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The role of science in sustainable development of agriculture according to the Polish scientific community

Abstract: *Sustainable development of agriculture and rural areas is a complex issue. Therefore, identifying the needs for sustainability, study the stage of its conceptualization, developing methods and implementation instruments, require the involvement of different scientific fields. Their role varies both in concept and implementation. The aim of the research was to determine the scientific community representatives' opinion on the role of science and its particular fields in the implementation of sustainable development of agriculture and rural areas. This analysis was preceded by determining the importance of science against the background of other factors. Surveys were conducted using a structured interview with 128 representatives of socio-economic and the life sciences. Basic descriptive statistics were used to characterize the obtained results.*

The vast majority of respondents stated that implementing the ideas of sustainable development of agriculture and rural areas is possible and justified. Analyses have shown that at the current stage of sustainable development implementation, the most important factors include scientific research and transfer of new technologies (in addition to political decisions). Such an opinion is expressed by the experts regardless of scientific field they represent (socio-economic and the life sciences). Moreover, ecology has been indicated as a science that mostly contributes to implementing principles for sustainable development of agriculture. Less importance has been, in turn, attached to the political sciences. The role of life and agricultural sciences (agronomy, zootechnics, veterinary medicine, agricu-

ltural chemistry) was rated more highly by representatives of the life sciences. The idea of sustainable development is still evolving concept, which is indirectly indicated by the opinions about increasing need for further engaging all scientific fields that were analyzed. Experts claim that in the future the role of sociology and rural sociology in implementing concepts will increase most significantly, which may indicate that a better understanding of social order will be required.

Keywords: *Rural development programme, Slovenia, sustainable agriculture*

Introduction

In recent centuries the development of science and technology has contributed to improvement in the living conditions and life expectancy of a large part of the human society, but simultaneously, in many places it has led to deterioration in the quality of the natural environment. Therefore, the concept of sustainable development, which was developed in the second half of the 20th century, and which is a reaction to more and more noticeable ecological dangers, stresses the need for further economic and civilisation development but with respect to the rights of nature. Numerous definitions of the phenomenon (Paszkowski, 2001; Piontek, 2002; Zbierska, 2007; Majewski, 2008; Fiedor and Jończy, 2009) stress the need to balance three substantial orders (economic, environmental and social) and point to the need to ensure long-term (intertemporal) durability of the development. In this context the reference of the general rules of sustainable development to agriculture is important, because the issues of sustainability (correlations between the individual orders) and durability are particularly significant. Agricultural production takes place in the natural environment. Therefore, its quality (above all the fertility of soil and weather conditions) has stronger influence on the production capacity and economic results achieved by individual entities than in many other sectors of economy. Apart from that, the specific symbiosis between the farm and household, which is characteristic of the European model of agriculture with the dominant individual (family) form of proprietorship, encourages the search for balance between the economic order (the possibility to achieve income from the agricultural activity) and the social order (pursuit of life aspirations by members of a family of farmers). Besides, agriculture is a branch of production which caters to the essential – nutritional needs of every person. This fact is an argument speaking in favour of ensuring the appropriate economic conditions of production in terms of quality and quantity and to retain the production capacity in the future. Simultaneously, this means that the assumptions of sustainable development of agriculture should be considered in the context of its nutritional function, assuming a long, multi-generation perspective. The systems of conventional agriculture which are currently used in developed countries were formed as a result of the implementation of numerous scientific and technological achievements. They consist in a wide application of external means of production (which do not come from the

farm) and mechanisation based on the application of non-renewable fossil fuels (Zegar, 2012). The chief merit of those systems was the fact that they enabled increase in the scale of agricultural production and in consequence, they eliminated or considerably limited famine and malnutrition. Inappropriately applied technologies, including above all simplifications in the sowing structure, which ignored the rules of crop rotation or excessively applied chemical growth substances, contributed to the degradation of the agricultural environment in many places. Not only did they have negative influence on the health quality of products, but also and above all on the fertility of soil, which had consequences in the possibility of satisfying the demand for food in the long run. Therefore, it was necessary to work out the rules of sustainable development of agriculture, which would simultaneously ensure the appropriate supply of food and respect the environment, retain the qualitative parameters of agricultural products and give producers a possibility to gain appropriate agricultural income.

