
Implementation of the Principles of Sustainable Development by Agricultural Producers in Poland

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Abstract:

Purpose: The aim of the research is to identify and assess the opportunities and processes of implementing sustainable development in agricultural activities. It is also to assess farmers' awareness and knowledge of the principles of sustainable development in agriculture.

Design/Methodology/Approach: Research on the application of the principles of sustainable development in agricultural production was carried out in 2019. Data was collected in four voivodships using the interview questionnaire. The research area was chosen deliberately. They were voivodships with the largest share of sown crops. The collected material was analyzed in terms of farmers' knowledge of the principles of sustainable development in agricultural production and the level of their application on the farm.

Findings: Based on the collected information, it was found that the respondents had a high level of knowledge about the sustainable development of agriculture. The results show significant differences in the application of sustainable development principles. It was also found that there is a relationship between the level of education and age of farmers and the application of sustainable development principles among them. Knowing the principles of sustainable development has not always coincided with the application.

Practical Implications: The results obtained may be used for development of the agricultural policy, aimed at agricultural farms, as well as in programming agricultural development and shaping farmers' income.

Originality/Value: The results are original because they can be used to develop future agricultural policy scenarios in terms of compensation for conducting agricultural production in a sustainable way.

Keywords: Farms, sustainable agriculture, agricultural income, farmers' income.

JEL codes: Q5.

Paper Type: Research Article

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1. Introduction

The main reason for considering sustainable development is the issue of depletion of natural resources and increasing pollution of the natural environment. This is particularly important in relation to agriculture due to the fundamental importance of the natural environment in agricultural production, which is a challenge in the field of food security. The demand for food increases as the population increases and greater income is earned. As shows by Garnett *et al.* (2013), competition for land, water, energy and other resources necessary for food production increases. Renewable resources are now often used at such a pace that the environment cannot keep up with recovery (Zegar, 2013). Therefore, as pointed out in the 1980s by Steffen and Born, it is necessary to conduct observations in order not to cross the border from which irreversible destruction of the system begins (Steffen and Born, 1987). This is not a simple task, because solutions should be sought to reconcile economic goals shaping material well-being and ecological goals necessary for sustainable development. This is particularly important in agriculture, where many current production practices harm the environment and are a major source of greenhouse gas emissions (Muller *et al.*, 2011; Rodríguez, 2019).

Many studies have been written on the subject of sustainability in agricultural production. However, discussions are still ongoing on establishing a precise definition and understanding of sustainable development (Majewski, 2008; Rogall, 2010), as well as how to implement the principles of such development into practice in various areas of economic life (Hartig *et al.*, 1996, Lorenz, 2006, Billington *et al.*, 2008). At the same time, it should be emphasized that this is particularly important at the first stage of the food chain, i.e., in the production of food based on raw materials produced in agriculture. Agriculture is the main user of natural resources, although environmental impact depends on the way production is carried out. Just knowing the principles of sustainable agriculture does not mean that they are being used during production.

According to Antoszek (2002), the introduction of the principles of sustainable development requires the country inhabitants to understand the clean environment problem as an important global problem on a local scale. They must be convinced of the rightness of environmental protection by expressing this in their actions and proper management. Pawłowski (2011) stated that currently sustainable development is one of the most important canons that determine the theoretical principles of the functioning of the modern world. Sustainable agriculture is becoming more and more popular among members of society, mainly due to its environmentally friendly features, importance for food quality and vitality of rural areas (Czyżewski and Brelik, 2014; Gołębiowska and Pajewski, 2016). This research, however, emphasized the word ‘theoretical’, because it varies with the practical implementation of sustainable development.

