Nature and Information Engineering Publishing

Journal of Emerging Markets and Management

https://journals.niepublish.com/jemm

ARTICLE

Regional Demographic Correlates of Aggregate Readiness for Sustainable Entrepreneurship in the Wielkopolska Region in Poland, 2016 to 2025

Jacek Piotr Kwaśniewski

Institute of Economics, University of Economy in Bydgoszcz, 85-229 Bydgoszcz, Poland

ABSTRACT

This article aims to analyze the regional demographic correlates of overall readiness for sustainable entrepreneurship. The study aims to identify the impact of age and gender structure on the declared willingness to conduct business activities consistent with the principles of sustainable development in the Wielkopolska region in Poland between 2016 and 2025. The analysis is macroeconomic and ecological in nature, based on aggregated survey data and regional demographic data. The analysis does not identify determinants at the individual level, and the obtained relationships should be interpreted as ecological correlations. The results indicate that the age and gender structure in the region correlates with changes in overall readiness for sustainable entrepreneurship, with the participation of younger working-age cohorts being particularly significant. The dependent variable is the average annual level of readiness for sustainable entrepreneurship (SEE), constructed based on surveys conducted among entrepreneurs. The study utilized statistical and econometric methods, particularly the classical least squares method, and calculations were performed using the GRETL package. The results of the analyses indicate statistically significant correlations between the region's demographic structure and the level of readiness to implement sustainable development principles in business. A particularly strong and positive effect was noted for men under 40, suggesting greater openness to ecological and social innovations in this group. At the same time, negative correlations were observed for older age cohorts and the overall population, which may be due to structural and competitive

*CORRESPONDING AUTHOR:

Jacek Piotr Kwaśniewski, Institute of Economics, University of Economy in Bydgoszcz, 85-229 Bydgoszcz, Poland;
Email: jacek.piotr.kwasniewski@wp.pl

ARTICLE INFO

Received: 11 November 2025 | Revised: 20 February 2026 | Accepted: 2 March 2026 | Published Online: 10 March 2026
DOI: https://doi.org/10.63385/jemm.v2i2.395

CITATION

Kwaśniewski, J.P., 2026. Regional Demographic Correlates of Aggregate Readiness for Sustainable Entrepreneurship in the Wielkopolska Region in Poland, 2016 to 2025. Journal of Emerging Markets and Management. 2(2): 62–79. DOI: https://doi.org/10.63385/jemm.v2i2.395

COPYRIGHT

Copyright © 2026 by the author(s). Published by Nature and Information Engineering Publishing Sdn. Bhd. This is an open access article under the Creative Commons Attribution 4.0 International (CC BY 4.0) License (https://creativecommons.org/licenses/by/4.0/).

factors. The author emphasizes the exploratory nature of the model and the limitations resulting from the ecological level of analysis, pointing to the need for further research using a multilevel approach.
Keywords: Entrepreneurship; Sustainable Development; Model Estimation

1. Introduction

The contemporary global economy is facing challenges that increasingly force the need to redefine development goals and strategies. In the face of ongoing environmental degradation, deepening social inequalities, and limited natural resources, the concept of sustainable development has become one of the most important paradigms determining the directions of economic, social, and environmental policy. This idea, rooted in UN reports, especially in the document "Our Common Future", from 1987, envisions a harmonious combination of economic growth with environmental protection and social well-being. In the 21st century, sustainable development has ceased to be a theoretical concept it has become a mandatory standard for conducting business and a prerequisite for maintaining the competitiveness of enterprises in the global market.

Sustainable development is given practical expression in the concept of sustainable entrepreneurship, which integrates economic goals with social and environmental values. In the era of energy, digital, and social transformation, enterprises are not only market participants but also active agents of change – their decisions influence resource management, employment structure, innovation levels, and accountability to stakeholders. Sustainable entrepreneurship is therefore becoming a key factor in achieving the goals of the 2030 Agenda and the UN Millennium Development Goals.

However, the implementation of sustainable development concepts in business practice is uneven. At the microeconomic level, a discrepancy remains between awareness of the need for sustainable action and the actual willingness to implement it. These attitudes are influenced by numerous factors, both external (economic, legal, institutional) and internal (psychological, social, demographic). Among the latter, gender and age are particularly significant, shaping the perception of environmental responsibility, the level of innovation, and the willingness to take business risks.

The differences in entrepreneurial attitudes between women and men regarding the implementation of sustainable development principles stem from differences in socialization, professional experience, and management style preferences. Numerous studies indicate that women are more likely to demonstrate a social and pro-ecological orientation, focusing on the long-term effects of their actions, while men more often emphasize economic aspects and operational efficiency. In turn, entrepreneurs' age is strongly associated with their level of openness to innovation, adaptability, and environmental awareness.

The aim of this article is to identify the influence of age and gender on the willingness to run a business in accordance with the principles of sustainable development and to assess the extent to which these variables can determine the direction and intensity of pro-environmental activities among entrepreneurs. The research findings can become the basis for formulating regional strategies aimed at supporting sustainable entrepreneurship, especially among young people and women, whose innovative and social potential is crucial for transforming the economy towards sustainable development.

The author would like to point out that some of the conceptual elements of this study draw on the author's earlier work. However, this paper introduces new data, an extended time horizon, and an original econometric specification.

2. Materials and Methods

Observations from 2016 to 2025 were used to quantitatively analyze the impact of gender and age on the willingness to run a business according to the principles of sustainable development. The set of administrative units covered by the constructed model consists of the Wielkopolska Voivodeship.

The following research methods were used during the research: survey, statistical, econometric, and graphical. The primary research tool was a computer with statistical software (GRETL and EXCEL) and graphics software. The scope of the study covered the years 2016 to 2025, and the area covered the Wielkopolska Voivodeship. The research proper consisted of sending survey questionnaires via email

to 232 businesses located in the Wielkopolska Voivodeship. 129 correctly completed surveys were returned.

3. Sustainable Development Enterprise

Sustainable enterprises are companies that conduct business in a way that generates economic value while minimizing negative impacts on people and the planet. They also enhance the long-term trust of employees (three dimensions: economic, social, and environmental), customers (minimizing waste, product longevity), local communities (corporate social responsibility), and investors (environment, society, and corporate governance). Sustainability can be measured using the following indicators: financial (CO_2 emissions, energy consumption, safety, workforce diversity, ethical supply chain), non-financial (ESG tests—environment, society, and governance, CSR reports—publications on companies managing their operations in a socially responsible manner), and assessment of risks related to climate, regulations, and reputation. The most important element of sustainable enterprises' operations is the principles they adhere to in achieving their goals.

3.1. Principles of Sustainable Development

Sustainable development can be approached on many levels, including philosophy, anthropocentric views, economics, ecology, and politics. In politics and political programs, it is the focus of attention of various international organizations, such as the UN, the European Union, non-governmental organizations, nation-states, and local governments[1] (p. 107).

In the anthropocentric interpretation, the term sustainable development functions as a slogan calling for the fight against environmental threats and growing social disproportion that destroys solidarity, the sense of justice, and humanitarianism[2] (p. 9). According to biometricians, sustainable development is a vision of a new human community characterized by ecological awareness, which treats humans like other forms of life (a cosmic ecosystem)[1, 3] (p. 65; p. 66).

The concept of sustainable development aims to reconcile two seemingly contradictory interests. It aims to ensure a life of increasing prosperity while simultaneously reducing the consumption of energy resources. Resolving the following current and future dilemmas depends on this[2] (p. 10):

- Producing more products from something that is becoming scarcer;
- Getting rich moderately dynamically;
- Motivating productivity growth with limited enrichment;
- Limited enrichment should become the driving force of the economy in the future.

The 20th century resulted in the strengthening of the conviction of many scientists about the importance of understanding the diversity and multiple paths and patterns of development, which should constitute the most important principles of transition to sustainable development processes[4] (p. 179).