The main problem related with the practical implementation of these rules is that as entrepreneurs the farmers who make current and strategic decisions are mainly interested in the current microeconomic calculations (Poczta and Sadowski, 2007; Sadowski, 2009), which in many cases diverge from the need to protect the environment and are in disagreement with the long-term interest of the farm, which is chiefly related with retaining fertility of the soil. Therefore, in order to realise this concept it is necessary to apply the instruments of agricultural policy, both in the form of support schemes and the current regulations and required agricultural practices. Science plays an equally important role in creating the rules of sustainable development of agriculture, mainly because of its multidimensional character, multitude of purposes and long perspective. It is necessary to mention the fact that the complexity of the issue requires engagement of representatives of many fields of science and an interdisciplinary and holistic approach, which will encompass the problem of agricultural development in all its aspects, above all including environmental, technological, organisational, economic and social issues as well as those related with the agricultural policy.

Therefore, the aim of the research was to identify the opinion of the scientific environment about the essence of the issue of sustainable development of agriculture and the factors responsible for this development, above all including the scientific disciplines which play a role in the development of the concept. Due to the wide area of interest and the assumption of a holistic approach to reality the issues related with sustainable development of agriculture may be considered from different points of view. Therefore, the research attempted to determine the diversification of opinions between the representatives of socioeconomic sciences (understood as the people who chiefly investigate this fragment of reality which was created by man or which is only characteristic of the Homo sapiens species) and life sciences (the people who chiefly investigate the aspects of the world which are independent of the human activity or which are dependent on the human only to a certain, limited extent).

Methodology

The research included a standardised interview with representatives of selected fields of science, which concerned their opinions about the sustainable development of agriculture. The survey encompassed 128 people with doctoral, post-doctoral or professor degrees. They represented the following sciences: agronomy, zootechnics, veterinary science, agroecology, ecology and environmental protection, agricultural and food economics, economics and rural and agricultural sociology. During the research the respondents were grouped into the following two categories:

- representatives of socioeconomic sciences such as: agricultural and food economics, and rural and agricultural sociology,
- representatives of life sciences such as: agronomy, zootechnics, veterinary science, agroecology, ecology and environmental protection.

The ranking questions, which prevailed in the questionnaire, applied the most popular Likert scale, where 1 is the least significant (insignificant) factor and 5 is the most significant (very important) factor.

During the research the results were statistically analysed in order to determine the significance of differences in the answers given. The λ^2 test was applied, which is the most common in the analysis of qualitative variables.

It is described by the following formula (Stanisz, 2006):

$$\lambda^2 = \sum \frac{(O-E)^2}{E}$$

where:
E – expected (theoretical) cell frequency
O - observed cell frequency

Its essence boils down to the comparison of expected and observed frequencies, with the zero hypothesis, which assumes no correlations between the variables (Stanisz, 2006). The level of significance $\alpha = 0.005$ and the number of degrees of freedom df = r-1 were assumed (where r is the number of classes into which the values in the sample were divided; in this case these are representatives of socioeconomic and life sciences). The zero hypothesis is rejected if the value of test probability is $p<0.05$ (Kot et al., 2011). The obtained results were also processed into descriptive statistics with the coefficients of variation and skewness.

Results

The issue of sustainable development is a general concept (idea), which assumes the need for a holistic (complex) approach and analysis of the processes

occurring in the economy and society, with all their complexity and allowance for the existing correlations. In spite of this fact the specific character of certain sectors justifies disaggregation, which takes place in the case of agriculture due to its specific position in the natural environment and the strategic and irreplaceable role in the functioning of society. A vast majority of the surveyed representatives of sciences share this point of view. Regardless of the discipline they represent, more than 80% of them think it is justified to make analytical reference between the rules of sustainable development and particular sectors (table 1).