2. Literature Review

When undertaking the issue of sustainable development in agricultural production, it is necessary to first analyze the concept itself. Following the Brundtland report (Report ..., 1987), it is widely recognized that the goal of sustainable development is to meet the current needs of society without jeopardising the future generations' ability to function well and meet their needs. It emphasizes the sustainability of development (Daly, 1990) and draws attention to environmental protection as well as social and economic justice (Hansen, 1996). The concept of sustainable development of agricultural production must take into account four key principles (Pretty, 2008):

1. Persistence – the capacity to continue to deliver desired outputs over long periods of time (human generations), thus conferring predictability;
2. Resilience – the capacity to absorb, utilize or even benefit from perturbations (shocks and stresses), and so persist without qualitative changes in structure;
3. Autarchy – the capacity to deliver desired outputs from inputs and resources (factors of production) acquired from within key system boundaries;
4. Benevolence – the capacity to produce desired outputs (food, fuel, oil) while sustaining the functioning of ecosystem services and not causing depletion of natural capital (eg minerals, biodiversity, soil, clean water).

Pearce (1988) pointed out that sustainable development requires natural capital, understood as a set of all environmental resources, and the advanced definition suggests that sustainable development is based on a constant resource of natural capital. This approach appears to be directly related to the social goals of equality in and between generations, economic efficiency and vitality. This suggests compliance with the laws of nature. So sustainable development, as Żylicz (1998) emphasizes, is a prudent use of available resources. However, in practice it is difficult to say whether a particular use of resources is sustainable or not. We cannot accurately predict technological progress or future requirements of society. So, it may turn out what we leave to the next generation is enough to maintain the current material level or not. It is therefore a very complex problem. Kowalczyk (2018) also pointed this out, giving as an example the Response-Inducing Sustainability Evaluation model, which takes into account 12 indicators of agriculture sustainability. These indicators are calculated on the basis of soil, water, energy, climate, economic viability, farm management, animal husbandry, biodiversity, working conditions and quality of life as well as nutrients. Activities in this area can be measured and verified when assessing their contribution to sustainable development, as indicated by Harger and Meyer (1996).

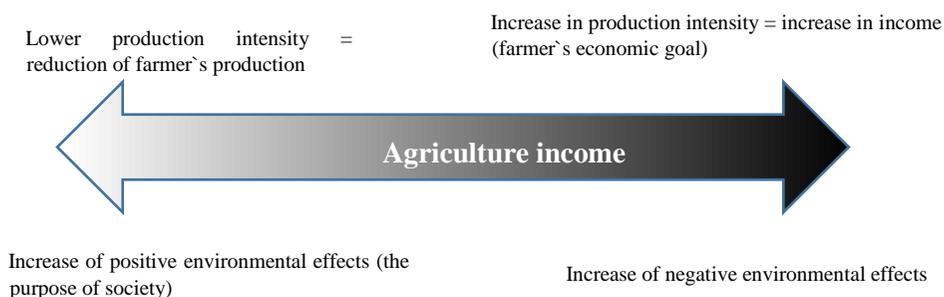
The concept of sustainable development falls within the framework of the civilization development paradigm. At the same time, however, it shapes the possibility of understanding development in a quite separate way, which can be the starting point for a new vision of social development. This requires the inclusion of

sustainability content in every sphere of human life. But at the same time, it expresses the desire to continue, although in a changed version, the current development model (Hull, 2008). However, in order to meet our commitment to climate protection and sustainable development, it is crucial to reverse the trend of environmental destruction and biodiversity loss.

According to UNEP data, the agreement on the universally accepted definition of sustainable agriculture has proved difficult to clarify, taking into account the diversity and complexity of the use of agricultural land and the assumed relationship between producer and consumer. They were ultimately defined as the ability of arable land to produce food and other agricultural products to meet human needs as well as to exert a lasting impact on the environment (UNEP, 2010; RSP, 2019). It is undeniable, which is increasingly pointed out, that the balance between human activity and the environment has been disturbed. Humanity has already reached certain limits of the “endurance” of the environment in terms of its pollution burden. In the past, the natural environment “adapted” to the economy and leveraged by-products of civilization development, which were negative for the environment (Woś and Zegar, 2002). In agriculture, the reason for this was the industrial method of production, which, although ensured sufficient food supply for the population, but at the same time created threats to the natural environment on an unprecedented scale (Clock, 2013). Therefore, organic farming is often proposed as an alternative to current conventional agriculture.