The first principles regarding the future use of the environment were defined in 1972 in Stockholm[5]. During the conference held there, the term "eco-development" began to be used to describe actions that take into account environmental protection[6] (p. 13). Conference participants recognized that environmental resource management cannot proceed without the involvement of developing countries. To this day, the conclusions from this conference constitute a reference point for shaping international relations in the area of using the natural environment[7] (p. 16). In parallel, an alternative paradigm emerged, recognizing that the quality of human life, not just the economy, is paramount. This approach allowed for the formulation of the concept of the right to human development as inalienable[8] (pp. 135–137).

In Polish legislation, sustainable development was already included in the Act on the Protection and Management of the Environment in 1980[9]. According to this Act, sustainable development means: efficient use of resources and their legal protection, ensuring the regeneration of natural resources, protecting biodiversity, guaranteeing ecological safety, the natural environment being a common good, appropriate conditions for entrepreneurs in accessing resources, and opportunities for removing pollution[10] (p. 25).

Sustainable development was also included in the Constitution of 1997[11] (art. 5), and according to the Environmental Protection Law, it is presented as follows: it is socio-economic development, ensures the maintenance of natural

balance in all aspects of development, and guarantees the provision of basic social needs of both present and future generations [12].

During the 1992 Earth Summit, the so-called Declaration of Rights and Responsibilities in the Process of Sustainable Development was adopted. The basic principles that emerged therein constitute a set of recommendations on a global scale [13] (pp. 10–12). The Agenda contains 2.500 recommendations for states, governments, international and intergovernmental organizations, and societies. The Agenda is divided into four parts, which refer to integrated development levels, such as Transforming Our World: The 2030 Agenda for Sustainable Development [7] (p. 17): The social and economic dimensions, the conservation and management of resources, strengthening the role of significant social groups, and means of implementation.

Many UN conferences have addressed socio-economic issues such as education, human rights, the situation of women, and food and nutrition. The conclusions from these discussions have led to international principles and development goals, known as the Millennium Development Goals (MDGs), adopted in 2000 (**Table 1**).

Table 1. Goals and tasks of sustainable development, UN Millennium Declaration [14] (p. 9).

Goals	Tasks
Eliminating extreme poverty and hunger in the world	Halve the number of people whose income is less than $1 a day and the number of people suffering from hunger.
Ensuring universal primary education	Ensuring that all boys and girls have the opportunity to complete their primary education.
Promoting gender equality and women's social advancement	Eliminating gender inequality in access to primary and secondary education.
Reducing child mortality	Reducing the mortality rate of children under five by two-thirds.
Improving maternal health care	Reduction in maternal mortality rate by 3/4.
Limiting the spread of HIV/AIDS, malaria and other diseases	Stopping the spread of HIV/AIDS and reducing the number of new infections. Stopping the spread of malaria and other serious diseases and reducing new cases.
Applying sustainable methods of managing natural resources Creating a global partnership for development	Integrating the principles of sustainable development into national strategies and programmes; reducing by half the number of households without permanent access to clean drinking water; achieving a significant improvement in the living conditions of people living in slums; eliminating discrimination in access to the trade and financial system; abolishing customs duties on goods exported by the financially weakest countries; reducing poverty; and promoting access to new technologies.

The next step towards specifying the principles of sustainable development was the 2030 Agenda [UN, 2015, A/RES/70/1], under which member states agreed on basic development goals that could be used to verify the main goal of sustainable development. Seventeen goals and 169 related targets were identified [15] (p. 102).

The main feature that distinguishes traditionally perceived development from sustainable development is a longer time perspective. Actions undertaken in accordance with the concept of sustainable development should take into account not only current changes but also future changes [16] (pp. 81–82). The quality of human life in the natural and economic environment should be characterized by ecological, social, and economic security.

There are two pillars of sustainable development policy: intragenerational and intergenerational sustainability, and equivalence, i.e., the achievement of economic and social goals, taking into account the maintenance of high quality of the natural environment [17] (pp. 108). Implementing the idea of sustainable development entails the integration of many levels of action, such as moral, ecological, technical, legal, social, and political [18] (p. 22).

3.2. The Essence of a Sustainable Enterprise

Three types of business activity are crucial for sustainable development: social, ecological, and sustainable. Social entrepreneurship is an economic activity that combines economic goals with public welfare activities. The goal of such an enterprise is not only to maximize profits but also to pursue a social mission. Ecological entrepreneurship, on the other hand, encompasses activities that an enterprise

undertakes for the benefit of the environment. Sustainable entrepreneurship combines the aforementioned activities and refers to conducting them in a way that takes into account profit maximization while simultaneously promoting social and environmental development [19] (p. 363). It can also be defined as the concept of mutual relationships that exist between an enterprise and the market, the environment, and society [20] (p. 149).

Social entrepreneurship is one of the most important factors in the development of modern societies. Its task is to solve problems resulting from social inequalities, improve the quality of life of citizens, and create attitudes that support the common good [20] (p. 150). The mission of this type of enterprise is to find better ways to create social value [21] (p. 193), activating social capital and cooperation networks between organizations to create specific social benefits [20] (p. 151).

Social enterprises can operate as social cooperatives, foundations, rural women's associations, limited liability companies, or joint-stock companies. Entities excluded from applying for social enterprise status include: reintegration companies, private and commercial companies, local government units and their associations, political parties, employer organizations, trade unions, professional self-governments, and European political foundations [22] (pp. 2–3).

According to the EU concept, the main goal of a social enterprise should be to create sustainable development and environmental protection, and to create so-called social value [23]. The activities of social enterprises concern meeting various social needs, such as manufacturing products, providing services, and employing vulnerable people [24] (p. 368). However, companies that create appropriate social changes through the practices of social responsibility in their business activities only use existing opportunities to create something new, something socially useful [25] (p. 33).

Ecological, green, or eco-entrepreneurship is often equated with sustainable entrepreneurship, despite its focus on ecological development. This type of entrepreneurship encompasses efforts to reduce the negative impact of its activities on the natural environment [26] (p. 1098). It can also be understood as sectors of the economy dealing with recycling, water purification and distribution, waste collection, and sanitation services [27] (p. 2167). Green entrepreneurship can also be defined as a company's strategy to implement environmentally friendly practices, for example, to gain a competitive advantage [28] (p. 4). According to Speckemeier and Tsivrikos [29] (p. 12), green entrepreneurship has the potential to shape economic and social prosperity and plays an important role in providing medicine for a greener society. Green entrepreneurs play a significant role in shaping ecological innovations and environmentally friendly technologies. Implementing new solutions supports other sectors of the economy.

Green entrepreneurship, therefore, serves to generate profits from ecological activities, can constitute an important source of competitive advantage, and strengthen the ecological awareness of the population, i.e., lead to the stabilization of socio-economic development.

Sustainable entrepreneurship is a relatively new term. Dean and McMullen [30] (p. 54), defined it as the process of discovering, evaluating, and exploiting economic opportunities that are important for the environment, as well as those that harm it. According to Hockerts and Wüstenhagen [31] (p. 37), sustainable entrepreneurship combines economic, environmental, and social value creation. Gregori and Holzmann [32] (p. 106) believe it is a solution to major social and environmental challenges, such as social inequality and climate change.

The task of sustainable enterprises is therefore to operate in a way that allows them to generate profits without harming nature or society. Sustainable entrepreneurship can be said to exploit opportunities, threats, and available resources to generate profits and promote environmentally friendly activities, which often requires the implementation of support programs and political socio-economic initiatives.

3.3. Factors Influencing the Development of Sustainable Entrepreneurship

The development of sustainable entrepreneurship can be determined by many factors, which can be divided into the following two groups: external (technical, political, social, environmental and institutional as well as the level of market competitiveness) and internal (related to the entrepreneur and the enterprise itself: employee competences, attitude towards the implementation of environmental issues (gender, age, place of residence, knowledge of ecology), property

resources, adaptability)[33] (pp. 162–163).

Economic and technical factors largely determine the level of development of a given society and are important for stability and the speed of development (good economic conditions, low inflation, and low unemployment rates). The situation of enterprises and economic growth is bidirectional. On the one hand, they generate budget revenues, and on the other, they influence consumer behavior[33] (p. 164).

