersytetu Wrocławskiego. Pełnomocnik Rektora UW ds. innowacji i transferu wiedzy. Główne zainteresowania badawcze: krajowe i regionalne systemy i polityki innowacyjne, zarządzanie publiczne, polityki publiczne, integracja europejska. Wybrane publikacje: *W kierunku nowej polityki przemysłowej Unii Europejskiej: rola mechanizmu IPCEI*, „Horyzonty Polityki”, T. 13, nr 42; *Rola administracji publicznej w procesie europeizacji na przykładzie Polski i Niemiec*, „Przegląd Zachodni” 2020, nr 1(374).

➔ References:

- ALSOS Gary A., HYTTI Ulla, LJUNGGREN Elisabet (eds) (2016), *Research Handbook on Gender and Innovation*, Edward Elgar Publishing.
- ADAMS Renée B., FERREIRA Daniel (2009), *Women in the Boardroom and their Impact on Governance and Performance*, "Journal of Financial Economics", vol. 94, issue 2, DOI: 10.1016/j.jfineco.2008.10.007
- ADLER Nancy J., IZRAELI Dafna N. (1988), *Women in Management Worldwide*, New York.
- ARFKEN Deborah E., BELLAR Stephanie L., HELMS Marilyn M. (2004), *The Ultimate Glass Ceiling Revisited: The Presence of Women on Corporate Boards*, "Journal of Business Ethics", vol. 50, DOI: 10.1023/B:BUSI.0000022125.95758.98
- BELGHITI-MAHUT Sophia, LAFONT Anne-Laurence, YOUSFI Ouidad (2016), *Gender Gap in innovation: A confused link?*, "Journal of Innovation Economics & Management", vol. 19, issue 1, DOI: 10.3917/jie.019.0159
- BEEDE David, JULIAN Tiffany, LANGDON David, MCKITTRICK George, KHAN Beethika, DOMS Mark (2011), *Women in STEM: A Gender Gap to Innovation*, "Economics and Statistics Administration", Issue Brief No. 04-11, DOI: 10.2139/ssrn.1964782
- BISCIONE Antonella, BOCCANFUSO Dorothée, CARUSO Raul (2022), *The innovation gender gap in transition countries*, "Economia Politica", vol. 39, DOI: 10.1007/s40888-021-00238-4
- BLAKE Megan K., HANSON Susan (2005), *Rethinking Innovation: Context and gender*, "Environment and Planning A: Economy and Space", vol. 37, issue 4, DOI: 10.1068/a3710
- BORYS Tadeusz (2011), *Zrównoważony rozwój – jak rozpoznać ład zintegrowany*, „Problemy Ekorozwoju – Problems of Sustainable Development”, vol. 6, no 2.
- BOULOUTA Ioanna (2013), *Hidden connections: The link between board gender diversity and corporate social performance*, "Journal of Business Ethics", vol. 113, DOI: 10.1007/s10551-012-1293-7
- CAMPBELL Kevin, MÍNGUEZ-VERA Antonio (2008), *Gender diversity in the boardroom and firm financial performance*, "Journal of Business Ethics", vol. 83, DOI: 10.1007/s10551-007-9630-y