According to Seufert and Ramankutty (2017), organic farming has many potential benefits, but also many adverse effects for both producers and consumers. These include lower yields and higher product prices for consumers. This was also emphasized by Tilman, stating that the principles of organic production do not seem to offer easy solutions, mainly due to the fact of entering the world in an era in which global food production must probably double. Therefore, it is extremely important to modify agricultural practices to minimise their impact on the environment, even if many such practices can increase production costs (Tilman, 1999).

In turn, when analyzing economic issues in terms of the impact on the results of farms, the results of the research clearly show that the incomes in farms conducting production with the organic system are lower than in conventional ones (Nachtman, 2015), which is the result of lower yields due to lower production intensity. In conventional agriculture, higher income is achieved with a higher production intensity, which leads to greater environmental risks (Figure 1).

Figure 1. Relationship of agricultural income with social and environmental goals

Source: Own study based on Gołębiwska and Pajewski 2016.

That is why organic farming cannot become the only solution to our challenges in the field of environmental protection and food safety. The literature indicates that the solution may, to some extent, be conducting production in a sustainable way, and even—as indicated in reaping the benefits science and the sustainable intensification of global agriculture, producing food in a sustainable manner with minimal use of additional land resources, as part of the sustainable intensification of agriculture (The Royal Society, 2009).

Theoretical considerations on this topic may indicate great possibilities in terms of expected solutions. However, research shows that implementation of the concept of sustainable development of agriculture and rural areas faces many difficulties. For example, as a result of her research, Antoszek (2002) stated that it is unlikely that the transition to ecological values declared for implementation would take place in a short time, because the positive attitude of farmers towards environmental issues loses in confrontation with the economic conditions of their activities. In turn, Ikerd stated that sustainable farming systems must be environmentally and socially responsible and economically viable. A farm that does not meet the needs of society—not only as consumers but also as producers and citizens—should not be maintained by society (Ikerd, 2008).

3. Materials and Methods

The aim of the research was to identify and assess the attitudes and views of Polish farmers on the concept of sustainable agriculture and the process of its implementation in agricultural production. The time range of the collected research material concerned 2019. Data on the application of sustainable development principles in agricultural production was obtained from 310 farmers from farms located in typically agricultural regions of Poland (Kuyavian-Pomeranian, Masovian, Lublin and Greater Poland voivodeships). These four voivodeships are recognised as having the highest share of sown area.

The research was conducted using an interview questionnaire containing six questions and a metric. Their purpose was to determine whether farmers are aware and knowledgeable of the principles of sustainable development and to what extent these principles are implemented during agricultural production. The answers were grouped on the basis of the Likert 5-point scale, in which 1 means definitely disagree and 5 means definitely agree. The collected empirical material was developed using an Excel spreadsheet.

4. Results and Discussion

The respondents' age ranged from 19 to 78 years, with 60% of the respondents classified in the age range 40-60. Most of the respondents were men, while respondents with secondary and vocational education predominated in terms of education. Agricultural activity was the main source of income in over 66% of farms, including 100% in over half of them. Table 1 summarizes the basic information characterizing the respondents.

Table 1. *Socio-demographic characteristics of respondents*

Specification		Share (%)
Sex	Female	22.2
	Male	77.8
Age [Year]	19-29	11.6
	30-39	17.3
	40-49	36.2
	50-59	23.9
	>59	11.0
Education	Primary	6.7
	Secondary	44.2
	Higher	17.9
	Vocational	31.2
Share of agricultural income in total income (%)	to 39.9	14.6
	40-59.9	19.2
	60-79.9	15.4
	80-99.9	18.9
	100.0	31.9