Social factors mean the level of ecological knowledge among a given community, but also expectations regarding the implementation of environmentally friendly technologies and the level of human capital development[34] (pp. 250–251). The level of building an organization's social responsibility strategy can be implemented based on the following goals[35] (p. 117):

- fulfilling legal and ethical obligations (the basic level of an organization's social responsibility is the ability to generate profits and growth in accordance with applicable law),
- building and protecting the organization's reputation (respect for human and labor rights, environmental protection, information transparency, respect for the customer),
- creating a distinctive organizational model (philanthropic, charitable, and sponsorship activities)

Modern technical and technological solutions also significantly impact the quality of environmentally friendly business practices. Environmental protection regulations play a similarly important role in the development of sustainable business. Restrictive regulations necessitate the implementation of environmentally friendly technologies[34] (p. 251).

Undoubtedly, psychological factors and the environmental awareness of entrepreneurs and employees influence the direction of entrepreneurship development, including sustainable entrepreneurship. Management staff of companies that prioritize environmental protection should implement sustainable business models and strategies.

For the empirical considerations of this study, two internal factors distinguished by the attitude towards the implementation of environmental issues and influencing the development of sustainable entrepreneurship were selected: the gender of the respondents and their age.

Although the theoretical framework discusses psychological and social determinants of sustainable entrepreneurship at the individual level, the empirical model relies on aggregated macro-demographic data (population counts). This creates a methodological discontinuity: attitudes measured at the individual level are explained using region-level structural variables. Such an ecological model cannot capture intra-individual psychological variation and may suffer from ecological fallacy.

A more rigorous approach would integrate multi-level modelling, combining survey microdata with regional characteristics. The current macro-econometric model should therefore be interpreted as exploratory and illustrative rather than as a full behavioural explanation.

4. Methodology

Observations from 2016 to 2025 were used to quantitatively analyze the impact of gender and age on the willingness to run a business according to the principles of sustainable development. The set of administrative units covered by the constructed model consists of the Wielkopolska Voivodeship.

In addition to administrative demographic data, the core hypotheses of the study were tested using micro-level survey data collected from 129 respondents. The survey included items measuring individual pro-environmental attitudes, perceived social responsibility, environmental knowledge, and self-reported willingness (*Ch*) to engage in sustainable entrepreneurship. These micro-level data were used both to compute the dependent variable (average *Ch* per year) and to validate the direction of demographic effects observed in macro data. The survey results, therefore, constitute the primary empirical basis for hypothesis testing, whereas population data serve as contextual explanatory variables in the regression models.

4.1. Level of Analysis and Nature of the Study

This study is ecological in nature and addresses the regional level. The dependent variable (*Ch*) is an aggregated, average annual measure of declared readiness for sustainable entrepreneurship, and the explanatory variables describe the demographic structures of the region. The results do not allow for inferences about individual behaviors or motivations.

4.2. Construction of the Dependent Variable (*Ch*)

The *Ch* variable was constructed based on individual survey responses regarding readiness to conduct business in accordance with the principles of sustainable development. Respondents rated their readiness on a five-point Likert scale (1 = very low, 5 = very high). The arithmetic mean of responses for a given year was then calculated and rescaled to a percentage (1–5 → 0–20%). This *Ch* measure represents the aggregated, annual intensity of declared readiness in the region.

4.3. Subject, Object, and Purpose of Research

The aim of the research, understood as an activity enabling the examination of the significance of the impact of a specific data[36] (p. 36) and scientific knowledge of the existing social reality, institution or individual[37] (p. 8), was defined as follows: The aim of this article is to determine the influence of gender and age on the willingness to run a business according to the principles of sustainable development.

The research subject, defined by Creswell[38] (p. 44), is to determine the willingness to run a business according to the principles of sustainable development, and the subject – the inhabitants of the Wielkopolska Voivodeship.

4.4. Research Methods and Problems

The following research methods were used during the research: survey, statistical, econometric, and graphical, as well as software tools: EXCEL and GRETL.

The main research problem was formulated as the following question: How do gender and age influence the willingness to run a business according to the principles of sustainable development?

4.5. Tools, Scope, and Area of Research

The primary research tool was a computer with statistical software (GRETL and EXCEL) and graphics software. The scope of the study covered the years 2016 to 2025, and the area covered the Wielkopolska Voivodeship (**Figure 1**).

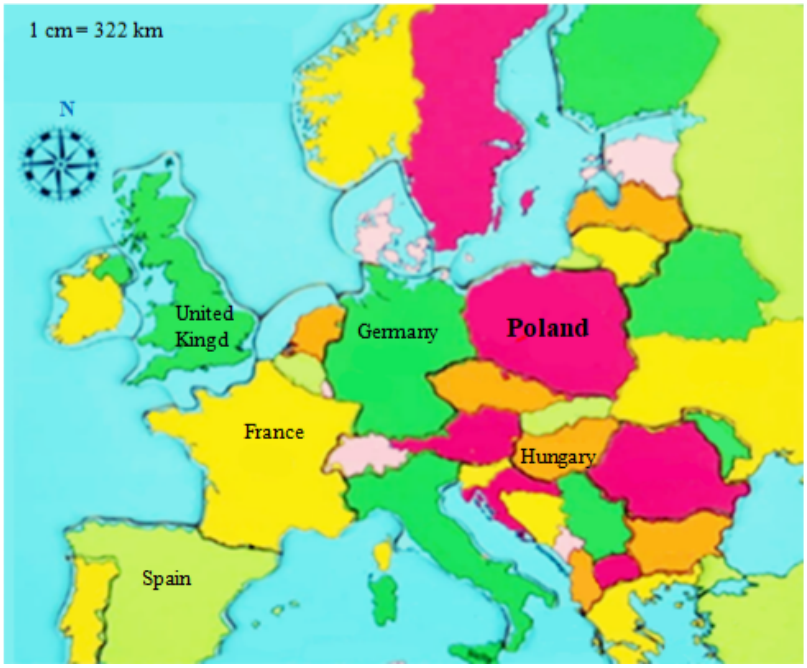

Figure 1. Greater Poland against the background of Poland and Europe (2023)[39].

The Wielkopolska Voivodeship is one of the four most developed regions in Poland, characterized by a highly developed and diversified industry, effective agriculture, and a well-developed service sector, such as financial and consulting services. A specific characteristic of this region is its high economic development, driven by factors, such as a con-

venient communication location, transit routes (east-west), Poznań-Ławica Airport, natural resources, a high level of entrepreneurship, the growing role of business tourism, and high qualifications of the labor force [40] (p. 7).

The research proper consisted of sending survey questionnaires via email to 232 businesses located in the Wielkopolska Voivodeship. 129 correctly completed surveys were returned—**Tables A1** and **A2**.

The survey included items measuring individual pro-environmental attitudes, perceived social responsibility, environmental knowledge, and self-reported willingness (*Ch*) to engage in sustainable entrepreneurship. These micro-level data were used both to compute the dependent variable (average *Ch* per year) and to validate the direction of demographic effects observed in macro data. The survey results therefore constitute the primary empirical basis for hypothesis testing, whereas population data serve as contextual explanatory variables in the regression models.

5. Results

The data drawn from the observations expressed in **Appendix A** (**Tables A1** and A**2**) were used to create the subsets shown in **Tables 2** and **3**.

Table 2. Ordered data set, according to *wd40* (explanatory variables and dependent variable *Ch*).

YEAR	*LL* (Population)	*KK* (Number of Women)	*wd40* (Number of Men under 40 Years of Age)	Average *Ch* (%) (Willingness to Undertake Activities in a Sustainable Development System)
2016	1,814,623	2,177,756	162,889	4.08
2017	1,845,622	2,145,999	178,825	4.48
2018	1,855,006	2,134,028	203,042	5.09
2019	1,870,738	2,140,245	222,610	5.55
2020	1,955,209	2,120,756	266,976	6.55
2021	1,940,130	2,101,952	312,049	7.72
2022	1,943,053	2,086,236	459,339	11.4
2023	1,949,014	2,080,619	507,734	12.6
2024	1,957,171	2,085,504	587,401	14.53
2025	1,964,021	2,074,087	618,638	15.32

Table 3. Ordered data set according to *wp40* (explanatory variables and dependent variable *Ch*).