- CARTER David A., SIMKINS Betty J., SIMPSON W. Gary (2003), *Corporate Governance, Board Diversity, and Firm Value*, "The Financial Review", vol. 38, issue 1, DOI: 10.1111/1540-6288.00034
- CARTER David A., D'SOUZA Frank, SIMKINS Betty J., SIMPSON W. Gary (2010), *The Gender and Ethnic Diversity of US Boards and Board Committees and Firm Financial Performance*, "Corporate Governance: An International Review", vol. 18, issue 5, DOI: 10.1111/j.1467-8683.2010.00809.x
- COUNCIL RECOMMENDATION (EU) 2021/2122 of 26 November 2021 on a Pact for Research and Innovation in Europe, OJ L 431/1, 2.12.2021, <http://data.europa.eu/eli/reco/2021/2122/oj> (26.11.2021).
- DÍAZ-GARCÍA Cristina, GONZÁLEZ-MORENO Angela, SÁEZ-MARTÍNEZ Francisco Jose (2013), *Gender Diversity within R&D Teams: Its Impact on Radicalness of Innovation*, "Innovations: Management, Policy & Practice", vol. 15, issue 2, DOI: 10.5172/impp.2013.15.2.149
- ELAM Amanda B. et al. (2021), *Women's Entrepreneurship 2020/21: Thriving Through Crisis*, Global Entrepreneurship Research Association, London Business School, London.
- EISMEA, EUROPEAN INNOVATION COUNCIL AND SMEs EXECUTIVE AGENCY (2022), *Record number of applications received under the second Women TechEU call*, https://eisma.ec.europa.eu/news/record-number-applications-received-under-second-women-techeu-call-2022-10-05_en (05.10.2022).
- EUROPEAN COMMISSION (2000), Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and to the Committee of the Regions: *Towards a European Research Area*, COM(2000)6, Brussels, 18.01.2000.
- EUROPEAN COMMISSION (2001), Communication from the Commission: *A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development*, COM(2001)264 final, Brussels, 15.05.2001.
- EUROPEAN COMMISSION (2013), *Guide to social innovation*, Brussels, https://www.ess-europe.eu/sites/default/files/publications/files/social_innovation_2013.pdf (12.12.2022).
- EUROPEAN COMMISSION (2019), *Reflection Paper: Towards a Sustainable Europe by 2030*, COM(2019) 22 final, Brussels, 30.01.2019.
- EUROPEAN COMMISSION (2020a), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: *Commission Work Programme 2020: a Union that strives for more*, COM (2020) 37 final, Brussels, 29.01.2020.
- EUROPEAN COMMISSION (2020b), Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and to the Committee of the Regions: *A New ERA for Research and Innovation*, COM(2020)628 final, Brussels, 30.09.2020.
- EUROPEAN COMMISSION (2021a), *Horizon Europe, gender equality: a strengthened commitment in Horizon Europe*, Directorate-General for Research and Innovation, Publications Office, <https://data.europa.eu/doi/10.2777/97891>
- EUROPEAN COMMISSION (2021b), *She Figures 2021, Gender in Research and Innovation Statistics and Indicators*, November 2021, https://south.euneighbours.eu/wp-content/uploads/2022/07/Kl0221406ENN.en_-1.pdf (31.07.2022).
- EUROPEAN COMMISSION (2022), *Towards inclusive gender equality in research and innovation*, Directorate-General for Research and Innovation, Publications Office, <https://data.europa.eu/doi/10.2777/162481>
- EUROPEAN COMMISSION (W/W), *European Innovation Council and SMEs Executive Agency (EISMEA), Women TechEU*, https://eisma.ec.europa.eu/programmes/european-innovation-ecosystems/women-techeu_en#women-techeu-2021-2022 (12.12.2022).

- EUROPEAN COUNCIL (2006), *Review of the EU Sustainable Development Strategy (EU SDS) - Renewed Strategy*, 10917/06, Brussels, 26.06.2006, <https://data.consilium.europa.eu/doc/document/ST-10917-2006-INIT/en/pdf> (26.06.2006).
- EUROPEAN INNOVATION COUNCIL (WWW), *EU Prize for Women Innovators*, https://eic.ec.europa.eu/eic-prizes/eu-prize-women-innovators_en (12.12.2022).
- FAGENSON Ellen A. (1990), *Perceived masculine and feminine attributes examined as a function of individuals' sex and level in the organizational power hierarchy: A test of four theoretical perspectives*, "Journal of Applied Psychology", vol. 75(2), DOI: 10.1037/0021-9010.75.2.204
- FAGENSON Ellen A. (1993), *Diversity in management: Introduction and the importance of women in management*, in: Ellen A. Fagenson (ed.), *Women in management: Trends, issues, and challenges in managerial diversity*, Newbury Park, Sage Publications.
- FAGERBERG Jan (2009), *Chapter 1. Innovation: A Guide to the Literature*, in: Jan Fagerberg, David C. Mowery (eds), *The Oxford Handbook of Innovation*, Oxford University Press, DOI: 10.1093/oxfordhpb/9780199286805.003.0001
- FRANCOEUR Claude, LABELLE Réal, SINCLAIR-DEGAGNÉ Bernard (2008), *Gender Diversity in Corporate Governance and Top Management*, "Journal of Business Ethics", vol. 81, DOI: 10.1007/s10551-007-9482-5
- FREEMAN Christopher (1990), *Schumpeter's Business Cycles Revisited*, in: Arnold Heertje, Mark Perlman (eds), *Evolving Technology and Market Structure: Studies in Schumpeterian Economics*, First Edition, Ann Arbor, University of Michigan Press.
- GAWOR Leszek (2006), *Antyglobalizm, alterglobalizm i filozofia zrównoważonego rozwoju jako globalizacyjne alternatywy*, „Problemy Ekorozwoju”, vol. 1, no. 1.
- HILLMAN Amy J., CANNELLA Albert A., PAETZOLD Ramona L. (2000), *The resource dependence role of corporate directors: Strategic adaptation of board composition in response to environmental change*, "Journal of Management Studies", vol. 37(2), DOI: 10.1111/1467-6486.00179
- HILLMAN Amy J., SHROPSHIRE Christine, CANNELLA Albert A. (2007), *Organizational Predictors of Women on Corporate Boards*, "The Academy of Management Journal", vol. 50, no. 4, DOI: 10.5465/AMJ.2007.26279222
- HORNER Martina S. (1972), *Towards an Understanding of Achievement-Related Conflicts in Women*, "Journal of Social Issues", vol. 28, DOI: 10.1111/J.1540-4560.1972.TB00023.X
- KANTER Rosabeth Moss (1988), *When a Thousand Flowers Bloom: Structural, Collective, and Social Conditions for Innovation in Organizations*, in: B. M. Staw, L. L. Cummings (eds), *Research in organizational behavior*, vol. 10, Greenwich.
- LJUBLJANA DECLARATION (2021) *Gender Equality in Research and Innovation*, Brussels, 26 November 2021, https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/PSEU/Ljubljana-Declaration-on-Gender-Equality-in-Research-and-Innovation-_endorsed_final.pdf (12.12.2022).
- LOWNDES Vivien (2006), *Neoinstytucjonalizm*, in: David Marsh, Gerry Stoker (eds), *Teorie i metody w naukach politycznych*, tłum. Joanna Tegnerowicz, Kraków.
- MALINOWSKI Bronisław (1945), *The Dynamics of Culture Change. An inquiry into race relations in Africa*, Yale University Press, Oxford University Press
- MALINOWSKI Bronisław (2002), *A Scientific Theory of Culture and Other Essays*, Routledge, London.
- OLEJNICZUK-MERTA Anna (2013), *Innowacje społeczne*, „Konsumpcja i Rozwój”, no. 1 (4).