Source: *Own research.*

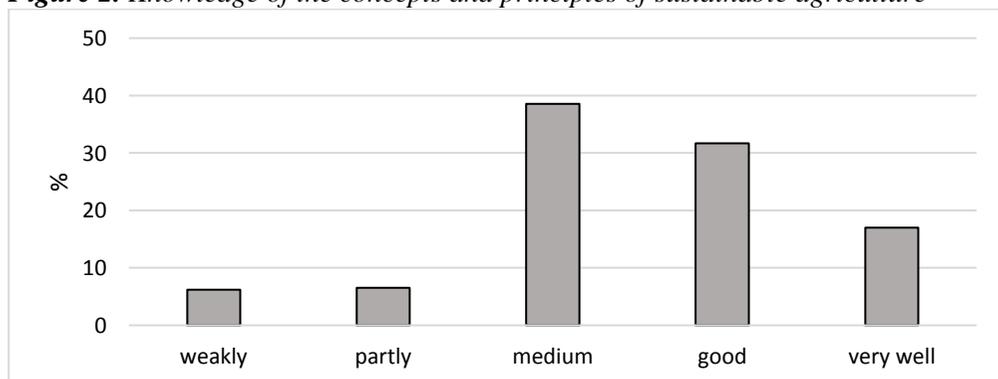
The application of the principles of sustainable development is extremely important, especially in agricultural production, which ensures the provision of food to the rapidly growing population of the world. However, the implementation of this process is not easy and depends mainly on agricultural producers. This is indicated by the research by Kata and Kusz (2015), who state that agricultural producers are key players in the field of sustainable agriculture, because they are directly involved in processes determining the effectiveness and efficiency of implementing this

concept. Despite many recommendations and restrictions in the field of environmental protection, the final decision to apply the principles of sustainable development has so far been the responsibility of farm owners. Research shows that farmers need to see economic benefits to apply the principles of sustainable development. This was stated by Aubert *et al.* (2012) examining the implementation of innovative technology that creates the possibility of obtaining higher productivity in agricultural production, while contributing to environmental sustainability of agricultural practices.

Nachtman (2015) came to similar conclusions when comparing organic and mixed farms (using conventional and ecological practices at the same time). The author stated that it should be possible for farmers to run both production systems, because the differences in the financial results of mixed and organic farms indicate that the ban on combining the organic and conventional systems may discourage farmers in the future from undertaking organic production, as well as lead to the abandonment of organic production of these, who currently implement it in part of the farm. In addition to economic factors, factors underlying knowledge and information (Nikolova, 2015), not only regarding the principles of sustainable agriculture and conditions of access to various support instruments, but also the idea of sustainable development are important when applying the principles of sustainable development in agriculture more often (Kata and Kusz, 2015). The tests carried out by our team mostly confirm these results.

Figure 2 presents the structure of respondents' declarations regarding knowledge of concepts and principles of sustainable agriculture. A total of 48.7% of surveyed farmers declared very good and good level of knowledge of the concepts and principles of sustainable agriculture, while only 12.7% of respondents admitted to a very poor and weak level, and therefore it can be concluded that the declared knowledge of the concept and principles of sustainable agriculture among farmers was relatively high in relation to the researched farms.

Figure 2. Knowledge of the concepts and principles of sustainable agriculture



Source: Own research.

In different countries, this knowledge is at different levels. In the study of Sadati *et al.* (2010) the share of farmers with very low and low knowledge about sustainable agriculture was around 60%. Research results by Azman *et al.* (2012) indicated that over 70% of respondents had very high knowledge about sustainable production. However, according to Ingram (2008) about farmers' knowledge of using land for agricultural production in a sustainable way, although farmers have a lot of knowledge, it is not in-depth and is often not enough to conduct sustainable soil management practice in agricultural production.