YEAR	*LL* (Population)	*KK* (Number of Women)	*wp40* (Number of Men Aged 40+)	Average *Ch* (%) (Willingness to Undertake Activities in a Sustainable Development System)
2016	1,814,623	1,814,623	1,303,869	2.85
2017	1,845,622	1,845,622	1,350,822	3.49
2018	1,855,006	1,855,006	1,371,274	4.33
2019	1,870,738	1,870,738	1,373,538	5.62
2020	1,955,209	1,955,209	1,401,509	10.18
2021	1,940,130	1,940,130	1,370,627	14.63
2022	1,943,053	1,943,053	1,389,087	17.86
2023	1,949,014	1,949,014	1,401,006	18.64
2024	1,957,171	1,957,171	1,411,317	19.66
2025	1,964,021	1,964,021	1,431,215	19.65

The selected set of explanatory variables shows the population of the Wielkopolska Voivodeship broken down by gender and age in the years from 2016 to 2025. The demographic structure directly influences the dynamics of development of a given region [41] (p. 397).

The model hypothesis is written in the following form:

$$Ch_t = \alpha_0 + \alpha_1 \cdot P_t + \alpha_2 \cdot LL_t + \alpha_3 \cdot W_t + \varepsilon_t \quad (1)$$

Where: Ch_t—time-varying willingness to run a business according to the principles of sustainable development (%); P_t—gender variable; LL_t—population variable; W_t—age variable; α_0, α_1, α_2—estimators of unknown parameters—random effect.

The variable *Ch* (average willingness to undertake business activities according to sustainable development principles) was derived from the survey dataset. Respondents an-

swered a five-point Likert item ranging from 1 (very low willingness) to 5 (very high willingness). This average value was subsequently expressed as a percentage scale (1–5 mapped into 0–20%) to harmonise with regional population indicators and to ensure comparability over time.

5.1. Estimation Results of the Assumed Models

The estimation results for the assumed models included the following statistical indicators: regression coefficients (the direction and strength of the relationship), R^2 coefficient (the degree of model fit to the data), *p*-values (statistical significance), and confidence intervals (the range within which the actual parameter value falls). These results will allow us to assess the model fit, understand the relationships between variables, and predict future values.

The linear econometric model for a given dependent variable (*Ch*) and selected explanatory variables is estimated using the classical least squares method (CLS). Estimation: observations used: 1–10; dependent variable: *Ch*-Model 1 [GRETL program was used for calculations] (**Tables 4** and **5**).

Table 4. *Ch*-Model 1: *CSM* estimation, using observations 2016–2025 (N = 10), dependent variable (*Y*): *Ch*.

Variables	Factor	Standard Error	*t*-Student	*p*-Value
const	8.38115	15.2588	0.5493	0.6065
YEAR	−0.00060513	0.00752324	−0.08043	0.9390
LL	−0.0000015	0.00000017	−8.864	0.0003***
KK	−0.000002	0.0000003	−6.023	0.0018***
wd40	0.00002	0.00000009	287.1	<0.0001***

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 5. *Ch*-Model 1 Continued.

Name	Result from the Gretl Program	Name	Result from the Gretl Program
Arithmetic mean of the dependent variable	8.732000	Standard deviation of the dependent variable	4.320408
Sum of squared residuals	0.000373	Standard error of residuals	0.008640
Coefficient of determination R^2	0.999998	Adjusted *R*-squared	0.999996
$F(4, 5)$	562661.0	*p*-value for *F*-test	2.57×10^{-14}
Log likelihood	36.79037	Akaike's Information Criterion	−63.58075
Schwarz's Bayesian criterion	−62.06782	Hannan-Quinn criterion	−65.24042
Autocorrelation of residuals (ρ_1)	−0.136500	Durbin-Watson Statistics	2.218588

Note: Own calculations using the GRETL.

These projections are for illustrative purposes only. Due to the small sample size (N = 10), the strong multicollinearity of demographic variables, and the ecological nature of the data, they do not constitute reliable predictions of future behavior. Their purpose is solely to demonstrate the computational properties of the model.

By substituting the obtained data into the linear equation of the econometric model, the following equation is obtained:

$$Ch_t = 8.8115 - 0.0000015 \cdot LL_t - 0.000002 \cdot K_t - 0.00002 \cdot Wd40_t \quad (2)$$

The estimated model parameters are presented in **Tables 6** and **7**.

Table 6. Model 2: CSM estimation, using observations from 2016 to 2025. Dependent variable: *Ch*.

Variable	Factor	Standard Error	*t*-Student	*p*-Value
Const (Constant)	−4936.66	642.837	−7.679	0.0003***
YEAR	2.46881	0.335379	7361	0.0003***
LL	0.0000498	0.00001726	2884	0.0279**
wp40	−0.00009778	0.00002479	−3.944	0.0076***

Note: *** $p < 0.01$, ** $p < 0.05$.

Table 7. Model 2: continued.

Name	Result from the Gretl Program	Name	Result from the Gretl Program
Arithmetic mean of the dependent variable	11.69100	Standard deviation of the dependent variable	7.153691
Sum of squared residuals	7.429042	Standard error of residuals	1.112733
Coefficient of determination R^2	0.983870	Adjusted R-squared	0.975805
$F(4, 5)$	121.9938	p-value for F-test	9.12×10^{-6}
Log likelihood	−12.70344	Akaike's Information Criterion	33.40689
Schwarz's Bayesian criterion	34.61723	Hannan-Quinn criterion	32.07915
Autocorrelation of residuals—$\rho 1$	0.060085	Durbin-Watson Statistics	1.750643

Note: Own calculations using GRETL.

Interpretation of the estimated model parameters (all results were obtained in the form of statistically significant values from $p < 0.05$ to $p < 0.001$):

- $-0.00001508 \cdot LL_t$ means that an increase in the population by 1000 will result in a decrease in the willingness to undertake activities in the sustainable development system by 0.0015%.
- $-2.00881 \cdot K_t$ means that an increase in the number of women in the region by 1000 will result in a decrease in the willingness to undertake activities in the sustainable development system by −0.002%, with other factors remaining unchanged.
- $-2.4725 \cdot Wd40_t$ means that an increase in the number of men aged up to 40 by 1000 will result in a decrease in the willingness to undertake activities in the sustainable development system by 0.02%, with other factors remaining unchanged.

$$Ch_t = -4936.66 + 0.0000498 \cdot LL_t - 0.00009778 \cdot Wd40_t \quad (3)$$

Interpretation of the estimated model parameters (all results were obtained in the form of statistically significant values from $p < 0.05$ to $p < 0.001$):

- $0.000049 \cdot LL_t$ means that an increase in the population by 1000 will result in an increase in the willingness to undertake activities in the sustainable development system by 0.05%, with other factors remaining unchanged,
- $-0.00009778 \cdot Wd40_t$ means that an increase in the number of men aged 40+ by 1000 will result in a decrease in the willingness to undertake activities in the sustainable development system by 0.05%, with other factors remaining unchanged.

In the further analysed cases, singular matrices appeared and were omitted. Model 1 is the better-fitting model and was adopted for further consideration.

The survey data and econometric models are directly linked through the dependent variable *Ch*. Individual survey responses are aggregated annually to form the dependent variable, whereas demographic variables constitute the explanatory factors. The models, therefore, explain year-to-year variation in survey-based willingness using macro-level structural determinants.

This approach treats the micro-level (survey attitudes) as outcomes, and macro-level demographics as contextual explanatory variables.