- OECD (2015), *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris, DOI: 10.1787/9789264239012-en
- OECD/EUROSTAT (2018), *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation*, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg, DOI: 10.1787/9789264304604-en
- PRASZKIER Ryszard, NOWAK Andrzej (2012), *Przedsiębiorczość społeczna. Teoria i praktyka*, Warszawa.
- RADCLIFFE-BROWN Alfred R. (1940), *On Social Structure*, "Journal of the Royal Anthropological Institute of Great Britain and Ireland", vol. 70(1).
- RADCLIFFE-BROWN Alfred R. (1965), *Structure and Function in Primitive Society*, London.
- REGULATION (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013, OJ L 170/1, 12.05.2021.
- RIGER Stephanie, GALLIGAN Pat (1980), *Women in management: An exploration of competing paradigms*, "American Psychologist", vol. 35(10), DOI: 10.1037/0003-066X.35.10.902
- SMITH Helen L. (ed.) (2020), *Gender, Science and Innovation. New Perspectives*, Edward Elgar Publishing.
- SOLAKOGLU Nihat M. (2013), *The role of gender diversity on firm performance: a regression quantile approach*, "Applied Economics Letters", vol. 20, issue 17, DOI: 10.1080/13504851.2013.829184
- SOLTYŚ Andrzej (2014), *Zrównoważony rozwój – idea czy rzeczywistość?*, in: Magdalena Terlecka (ed.), *Wybrane etyczno-filozoficzne aspekty ochrony środowiska*, Krosno.
- STATISTA.COM (WWW), *Female-founded startups worldwide 2021*, <https://www.statista.com/study/87230/female-startup-founders-globally/> (12.12.2022).
- SZTOMPKA Piotr (2007), *Socjologia. Analiza społeczeństwa*, Kraków.
- SZTUMSKI Wiesław (2006), *Idea zrównoważonego rozwoju a możliwości jej urzeczywistnienia*, „Problemy Ekorozwoju”, vol. 1, no. 2.
- TERBORG James R. (1977), *Women in management: A Research review*, "Journal of Applied Psychology", vol. 62(6), DOI: 10.1037/0021-9010.62.6.647
- TFEU, Treaty on the Functioning of the European Union (Consolidated version), OJ C 202, 07.06.2016.
- TRAUTH Eileen M. (ed.) (2023), *Handbook of Gender and Technology. Environment, Identity, Individual*, Edward Elgar Publishing.
- TURNER Laure (2009), *Gender diversity and innovative performance*, "International Journal of Innovation and Sustainable Development", vol. 4, no. 2-3, DOI: 10.1504/IJISD.2009.028067
- VON DER LEYEN Ursula (2019), *Political Guidelines for the next European Commission 2019-2024 "The Union that strives for more. My agenda for Europe"* by candidate for President of the EC, https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission_en_0.pdf (12.12.2022)
- WESTPHAL James D., MILTON Laurie P. (2000), *How Experience and Network Ties Affect the Influence of Demographic Minorities on Corporate Boards*, "Administrative Science Quarterly", vol. 45, issue 2, DOI: 10.2307/2667075