Table 1. The distribution of responses to the question: 'Is it justified to make references between the rules of sustainable development and particular sectors?'– the respondents grouped according to the branches of science

Respondents representing:	Percentage of responses		Number	Chi^2	Mean	Coefficient of variation	Skewness
	no (0)	yes (1)					
Socioeconomic sciences[a]	15.9	84.1	69	0.1157879	0.84	43.9	-1.9
Life sciences[b]	13.8	86.2	65	p=0.73365	0.86	40.4	-2.1
Total	14.9	85.1	134	df=1	0.85	42.0	-2.0

[a] Economics, agricultural and food economics, environmental economics, sociology, rural sociology, economic policy

[b] Agronomy, zootechnics and veterinary science, ecology and environmental development

Source: Authors' own calculations based on questionnaire survey, n=128

The representatives of science who were surveyed also mostly agreed that it is possible to put the rules of sustainable development of agriculture and rural areas into practice now or in the foreseeable future (table 2). This approach simultaneously points to the legitimacy of scientific research aimed at showing the directions and mechanisms of sustainable development.

Table 2. The distribution of responses to the question: Is it possible to implement the rules of sustainable development of agriculture and rural areas in the foreseeable future? - the respondents were grouped according to the branches of science

Respondents representing:	Percentage of responses			Number	Chi^2
	no	yes	The concept of sustainable development of agriculture and rural areas is wrong		
Socioeconomic sciences[a]	13.8	81.5	4.6	65	1.567045
Life sciences[b]	9.7	88.7	1.6	62	p=0.45680
Total	11.8	85.0	3.1	127	df=2

[a] As in Table 1

[b] As in Table 1

Source: Authors' own calculations based on questionnaire survey, n=128

Among the factors contributing to the implementation of the rule of sustainable development the respondents indicated scientific research and political decisions in the first place (table 3). It results from the very nature of the phenomenon, because the complexity of problems requires us to work out

the methods of implementation based on scientific research and technological solutions, but the aforementioned discrepancy between microeconomic and social problems causes the need to make regulations which will eliminate or at least limit them. Therefore, due to the specific view of business entities the representatives of the scientific community ranked farmers' decisions at a lower level. In spite of the fact that it is the farm where actions with direct influence on both the economic results and condition of the environment are taken (above all this concerns agro- and zootechnical procedures as well as investments made), most of the respondents thought that producers' autonomous decisions are mostly (or exclusively) motivated by current economic needs. Therefore, as such they are a less important factor than regulations or scientific and technological achievements. In spite of the fact that sustainable development refers to general social purposes and in agriculture it concerns such important issues as the health quality of food products and the social acceptance of applied procedures and their effect on the condition of the environment, the average rank of such factors as the pressure of the non-farming part of society and the pressure of recipients of agricultural products was the lowest of all suggestions. This may mean that similarly to farmers, their market partners and consumers in their individual decisions are mainly guided by the economic premises, where health and environmental aspects are less significant. These views may result from the fact that in Poland there is not a strong lobby group promoting cost-consuming practices ensuring environmental protection or the production of higher quality but more expensive food products.

Table 3. An assessment of the factors contributing to the implementation of the rule of sustainable development in agriculture - the respondents grouped according to the branches of science

Factors	Respondents representing:	Percentage of responses					Number	Chi^2	Mean	Coefficient of variation	Skewness
		1	2	3	4	5					
Scientific research and implementation of new technologies	Socioeconomic sciences[a]	1.6	4.8	19.0	34.9	39.7	63	1.824092	4.06	23.8	-0.9
	Life sciences[b]	1.6	1.6	16.4	31.1	49.2	61	p=0.76807	4.25	21.4	-1.2
	Total	1.6	3.2	17.7	33.1	44.4	124	df=4	4.15	22.6	-1.0
Political decisions	Socioeconomic sciences[a]	0.0	3.2	20.6	36.5	39.7	63	4.581728	4.13	20.6	-0.6
	Life sciences[b]	4.9	6.6	23.0	34.4	31.1	61	p=0.33297	3.80	29.1	-0.8
	Total	2.4	4.8	21.8	35.5	35.5	124	df=4	3.97	25.1	-0.8
Farmers' individual decisions	Socioeconomic sciences[a]	6.7	16.7	23.3	23.3	30.0	60	1.640018	3.53	35.9	-0.4
	Life sciences[b]	3.4	11.9	27.1	28.8	28.8	59	p=0.80158	3.68	30.5	-0.5
	Total	5.0	14.3	25.2	26.1	29.4	119	df=4	3.61	33.1	-0.4
Pressure of non-farming part of society	Socioeconomic sciences[a]	4.8	11.3	32.3	32.3	19.4	62	3.139318	3.50	30.9	-0.4
	Life sciences[b]	5.0	20.0	36.7	26.7	11.7	60	p=0.53479	3.20	33.0	-0.1
	Total	4.9	15.6	34.4	29.5	15.6	122	df=4	3.35	32.1	-0.2
Pressure of recipients of agricultural products (mainly processing)	Socioeconomic sciences[a]	8.1	16.1	24.2	25.8	25.8	62	4.111555	3.45	36.6	-0.4
	Life sciences[b]	3.2	11.3	27.4	38.7	19.4	62	p=0.39112	3.60	28.7	-0.5
	Total	5.6	13.7	25.8	32.3	22.6	124	df=4	3.52	32.7	-0.5