5.2. Interpretation of Coefficients of Determination and Mean Errors of Estimate

For Model 1, the coefficient of determination $R^2 = 0.999998$ indicates that 99% of the total variability in the willingness to engage in sustainable development activities was explained by the variability of the factors included in the model, while 1% of this variability is due to chance. The model fit is therefore very accurate. The value of the adjusted coefficient of determination = 0.975805 is lower, but still very high. This indicator identifies the best-fitting model, and the criterion for selection is its highest value.

The values of mean errors of parameter estimation and mean relative errors of parameter estimation are summarized in **Table 8.**

$$Ch_t = 8.38115 - 0.0000015 \cdot LL_t - 0.000002 \cdot K_t - 0.00002 \cdot Wd40_t \quad (4)$$

Interpretation of mean errors of parameter estimates:

- When estimating the parameter with the intercept, the error is on average +/−15.2588;

- With the population of the region under study, the error is on average +/−0.000000170190;
- For the number of women present in the studied region, the error is on average +/−0.000000333525;
- For men up to 40 years of age, the error is on average +/−0.00000861087.

Table 8. Values of mean errors of estimation and mean relative errors of estimation of parameters.

Variable	Parameter [a_i]	Mean Errors of Parameter Estimation [$S(a_i)$]	Mean Relative Errors of Parameter Estimation [$Sw(a_i) = \frac{S(a_i)}{\lvert a_i \rvert}$]
const	8.38115	15.2588	1.82%
YEAR	−0.000605131	0.00752324	12.43%
LL	−0.00000150856	0.000000170190	0.11%
KK	−0.00000200881	0.000000333525	0.17%
wd40	−0.0000247254	0.00000861087	0.35%

Note: Own study based on Model 1.

All values of the mean relative error of estimation range from 0.11% to 12.43% < 50%, hence the adopted model can be assessed positively.

5.3. Statistical Verification of the Model

In the estimated model, significant parameters are marked at the end of the row with additional symbols (***); the absence of asterisks indicates a statistically insignificant variable. In the case studied:

- *intercept* = 0.6065 > 0.05,
- *LL* = 0.0003 < 0.001,
- *KK* = 0.0018 < 0.05,
- *wd40* < 0.0001.

As can be seen, the above-mentioned variables statistically significantly influence the willingness to undertake activities in the sustainable development system in the municipalities of the Wielkopolska region, with the exception of the intercept.

Snedecor *F*-test (*F*-statistic) provides an overall assessment of the suitability of the econometric model. The final results of this test are $F(4, 5) = 562661, 0$ for *p*-values < 2.57×10^{-14}, which leads to the conclusion that the estimated model contains significant variables.

The assessment of the model fit was performed by estimating the residual error (standard error) $S_e = 0.008640$, and the residual variation coefficient: $V_e = \frac{S_e}{\overline{y}} = \frac{0.00864}{8.732} = 0.000989464$, which indicates what proportion of the mean value of the explained variable is the standard error of estimation. The permissible limit value, set at $V_{e-\max} = 0.1 > V_e = 0.000989464$[42] (p. 36), makes the model suitable for practical use.

Assessment of the normality of the residual component distribution: $\chi^2(2) = 2.617$ with *p*-value = 0.2703 > 0.10, which means that the residual distribution has the characteristics of a normal distribution (Doornik-Hansen test).

Frequency distribution for *uhat1*, observations 1–10, number of intervals = 5, mean = 1.15463×10^{-15}, standard deviation = 0.00864025 (**Table 9**).

Table 9. Frequency distribution for *uhat1*.

Compartments	Mean	Number	Frequency (%)	Cumulative (%)	Histogram
<−0.0060783	−0.0082132	2	20.00%	20.00%	*******
−0.0060783 to −0.0018085	−0.0039434	3	30.00%	50.00%	**********
−0.0018085 to 0.0024614	0.00032644	1	10.00%	60.00%	***
0.0024614 to 0.0067312	0.0045963	1	10.00%	70.00%	***
≥ 0.0067312	0.0088661	3	30.00%	100.00%	**********

Note: Own work using the GRETL. The asterisks (*) represent a graphical illustration of the frequency distribution (text-based histogram).

White's test for heteroscedasticity of residuals (variance of residual variance). OLS estimation, using observations from 2016 to 2025 (N = 10). Dependent variable (Y): *uhat^2* (**Table 10**).

Table 10. Frequency distribution for *uhat1*.

Variable	Factor	Mistake Standard	*t*-Student	*p*-Value
Const	35.8001	93.6005	0.3825	0.7674
YEAR	−0.0356380	0.0930833	−0.3829	0.7672
LL	1.00319×10^{-7}	1.49498×10^{-7}	0.6710	0.6237
KK	$1.12599e\times10^{-7}$	$4.24301e\times10^{-7}$	0.2654	0.8349
wd40	$3.69285e\times10^{-9}$	6.74867×10^{-9}	0.5472	0.6813
sq_ROK	8.81532×10^{-6}	2.30437×10^{-5}	0.3825	0.7674
sq_LL	0.00000	0.00000	−0.6793	0.6201
sq_KK	0.00000	0.00000	−0.2598	0.8382
sq_wd40	0.00000	0.00000	−0.4338	0.7394

Note: Own work using the GRETL.

The data matrix is singular. Coefficient of determination R^2 = 0.837701. Test statistic: TR^2 = 8.377008, with *p*-value = *P(Chi-square(4)* > 9.90805) = 0.0420053.

Multicollinearity assessment *VIF(j)*—variance inflation factor, the minimum possible value of which is 1.0. Values greater than 10.0 may indicate a multicollinearity problem (variance inflation). Variance inflation factor $VBIF(j) = \frac{1}{1-R(j)^2}$, where *R(j)* is the multiple correlation coefficient between variable *j* and the remaining independent variables of the model.

Nonlinearity test (logarithms). Auxiliary regression equation for the nonlinearity test (logarithms of variables). OLS estimation, using observations 2016–2025 (N = 10) (**Table 11**).

Table 11. Nonlinearity test.

Variable	Factor	Standard Error	*t*-Student	*p*-Value
Const	−23647.5	5137.06	−4.603	0.1362
YEAR	23.5605	5.10867	4.612	0.1359
LL	2.83700×10^{-5}	8.20485×10^{-6}	3.458	0.1792
KK	−0.000156475	2.32868×10^{-5}	−6.719	0.0941*
wd40	-1.65010×10^{-6}	3.70386×10^{-7}	−4.455	0.1406
sq_ROK	−0.00583401	0.00126470	−4.613	0.1359
sq_LL	-7.34548×10^{-12}	2.13413×10^{-12}	−3.442	0.1800
sq_KK	3.67282×10^{-11}	5.44632×10^{-12}	6.744	0.0937*
sq_wd40	2.12024×10^{-12}	4.66046×10^{-13}	4.549	0.1377

Note: Own work using the GRETL. * $p < 0.10$.

The data matrix is singular. The coefficient of determination is R^2 = 0.990805. Test statistic: TR^2 = 9.90805, with *p*-value = *P(Chi-square(4)* > 9.90805) = 0.0420053.

Multicollinearity assessment *VIF(j)*—variance inflation factor, the minimum possible value of which is 1.0. Values greater than 10.0 may indicate a multicollinearity problem (variance inflation). Variance inflation factor $VBIF(j) = \frac{1}{1-R(j)^2}$, where *R(j)* is the multiple correlation coefficient between variable *j* and the remaining independent variables of the model. The proportion of variance for individual variables is presented in **Table 12.**

The assessment of multicollinearity of the VIF-variance inflation factor is as follows:

$$1.0 < LL = 11.065 > 10; 1.0 < KK = 15.878 > 10;$$
$$1.0 < wd40 = 27.396 > 10.$$

As can be seen, there is high collinearity between the variables. Assessing the significance of the independent variables' impact on the dependent variable shows that these variables significantly influence the willingness to run a business according to the principles of sustainable development. An assessment of the model's fit indicates that the model is suitable for practical use.

5.4. Statistical Verification of the Model

To construct the forecast, data for the explanatory variables will be required. This requires supplementary information for future periods. Therefore, the sample size and variable definitions must be determined. **Table 13** presents the forecast results for the years 2026–2028 for the explanatory variables.