In order to confirm the knowledge of the principles of agricultural production in a sustainable system, respondents were asked about the benefits of their use. Table 2 summarizes the results of ranking by the respondents of the four benefits indicated in the questionnaire resulting from the implementation of sustainable agriculture principles in relation to environmental, social and farmer benefits, as well as their opinions (five-point scale) regarding other aspects related to the concept of sustainable agriculture. The presented summary shows that the most important benefit indicated by the respondents in relation to the environment was the protection of waters against pollution, then the reduction of greenhouse gas emissions, reduction of energy consumption from non-renewable sources and the increase of biodiversity in the natural environment. This is extremely important, because as Gołębiewski (2013 and 2018) indicates, during agricultural production a lot of waste materials are created that can pollute the environment. It is important that farmers are knowledgeable in this area.

Table 2. *Ranking of benefits for the environment, society and the farmer in the respondents' opinion*

Specification	Mean	SD	CV
Benefits for the environment – ranking			
Water protection against pollution	1.889	1.041	55.087
Reduction of greenhouse gas emissions	2.458	1.011	41.152
Reduction of energy consumption from non-renewable sources	2.595	0.975	37.563
Increase of biodiversity in the natural environment	3.036	1.114	36.699
Benefits for society – ranking			
More secure food for the health of the population	2.161	1.054	48.766
Improvement of working conditions on an agricultural holding	2.361	1.075	45.548
Improving livestock welfare	2.486	1.071	43.081
Increasing the attractiveness of rural areas	2.939	1.148	39.072
Benefits for the farmer – ranking			
Easier to sell products	2.305	1.122	48.679
Improvement of farm profitability	2.394	1.105	46.178
Soil improvement	2.397	1.102	45.989
Acquiring knowledge and experience	2.851	1.060	37.180
Evaluation of other benefits on a five-point scale			

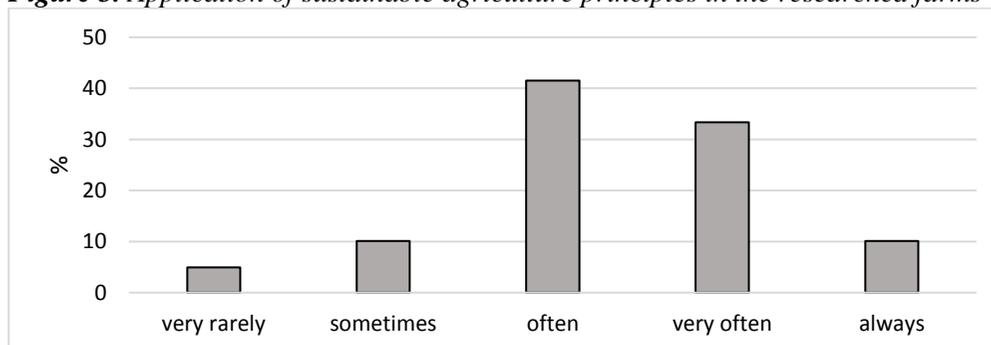
Guarantees care for animal welfare	4.013	1.021	25.442
It improves farmer's safety	3.821	1.060	27.748
Guaranteeing a fair income for the farming family	3.815	1.031	27.030
It enables the transfer of a farm to a successor	3.806	1.120	29.428
Application of agrotechnical practices in accordance with good agricultural practice	3.754	1.005	26.781
It allows to meet the social needs of the farming family	3.573	1.031	28.866

Source: Own research.

In the area of benefits for society, the production of safer food was identified as the most important, which is related to its impact on health. Sulewski and Gołaś (2019) came to similar conclusions in their research, who stated that farmers indicated the care for health as the main motive justifying the need to protect the environment. Further aspects include improving working conditions on a farm, improving livestock welfare and increasing the attractiveness of rural areas. In terms of benefits for the farmer, according to the respondents' opinion, the easier sale of products came first, while the differences in the second and third place were minimal, and this concerned the economic aspects of running a farm "improving farm profitability" and caring for production conditions "improving the condition soil". A guarantee of care for animal welfare was indicated as an important aspect related to the implementation of the concept of sustainable agriculture. Other benefits relate to issues regarding the areas of sustainable agriculture indicated by definition, although they do not always relate to only one of them. The respondents emphasized the importance of both improving work safety on the farm and facilitating the transfer of the farm to the successor.