[a] As in Table 1

[b] As in Table 1

Source: Authors' own calculations based on questionnaire survey, n=128

Besides, the low level of social self-organisation is related with limited possibilities to exert a pressure in this aspect. It is necessary to mention the fact that there are no statistically significant differences in views between the representatives of life and socioeconomic sciences at the level of defining the factors decisive to the possibility of implementation of the rule of sustainable development.

Table 4. The sciences contributing to the implementation of the rules of sustainable development in agriculture - the respondents grouped according to the branches of science

Sciences	Respondents representing:	Percentage of responses[c]					Number	Chi^2	Mean	Coefficient of variation	Skewness
		1	2	3	4	5					
Agronomy	Socioeconomic sciences[a]	1.7	10.3	34.5	32.8	20.7	58	10.07031	3.60	27.5	-0.2
	Life sciences[b]	1.8	5.5	14.5	34.5	43.6	55	p=0.03927	4.13	23.8	-1.1
	Total	1.8	8.0	24.8	33.6	31.9	113	df=4	3.86	26.3	-0.6
Zootechnics and veterinary science	Socioeconomic sciences[a]	1.8	16.4	32.7	32.7	16.4	55	7.280086	3.45	29.4	-0.1
	Life sciences[b]	1.8	7.3	18.2	41.8	30.9	55	p=0.12182	3.93	24.9	-0.8
	Total	1.8	11.8	25.5	37.3	23.6	110	df=4	3.69	27.6	-0.5
Agricultural technology	Socioeconomic sciences[a]	1.9	11.1	33.3	38.9	14.8	54	2.448272	3.54	26.7	-0.3
	Life sciences[b]	1.9	5.6	35.2	33.3	24.1	54	p=0.65392	3.72	25.8	-0.3
	Total	1.9	8.3	34.3	36.1	19.4	108	df=4	3.63	26.3	-0.3
Agricultural chemistry	Socioeconomic sciences[a]	5.5	10.9	27.3	29.1	27.3	55	5.372727	3.62	32.1	-0.5
	Life sciences[b]	1.8	5.5	16.4	43.6	32.7	55	p=0.25115	4.00	23.6	-1.0
	Total	3.6	8.2	21.8	36.4	30.0	110	df=4	3.81	28.1	-0.8
Agricultural economics	Socioeconomic sciences[a]	0.0	6.9	31.0	37.9	24.1	58	1.757205	3.79	23.6	-0.2
	Life sciences[b]	1.8	12.7	21.8	45.5	18.2	55	p=0.78030	3.65	27.0	-0.6
	Total	0.9	9.7	26.5	41.6	21.2	113	df=4	3.73	25.2	-0.4
Rural and agricultural sociology	Socioeconomic sciences[a]	3.6	10.7	42.9	28.6	14.3	56	5.059632	3.39	29.0	-0.2
	Life sciences[b]	9.8	21.6	31.4	21.6	15.7	51	p=0.28124	3.12	38.8	0.0
	Total	6.5	15.9	37.4	25.2	15.0	107	df=4	3.26	33.8	-0.2
Ecology	Socioeconomic sciences[a]	0.0	1.8	19.6	30.4	48.2	56	3.140532	4.25	19.7	-0.7
	Life sciences[b]	0.0	9.3	16.7	25.9	48.1	54	p=0.37047	4.13	24.5	-0.8
	Total	0.0	5.5	18.2	28.2	48.2	110	df=3	4.19	22.0	-0.8
Genetics	Socioeconomic sciences[a]	1.9	18.5	25.9	27.8	25.9	54	4.295065	3.57	31.5	-0.2
	Life sciences[b]	3.7	7.4	35.2	33.3	20.4	54	p=0.36755	3.59	28.4	-0.4
	Total	2.8	13.0	30.6	30.6	23.1	108	df=4	3.58	29.8	-0.3
Technical sciences	Socioeconomic sciences[a]	3.7	7.4	37.0	35.2	16.7	54	0.3736016	3.54	27.8	-0.4
	Life sciences[b]	3.8	7.7	42.3	30.8	15.4	52	p=0.98458	3.46	28.3	-0.3
	Total	3.8	7.5	39.6	33.0	16.0	106	df=4	3.50	28.0	-0.3
Economics	Socioeconomic sciences[a]	1.8	3.6	33.9	39.3	21.4	56	2.427999	3.75	24.0	-0.4
	Life sciences[b]	0.0	9.3	31.5	38.9	20.4	54	p=0.65757	3.70	24.4	-0.2
	Total	0.9	6.4	32.7	39.1	20.9	110	df=4	3.73	24.1	-0.3
Sociology	Socioeconomic sciences[a]	1.8	5.5	45.5	40.0	7.3	55	16.60037	3.45	22.8	-0.3
	Life sciences[b]	5.8	34.6	28.8	25.0	5.8	52	p=0.00231	2.90	35.6	0.2
	Total	3.7	19.6	37.4	32.7	6.5	107	df=4	3.19	29.9	-0.2
Political sciences	Socioeconomic sciences[a]	5.6	25.9	51.9	9.3	7.4	54	18.41926	2.87	32.5	0.4
	Life sciences[b]	26.9	32.7	17.3	17.3	5.8	52	p=0.00102	2.42	50.6	0.5
	Total	16.0	29.2	34.9	13.2	6.6	106	df=4	2.65	41.7	0.3