Table 12. Belsley-Kuh-Welsch collinearity diagnostics (variance proportions), where: lambda—eigenvalues, from largest to smallest; cond—condition index.

Lambda	Cond	Const	YEAR	*LL*	*KK*	*wd40*
4,851	1.000	0.000	0.000	0.000	0.000	0.000
0.149	5.701	0.000	0.000	0.000	0.000	0.036
0.000	138.373	0.000	0.000	0.199	0.014	0.097
0.000	734.841	0.001	0.001	0.432	0.826	0.112
0.000	17,357.653	0.999	0.999	0.369	0.160	0.755

Note: Own work using the GRETL.

Table 13. Forecast of explanatory variables in the years 2026 to 2028.

Forecast Years	For the 95% Confidence Interval, $t(5, 0.025) = 2.571$			
	Ch	Forecast	Standard Error	95% Range
2026	16.3200	15.9154	0.0445319	15.8009–16.0299
2027	17.7000	17.2519	0.0500496	17.1233–17.3806
2028	19.0800	18.5885	0.0559919	18.4446–18.7324

Note: Own study based on time series estimation.

The forecasting exercise for 2026–2028 should be interpreted exclusively as a hypothetical numerical illustration. Due to the limited sample, strong multicollinearity, and the ecological nature of the variables, the projections are not intended to predict real future behaviour. They serve solely to demonstrate the model's computational properties and the potential use of econometric tools in sustainability studies.

In order to determine the forecasts of variables, they had to be treated as time series (**Figure 2**).

Mean *ex-ante* prediction error informs about the expected deviations of the realization of the forecast variable from the prediction at time $t > n$. The *ex-ante* prediction error informs about how large the deviation of the forecast values will be. If the relative *ex-ante* error $V\tau \leq 3\%$, then the forecasts will be very accurate; if $3\% < V\tau \leq 5\%$, then they are considered accurate; and if $5\% < V\tau \leq 10\%$, then the forecasts can only be acceptable, whereas if $V\tau > 10\%$, then the forecasts are unacceptable (**Table 14**).

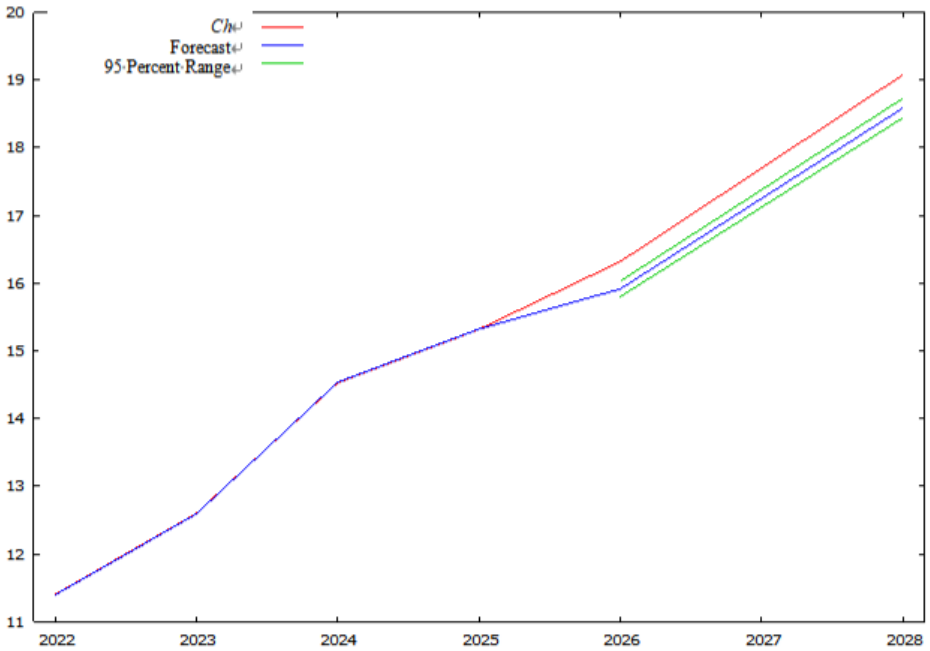

Figure 2. Forecast of the dependent variable (2026–2028).

Note: Based on own research results.

Table 14. Forecast and mean values of forecast error and their interpretation, for a 95% confidence interval, $t(13, 0.025) = 2.160$.

Year	Forecast *Ch*	Mean Forecast Error *Ex Ante*	Mean Relative Forecast Error *Ex Ante*	95% Confidence Interval
2026	16.32	15.92	4.5%	15.80–16.03
2027	17.7	17.25	5.0%	17.12–17.38
2028	19.08	18.59	5.6%	18.44–18.73

Note: Results obtained using the GRETL.

Ex ante forecast errors in this study do not exceed ten percent, which means that the forecast for the years 2026 to 2028 is very accurate (2026) and acceptable (2027, 2028).

The study examined the impact of the demographic structure of the population of the Wielkopolska region in 2016–2025 on the level of willingness to engage in sustainable development (marked as the variable *Ch*). Two sets of data were analyzed: the number of men under 40 years of age (*wd40*) and those over 40 years of age (*wp40*). Econometric models were estimated in GRETL using the classical least squares method (CLS).

For model 1 (*wd40*), the coefficient of determination: $R^2 = 0.999998$, which indicates an almost complete fit of the model to the empirical data. All explanatory variables (*LL, KK, wd40*) turned out to be statistically significant ($p < 0.05$). A *1000-unit* increase in the population (*LL*) causes a 0.0015% decrease in *Ch*, and a 1000-unit increase in the number of women (*KK*) causes a 0.002% decrease in *Ch*. A 1000-unit increase in the number of men under 40 years of age (*wd40*) increases *Ch* by *0.02%*, holding other factors constant. Standard error of the residuals: 0.00864, Snedecor's *F*-test*:* $F(4,5) = 562661$, $p < 2.57 \times 10^{-14}$, which confirms the significance of the entire model.

Doornik-Hansen test ($\chi^2 = 2.617$*;* $p = 0.2703$) confirmed the normality of the residual distribution. The White test did not indicate heteroscedasticity ($p = 0.3975$). VIF values exceed 10, indicating multicollinearity of variables, but this does not significantly affect the model's validity.

It should be emphasized that demographic structure has a significant impact on the level of residents' engagement in pro-ecological and pro-social activities. A particularly important factor contributing to the development of sustainable entrepreneurship is the number of men under the age of 40. Ninety-nine percent of the variability in the willingness to engage in sustainable development can be explained by demographic factors. The models do not exhibit large-scale random errors, are consistent with the assumptions of the classical regression model, and can be used in regional development planning.

6. Discussion

The study is subject to the following limitations: ecological fallacy (inability to draw conclusions about individuals), strong multicollinearity of demographic variables, small sample size (N = 10), risk of model overfitting, and the regional specificity of the Greater Poland Voivodeship.

Several regression coefficients obtained in Model 1 and Model 2 are negative (*LL*, *KK*, *wp40*). This phenomenon may be interpreted in two complementary ways. The diagnostic tests indicate severe multicollinearity (*VIF* > 10 for *LL*, *KK* and *wd40*). Multicollinearity inflates standard errors, destabilises coefficient signs, and may generate negative coefficients that do not reflect real relationships. In demographic models, high collinearity is structurally expected because the total population (*LL*), the number of women (*KK*), and the age-specific male cohorts (*wd40*, *wp40*) are mechanically correlated. Thus, part of the negative sign may be a statistical artefact of overlapping demographic structures.

Even after accounting for multicollinearity, negative coefficients may represent substantive mechanisms:

- Higher overall population density may reduce perceived entrepreneurial opportunities and increase competition;
- Regions with a higher female population share (*KK*) may be more urbanised and saturated with existing enterprises, which statistically reduces new sustainability initiatives;
- Older male cohorts (*wp40*) tend to be less willing to adopt social or ecological innovation, which is consistent with the literature on age-related risk aversion.

Therefore, the negative coefficients cannot be dis-

missed purely as statistical anomalies—they may partially reflect wider socio-economic structures influencing sustainable entrepreneurship.