The assessments indicated by farmers do not always go hand in hand with the implementation of recognized principles in practice. Most of the surveyed agricultural producers declared using the principles of sustainable agriculture on their own farm (Figure 3). Every tenth respondent has always applied these principles, and every third very often. The total percentage of farmers who declared that they did not, very rarely or only occasionally use solutions when conducting farm production in accordance with the concept of sustainable agriculture was 15%. So some farmers, despite knowing the principles of sustainable agriculture (e.g. 18% knew it very well) did not use it in practice (only 10% always used it). According to the data in Table 3, there is a negative correlation between the application of sustainable agriculture principles and the farmer's age and participation in training, although the correlation is low. The strength of the relationship between the share of non-agricultural income in the income of a farmer's family is also low, but the relationship is positive. Belonging to the producer group, the number of people in the family and the area of the farm practically showed no relation to the application of the principles of sustainable agriculture. Pearson's correlation was used to determine which factors were the most important when farmers used sustainable production (Table 3).

Figure 3. Application of sustainable agriculture principles in the researched farms



Source: Own research.

Table 3. Correlation between the approach to applying the principles of sustainable agriculture and selected variables

Specification	I use sustainable farming methods
Farmer's age	-0.365
Number of years of work on the farm	-0.156
Belonging to producer group	-0.096
Total number of people in the family	-0.078
Participation in training / internships	-0.240
The total area of the farm	0.039
Education	0.435
Share of agricultural income from family income	0.200

Source: Own research.

There are, however, positive relationships (significant relationship) between the application of the principles of sustainable agriculture and education. The results of our research confirm that education and knowledge are of the greatest importance when using sustainable production at the farm level.

5. Conclusion

The issue of agricultural production in accordance with the principles of sustainable agriculture has recently been raised by both scientists and practitioners. The way agriculture impacts the environment depends on the production system, which in turn is based on the farmer's knowledge and inclination to take this into account in his activities.

Based on the conducted research, it can be concluded that mere knowledge of the principles of sustainable agriculture does not mean that they are implemented during production. There was often a situation that farmers, despite their good knowledge of the principles of sustainable agriculture, did not apply it in practice. This could be due to the fear of lower income due to restrictions on production intensity in a sustainable agricultural production system. According to farmers, the most important benefit of

sustainable production in relation to the environment was the protection of waters against pollution, reduction of greenhouse gas emissions, reduction of energy consumption from non-renewable sources and increase of biodiversity in the natural environment. They pointed to the increase in food quality and population health as a benefit to society.

Research results also show that the most important factor influencing the application of sustainable farming principles was the education and age of farmers. Older and less educated farmers are less aware of the principles of sustainable agriculture in their activities. This indicates the legitimacy of conducting courses and training among agricultural producers.

References:

- Antoszek, J. 2002. The sustainable development conception and the possibilities of its implementation in rural areas in the province of Lublin (on the basis of survey). *Annales Universitatis Mariae Curie-Skłodowska*, LVII, 11, Section B, 193-210.
- Aubert, B.A., Schroeder, A., Grimaudo, J. 2012. IT as enabler of sustainable farming: An empirical analysis of farmers' adoption decision of precision agriculture technology. *Decision Support Systems*, 54(1), 510-520. doi:10.1016/j.dss.2012.07.002.
- Azman, A., D'Silva, L.J., Abu Samah, B., Man, N., Hayrol Azril Mohamed Shaffri. 2012. Comparative Study on Sustainable Agriculture Knowledge among Malaysian Contract Farmers. *American Journal of Applied Sciences*, 9(5), 673-677.
- Billington, R.D., Carter, N., Kayamba, L. 2008. The practical application of sustainable tourism development principles: A case study of creating innovative place-making tourism strategies. *Tourism and Hospitality Research*, 8(1), 37-43. doi:10.1057/thr.2008.4.
- Czyżewski, B., Brelik, A. 2014. Sustainable Development of Agriculture - Case of Poland. *Annals PAAAE*, 16(2), 38-43.
- Daly, H.E. 1990. Toward Some Operational Principles of Sustainable Development. *Commentary. Ecological Economic*, 2, 1-6. Elsevier Science Publishers B.V.
- Garnett, T., Appleby, M.C., Balmford, A., Bateman, I.J., Benton, T.G., Bloomer, P., Burlingame, B., Dawkins, M., Dolan, L., Fraser, D., Herrero, M., Hoffmann, I., Smith, P., Thornton, P.K., Toulmin, C., Vermeulen, S.J., Godfray, H.C.J. 2013. Sustainable Intensification in Agriculture: Premises and Policies. *Science*, 341(6141), 33-34. doi:10.1126/science.1234485.
- Gołębiewska, B., Pajewski, T. 2016. The Negative Effects of Agricultural Production and the Possibility of its Limitation. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu*, 18(3), 76-81.
- Gołębiewski, J. 2013. Sustainable bioeconomy - potential and development factors, In IX Congress of Polish Economists, Economics for the future. Discovering the nature and causes of economic phenomena. PTE, Warsaw.
- Gołębiewski, J. 2018. Spatial concentration of bioeconomy sectors in Poland. *Economic Science for Rural Development*, 49, 32-40. doi: 10.22616/ESRD.2018.117.
- Hansen, J.W., 1996. Is Agricultural Sustainability a Useful Concept? *Agricultural Systems*, Elsevier Science Limited, 50, 2, 117-143. doi.org/10.1016/0308-521X(95)00011-S.
- Harger, J.R.E., Meyer, F.M. 1996. Definition of indicators for environmentally sustainable development. *Chemosphere*, 33(9), 1749-1775. doi:10.1016/0045-6535(96)00194-4.

- Hartig, P.D., Hartig, J.H., Lesh, D.R., Lowrie, D.G., Wever, G.H. 1996. Practical application of sustainable development in decision-making processes in the Great Lakes Basin, *International Journal of Sustainable Development & World Ecology*, 3(1), 31-46. doi: 10.1080/13504509609469915.
- Hull, Z. 2008. Sustainable development: premises, understanding and prospects. *Sustainable Development*, 16(2), 73-80. doi:10.1002/sd.337.
- Ikerd, J. 2008. Sustainable capitalism: a matter of ethics and morality. *Problemy Ekorozwoju*, 3, 1, 13-22.
- Ingram, J. 2008. Are farmers in England equipped to meet the knowledge challenge of sustainable soil management? An analysis of farmer and advisor views. *Journal of Environmental Management*, 86(1), 214-228. doi:10.1016/j.jenvman.2006.12.036.
- Kata, R., Kusz, D. 2015. Barriers to the Implementation of Instruments Assisting Sustainable Development of Agriculture. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*. 15(1), 239-248.
- Kowalczyk, S. 2018. Z badań nad rolnictwem społecznie zrównoważonym. Rolnictwo zrównoważone w erze globalizacji. Zagrożenia i szanse. IERiGŻ_PIB, Monografie Programu wieloletniego, Warszawa.
- Lorenz, D.P. 2006. The Application of Sustainable Development Principles to the Theory and Practice of Property Valuation. Dissertation, genehmigt von der Fakultät für Wirtschaftswissenschaften der Universität Fridericiana zu Karlsruhe, doi: 10.5445/KSP/1000005408.
- Majewski, E. 2008. Sustainable development and sustainable agriculture, theory and practice of farms. Wyd. SGGW, Warszawa.
- Muller, A., Jawtusich, J., Gattinger, A. 2011. Mitigating Greenhouse Gases in Agriculture: A challenge and opportunity for agricultural policies. *Diakonisches Werk der EKD e.V. Stuttgart*.
- Nachtman, G. 2015. Farms combining organic and conventional production methods at the background of organic farms. *Zagadnienia Ekonomiki Rolnej*, 3(344), 129-147. doi: 10.5604/00441600.1167241.
- Nikolova, M. 2015. Relationship between the Sustainable Models of Production in Agriculture and the Challenges to Their Development in Bulgaria. *Journal of Economics and Development Studies*, 3(4), 57-68. DOI: 10.15640/jeds.v3n4a7.
- Pawłowski, L. 2011. Role of environmental monitoring in implementation of sustainable development. *Rocznik Ochrona Środowiska*, 13, 333-346.
- Pearce, D. 1988. Economics, equity and sustainable development. *Futures*, 20(6), 598-605. doi:10.1016/0016-3287(88)90002-x.
- Pretty, J. 2008. Agricultural sustainability: concepts, principles and evidence. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1491), 447-465. doi:10.1098/rstb.2007.2163.
- Report of the World Commission on Environment and Development, 1987. *Our Common Future*. <https://sustainabledevelopment.un.org>. Access: 12.02.2020.
- Rodríguez, D. 2019. Greenhouse Gas Emissions of Agriculture: A Comparative Analysis. *Environmental Chemistry and Recent Pollution Control Approaches*. Hugo Saldarriaga-Noreña, Mario Alfonso Murillo-Tovar, Robina Farooq, Rajendra Dongre and Sara Riaz, *IntechOpen*, doi: 10.5772/intechopen.84208. Available from: <https://www.intechopen.com>.
- Rogall, H. 2010. *Ekonomia zrównoważonego rozwoju. Teoria i praktyka (Nachhaltige Okonomische Theorie und Praxis einer Nachhaltigen Entwicklung)*. Zysk i S-ka.