[a] As in Table 1

[b] As in Table 1

[c] As in Table 3

Source: Authors' own calculations based on questionnaire survey, n=128

The opinions of the surveyed respondents about the role of individual sciences in the implementation of the rule of sustainable development in agriculture and rural areas are important for several reasons. First of all, the vast majority of them thought that such development is possible. Second of all, among the factors contributing to the development the role of science was particularly stressed. Third and probably most important of all, the sustainable development requires a holistic approach both at the stage when it is investigated and defined and at the stage of implementation. Therefore, the recognition of the roles of different disciplines, not only those represented by a particular person, is a significant contribution showing the directions of exploration of the problem under investigation. In this context it is particularly important to analyse the differences in views between the representatives of life sciences and socioeconomic sciences. Above all, it is necessary to notice rather considerable diversification in the views concerning the disciplines with direct connection with agriculture (table 4). The researchers of nature attribute a more important role to the sciences related with the productive and technological aspects of agriculture (chiefly to agronomy, zootechnics, veterinary science and agricultural chemistry), which may be connected both with the recognition of their own research areas and with the belief that the ecological order plays a principal role. This fact is also confirmed by the relatively low rank given by the representatives of life sciences to the other two orders (rural and agricultural sociology, agricultural economics, economics and sociology). In view of the fact that the concept of sustainable development was developed as a reaction to the deteriorating condition of the environment, such views may be considered to be justified. As far as the representatives of socioeconomic sciences are concerned, it is possible to observe greater balance in the opinions about the role of individual sciences (the mean value of responses does not exceed 4 in any case). This may result from the very character of research areas of interest, because understanding the problems concerning the functioning of economy and society (this fact is particularly noticeable as far as agriculture and rural areas are concerned) requires at least general knowledge of the issues related both with technology and organisation of production as well as the rights of nature, whereas detailed exploration of biological and agricultural problems does not always have to be connected with economic and social consequences. Both of the researched groups ranked ecology as the most important, which points to the fact that the representatives of socioeconomic sciences also recognise the significance of the environmental order in sustainable development. At the same time this means that a considerable number of the respondents think that researching the problems of agriculture and rural areas should go beyond the disciplines strictly related with the subject (i.e. agronomy, zootechnics, veterinary science and agricultural chemistry, agricultural technology, agricultural economics, rural and agricultural sociology) and make use of the achievements of other, more general sciences. However, the relatively low significance of sociology as well as rural and agricultural sociology may be intriguing, especially if we take into consideration the fact that these disciplines are directly related with one of the three orders of sustainable development. On the other hand, the representatives of both groups