Young men (<40) tend to exhibit higher technological openness, greater risk tolerance, and stronger orientation toward innovation – factors that the sustainability literature consistently links with pro-environmental entrepreneurship. Hörisch et al.[43] (p. 79), Urbano et al.[44] (pp. 112–113) and Bosma et al.[45] emphasize that regions with a greater concentration of young working-age population display faster adoption of green technologies.

Therefore, the number of men under 40 may influence the average willingness (*Ch*) not through biological sex per se, but because this group disproportionately engages in innovation-driven, opportunity-seeking entrepreneurship.

7. Conclusions

The study addresses the lack of empirical evidence linking demographic structure (age, gender composition) with sustainable entrepreneurial intentions at the regional level. Existing research focuses primarily on psychological, institutional, or macroeconomic determinants, but rarely examines how demographic cohorts shape sustainability-oriented entrepreneurship.

The results of the analysis indicate significant correlations between regional demographic structure and aggregate readiness for sustainable entrepreneurship. These relationships are macrostructural in nature and should not be interpreted as determinants of individual entrepreneurial decisions. The study highlights the importance of demography as a context for regional development and points to the need for further analysis using a multilevel approach.

Age and gender influence risk tolerance, ecological awareness, innovation orientation, and social responsibility key components of sustainable entrepreneurship. Prior studies show significant behavioural differences between age groups and between women and men, yet their combined demographic effects at regional level are understudied.

Earlier work tends to analyse sustainable entrepreneurship at the firm or individual attitude level. This study integrates survey-based behavioural indicators (*Ch*) with regional demographic structures, offering a hybrid behavioural–structural model. It also focuses specifically on the age segment of young men (<40), a demographic rarely analysed in sustainability modelling.

The analysis presented in this article allows for the formulation of a number of conclusions of a cognitive, practical, and predictive nature. The research findings confirm that demographic factors, such as age and gender, significantly influence entrepreneurs' willingness to engage in sustainable development. The statistical and econometric correlations clearly indicate that younger age groups, especially men under 40, demonstrate greater openness to ecological and social innovations and greater motivation to implement sustainable practices.

From a public and educational policy perspective, the results highlight the need to intensify efforts to promote environmental and social education, especially among young people just starting their own businesses. Providing substantive and financial support for innovative, pro-ecological projects can stimulate the development of sustainable entrepreneurship in regions with high demographic potential, such as Greater Poland. It is also essential to strengthen the role of women in decision-making and economic processes through mentoring programs, financial support instruments, and the promotion of best practices in equal opportunities in business.

It is important to note that the development of sustainable entrepreneurship is not a one-dimensional process but rather stems from complex relationships between demographic, social, economic, and cultural factors. Effective implementation of sustainable development principles requires not only knowledge and competencies but also appropriate attitudes, motivation, and institutional support. In the long term, these actions can contribute to increasing economic competitiveness, improving the quality of life of residents, and maintaining ecological balance. Sustainable entrepreneurship is therefore becoming not only a contemporary requirement but also the foundation for future socio-economic development based on responsibility, innovation, and intergenerational solidarity.

Future research should utilize multilevel modeling, combining data from individual surveys with regional contextual variables. This would allow for the simultaneous consideration of micro- and macro-social mechanisms and reduce the risk of ecological fallacy.

"This work did not receive any external funding".

"Informed consent was obtained from all individuals participating in the study".

"The authors declare no conflict of interest".

"The data used in this study are available in this article".

Funding

This work received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The data used in this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest.

Appendix A

Table A1. Dataset by gender (explanatory and explained variables *Ch*).

LP	Year	*LL Population*	*P Gender*								Average by Gender *Ch*	
			K		*Ch*		*M*		*Ch*			
			l	%	l	%	l	%	l	%	l	%
1.	2016	3,481,625	1,814,623	52.12	53,168	2.93	1,667,002	47.88	87,184	5.23	142,050	4.08
2.	2017	3,496,821	1,845,622	52.78	55,000	2.98	1,651,199	47.22	98,742	5.98	156,658	4.48
3.	2018	3,505,302	1,855,006	52.92	60,288	3.25	1,650,296	47.08	114,200	6.92	178,420	5.09
4.	2019	3,513,783	1,870,738	53.24	73,520	3.93	1,643,045	46.76	117,642	7.16	195,015	5.55
5.	2020	3,522,265	1,955,209	55.51	100,107	5.12	1,567,056	44.49	125,051	7.98	230,708	6.55
6.	2021	3,472,579	1,940,130	55.87	142,018	7.32	1,532,449	44.13	124,435	8.12	268,083	7.72
7.	2022	3,475,323	1,943,053	55.91	196,443	10.11	1,532,270	44.09	194,445	12.69	396,187	11.40
8.	2023	3,481,625	1,949,014	55.98	230,763	11.84	1,532,611	44.02	204,757	13.36	438,685	12.60
9.	2024	3,496,821	1,957,171	55.97	257,759	13.17	1,539,650	44.03	244,650	15.89	508,088	14.53
10.	2025	3,505,302	1,964,021	56.03	283,801	14.45	1,541,281	43.97	249,379	16.18	537,012	15.32

Note: Data from Bogacka et al. (2024) [46].

Table A2. Dataset, by age (explanatory variables and explained *Ch*).

LP	Year	*LL* Population	*W* (Age)								Average by Age *Ch*	
			Wd40 Up to 40 Years Old		*Ch*		*Wp40* Over 40 Years Old		*Ch*			
			l	%	l	%	l	%	l	%	l	%
1.	2016	3,481,625	2,177,756	62.55	94,732	4.35	1,303,869	37.45	17,472	1.34	99,052	2.85
2.	2017	3,496,821	2,145,999	61.37	107,944	5.03	1,350,822	38.63	26,206	1.94	121,864	3.49
3.	2018	3,505,302	2,134,028	60.88	127,615	5.98	1,371,274	39.12	36,750	2.68	151,780	4.33
4.	2019	3,513,783	2,140,245	60.91	173,788	8.12	1,373,538	39.09	42,854	3.12	197,475	5.62
5.	2020	3,522,265	2,120,756	60.21	292,452	13.79	1,401,509	39.79	91,939	6.56	358,390	10.18
6.	2021	3,472,579	2,101,952	60.53	410,511	19.53	1,370,627	39.47	133,362	9.73	508,038	14.63
7.	2022	3,475,323	2,086,236	60.03	478,165	22.92	1,389,087	39.97	177,664	12.79	620,519	17.86
8.	2023	3,481,625	2,080,619	59.76	478,126	22.98	1,401,006	40.24	200,204	14.29	648,801	18.64
9.	2024	3,496,821	2,085,504	59.64	486,757	23.34	1,411,317	40.36	225,528	15.98	687,475	19.66
10.	2025	3,505,302	2,074,087	59.17	480,773	23.18	1,431,215	40.83	230,712	16.12	688,792	19.65

Note: Data from Bogacka et al. (2024) [46].

References

[1] World Commission on Environment and Development (WCED), 1987. Report of the World Commission on Environment and Development: Our Common Future. United Nations: New York, NY, USA. pp. 43–65.

[2] Hopwood, B., Mellor, M., O'Brien, G., 2005. Sustainability: Mapping Different Approaches. Sustainability. 13(1), 38–52.

[3] Redclift, M., 2005. Sustainability (1987–2005): An oxymoron comes of age. Sustainability. 13(4), 212–227.

[4] Rapley, J., 2008. End of Development or Age of Development. Progress in Development Studies. 2, 177–182.

[5] United Nations, 1973. Declaration of the United Nations Conference on the Human Environment. In Report of the United Nations Conference on the Human Environment. United Nations: New York, NY, USA.

[6] United Nations, 2015. Transforming Our World: The 2030 Agenda for Sustainable Development. United Nations: New York, NY, USA. pp. 3–35.