- RSP. 2019. Resolution on the 15th meeting of the Conference of Parties (COP15) to the Convention on Biological Diversity. <https://oeil.secure.europarl.europa.eu>.
- Sadati, S., Abolhasan, F., Shabanali, H., Asadi, A. 2010. Farmer's Attitude on Sustainable Agriculture and its Determinants: A Case Study in Behbahan County of Iran. *Research Journal of Applied Sciences, Engineering and Technology*, 2(5), 422-427. <http://hdl.handle.net/10535/6663>.
- Seufert, V., Ramankutty, N. 2017. Many shades of gray, The context-dependent performance of organic agriculture. *Science Advances*, 3, 3, 1-14. doi:10.1126/sciadv.1602638.
- Steffen, G., Born, D. 1987. *Prowadzenie gospodarstw i przedsiębiorstw w rolnictwie. Książka i Wiedza, Warszawa.*
- Sulewski, P., Gołaś, M. 2019. Environmental awareness of farmers and farms' characteristics. *Problems of Agricultural Economics*, 4(361), 55-81. DOI: 10.30858/zer/115186.
- The Royal Society. 2009. Reaping the Benefits. Science and the Sustainable Intensification of Global Agriculture. RS Policy Document 11/9.
- Tilman, D. 1999. Global environmental impacts of agricultural expansion: The need for sustainable and efficient practices. *Proceedings of the National Academy of Sciences*, 96(11), 5995-6000. doi:10.1073/pnas.96.11.5995.
- UNEP. 2010. Sustainable Agriculture and the Sustainable Use of Agricultural Biodiversity: Concepts, Trends and Challenges. Convention on Biological Diversity. <https://www.cbd.int/doc>. Access: 14.02.2020.
- Woś, A., Zegar, J.S. 2002. *Rolnictwo społecznie zrównoważone, IERiGŻ, Warszawa.*
- Zegar, J. 2013. Competitiveness of ecological and economic goals in agriculture. From research on socially sustainable agriculture. Selected issues of sustainable agriculture development, No 20. IERiGŻ-PIB, Warsaw, 28-46.
- Żylicz, T. 1998. Sustainable development. *Aura*, 5, 1-2.