[7] Dahlman, K., 2016. A New Paradigm for Rural Development. In: Love, P. (Ed.). Debate the Issues: New

Approaches to Economic Challenges. OECD Publishing: Paris, France. pp. 123–126.
[8] Sen, A., 2000. Development as Freedom. Alfred A. Knopf, Inc.: New York, NY, USA.
[9] Sejm of the Republic of Poland, 1980. Act of 31 January 1980 on the protection and management of the environment. Journal of Laws. 3(6), 10–22. Available from: https://eli.gov.pl/eli/DU/1980/6/ogl?utm_source (in Polish).
[10] Tenety, D., 2024. Sustainable Development—Trends, Challenges, Controversies. EU: Wrocław, Poland.
[11] Sejm of the Republic of Poland, 1997. Constitution of the Republic of Poland of 2 April 1997. Journal of Laws. 78, 483. Available from: https://www.sejm.gov.pl/prawo/konst/angielski/konse.htm.
[12] Sejm of the Republic of Poland, 2025. Announcement of the Marshal of the Sejm of the Republic of Poland of 9 May 2025 on the Announcement of the Consolidated Text of the Environmental Protection Law Act. Journal of Laws. 647. Available from: https://dziennikustaw.gov.pl/DU/2025/647?utm_source (in Polish).
[13] United Nations Conference on Environment & Development, 1992. United Nations Conference on Environment & Development Rio de Janerio, Brazil, 3 to 14 June 1992: Agenda 21. UNCED: New York, NY, USA. pp. 1–20.
[14] Szymczak, D., 2018. Millennium Development Goals. In: Szewczyk, M., Okraszewska, E., Dziuba, R. (Eds.). Economics of Sustainable Development: Economy, Environment, Investments. University of Łódź Publishing House: Łódź, Poland. (in Polish).
[15] Sachs, J.D., 2015. The Age of Sustainability. Columbia University Press: New York, NY, USA. pp. 1–55.
[16] Dąbrowska, A., Bylok, F., Janoś-Kresło, M., et al., 2015. Consumer Competences, Innovative Behavior, Sustainable Consumption. Polish Economic Publishing House S.A. (PWE): Warsaw, Poland. (in Polish).
[17] Baker, S., 2016. Sustainable Development. Routledge: London, UK; New York, NY, USA. pp. 27–48.
[18] Daly, H.E., 1996. Beyond Growth: The Economics of Sustainable Development. Beacon Press: Boston, MA, USA. pp. 19–34.
[19] Hendricson, L., Tuttle, D., 1997. Dynamic Management of the Environmental Enterprise: A Qualitative Analysis. Journal of Organizational Change Management. 10(4), 363–382.
[20] Zioło, K., 2014. Social entrepreneurship: Key development factors. Studies and Works of the Faculty of Economic Sciences and Management. 37(2), 147–156. Available from: https://www.wneiz.pl/nauka_wneiz/sip/sip37-2014/SiP-37-t2-147.pdf?utm_source (in Polish).
[21] Anderson, B.B., Dees, J.G., Emerson, J., 2002. Developing Viable Earned Income Strategy. In: Dees, J.G., Emerson, J., Economy, P. (Eds.). Strategic Tools for Social Entrepreneurs: Enhancing the Performance of Your Enterprising Nonprofit. John Wiley & Sons, Inc.: New York, NY, USA.
[22] Brdulak, J., Florczak, E., 2022. A social enterprise within the meaning of the Social Economy Act in the context of economic theory and practice. Economic and Regional Studies. 15(4), 492–508.
[23] European Commission, 2014. A Map of Social Enterprises and Their Eco-Systems in Europe. European Commission: Brussels, Belgium.
[24] Wronka-Pośpiech, M., 2014. Success and its measurement in social enterprises: An attempt at operationalization. In: Krupski, R. (Ed.). Strategic Management. Development of Concepts and Methods. Wałbrzych University of Management and Entrepreneurship (WWSZiP): Wałbrzych, Poland. pp. 363–387. (in Polish).
[25] Korowaj, B., 2022. The Role and Nature of Social Enterprises in Poland as Exemplified by Non-Profit Organizations. Uniwersytet Ekonomiczny we Wrocławiu (UE): Wrocław, Poland. pp. 26–36. (in Polish).
[26] Fan, Y., Wu, S., Lu, Y., et al., 2019. Study on the effect of the environmental protection industry and investment for the national economy: An input-output perspective. Journal of Cleaner Production. 227, 1093–1106.
[27] Grillitsch, M., Hansen, T., 2019. Green industry development in different types of regions. European Planning Studies. 27(11), 2163–2183.
[28] Nikolaou, E.I., Ierapetritis, D., Tsagarakis, K.P., 2011. An evaluation of the prospects of green entrepreneurship development using a SWOT analysis. International Journal of Sustainable Development & World. 18(1), 1–16.
[29] Speckemeier, L., Tsivrikos, D., 2022. Green Entrepreneurship: Should Legislators Invest in the Formation of Sustainable Hubs. Sustainability. 14(12), 7152.
[30] Dean, T.J., McMullen, J.S., 2007. Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. Journal of Business Venturing. 22(1), 50–76.
[31] Hockerts, K., Wüstenhagen, R., 2010. Greening Goliaths versus emerging Davids—Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. Journal of Business Venturing. 25(5), 31–44.
[32] Gregori, P., Holzmann, P., 2020. Digital sustainable entrepreneurship: A business model perspective on embedding digital technologies for social and environmental value creation. Journal of Cleaner Production. 272, 122817.
[33] Misztal, A., Kowalska, M., 2020. Determinants of Sustainable Development of Industrial Enterprises in Poland in the Period from 2010 to 2019—A Statistical

Evaluation. Research Papers of Wrocław University of Economics. 64(1), 160–173. (in Polish).

[34] Niedźwiedzińska, H., Kowalska, M., 2020. External factors influencing sustainable development of Polish Enterprises in the TSL Sector in 2010–2017. Autobusy: Technika, Eksploatacja, Systemy Transportowe. 20, 249–253. (in Polish).

[35] Carroll, A.B., 1999. Corporate Social Responsibility: The Evolution of a Defining Construct. Business & Society. 38(3), 268–295.

[36] Bryman, A., 2016. Social Research Methods. University Press: Oxford, UK. pp. 22–44.

[37] Kowalska, K., 2016. Deviant behavior of minors. Biuletyn Polskiego Towarzystwa Kryminologicznego im. prof. Stanisława Batawii (PTK Bulletin). 23, 7–28. (in Polish).

[38] Creswell, J.W., 2014. Research Design: Qualitative, Quantitative, and Mixed Methods. Sage: Thousand Oaks, CA, USA. pp. 3–24.

[39] Eurostat, 2023. Regions in Europe—2023 Interactive Edition. Publications Office of the European Union: Luxembourg, Luxembourg. pp. 11–29.

[40] Cader, J., Koneczna, R., Marciniak, A., 2024. Indicators for a circular economy in a regional context: An approach based on Wielkopolska region. Environmental Management. 73, 293–310.

[41] Florczak, W., Przybyliński, M., 2016. Changes in the size and structure of the population and socio-economic development. Economic Studies. 3(XC), 396–422. (in Polish).

[42] Wątroba, J., 2011. Simply about Fitting Lines: Linear Regression Analysis in Practice. StatSoft: Cracow, Poland. (in Polish).

[43] Hörisch, J., Schaltegger, S., Freeman, R., 2020. Integrating stakeholder theory and sustainability accounting: A conceptual synthesis. Journal of Cleaner Production. 275, 124097.

[44] Urbano, D., Aparicio, S., Audretsch, D., 2019. Twenty-five years of research on institutions, entrepreneurship, and economic growth: What has been learned? Small Business Economics. 53(1), 21–49.

[45] Bosma, N., Schøtt, T., Terjesen, S., 2021. Global Entrepreneurship Monitor (GEM) 2020/2021 Global Report. Global Entrepreneurship Research Association (GERA): London, UK.

[46] Bogacka, E., Borowicz, N., Kowalka, E., et al., 2024. Wielkopolska in the context of EU Regions. Statistical Office: Poznań, Poland.