under investigation ranked political sciences lowest, which seemingly stands in opposition to the declared high significance of political factors. Such opinions of the scientific community may result from the fact that politics is chiefly treated as a domain of practical activity. Therefore, the scientific exploration of this issue does not have significant influence on the concept of sustainable development of agriculture and rural areas.

Table 5. The distribution of responses to the question: 'At which level should the condition of sustainability of agriculture chiefly be considered?' - the respondents grouped according to the branches of science

Level	Respondents representing:	Percentage of responses[c]					Number	Chi^2	Mean	Coefficient of variation	Skewness
		1	2	3	4	5					
World	Socioeconomic sciences[a]	7.8	10.9	31.3	18.8	31.3	64	2.457924	3.55	35.5	-0.4
	Life sciences[b]	6.8	18.6	23.7	23.7	27.1	59	p=0.65219	3.46	36.6	-0.3
	Total	7.3	14.6	27.6	21.1	29.3	123	df=4	3.50	35.9	-0.3
Continental	Socioeconomic sciences[a]	3.1	12.3	27.7	24.6	32.3	65	1.932771	3.71	30.8	-0.4
	Life sciences[b]	3.3	19.7	21.3	27.9	27.9	61	p=0.74812	3.57	33.3	-0.3
	Total	3.2	15.9	24.6	26.2	30.2	126	df=4	3.64	31.9	-0.4
National	Socioeconomic sciences[a]	3.0	1.5	16.4	37.3	41.8	67	4.697068	4.13	23.0	-1.3
	Life sciences[b]	0.0	4.8	22.6	27.4	45.2	62	p=0.31982	4.13	22.6	-0.6
	Total	1.6	3.1	19.4	32.6	43.4	129	df=4	4.13	22.7	-1.0
Regional (e.g. province)	Socioeconomic sciences[a]	1.5	1.5	13.6	33.3	50.0	66	2.549712	4.29	20.4	-1.3
	Life sciences[b]	1.6	6.5	11.3	37.1	43.5	62	p=0.63576	4.15	23.5	-1.2
	Total	1.6	3.9	12.5	35.2	46.9	128	df=4	4.22	21.8	-1.2
Local (e.g. commune, village)	Socioeconomic sciences[a]	0.0	3.1	9.2	32.3	55.4	65	2.390386	4.40	17.9	-1.2
	Life sciences[b]	3.2	3.2	9.5	27.0	57.1	63	p=0.66437	4.32	23.1	-1.7
	Total	1.6	3.1	9.4	29.7	56.3	128	df=4	4.36	20.5	-1.6
Farm	Socioeconomic sciences[a]	1.5	3.1	7.7	24.6	63.1	65	2.242346	4.45	19.9	-1.9
	Life sciences[b]	4.8	6.3	9.5	20.6	58.7	63	p=0.69128	4.22	27.4	-1.5
	Total	3.1	4.7	8.6	22.7	60.9	128	df=4	4.34	23.7	-1.7
Field/animal	Socioeconomic sciences[a]	3.2	9.7	21.0	22.6	43.5	62	4.637022	3.94	29.4	-0.8
	Life sciences[b]	11.1	9.5	12.7	28.6	38.1	63	p=0.32661	3.73	36.4	-0.8
	Total	7.2	9.6	16.8	25.6	40.8	125	df=4	3.83	32.9	-0.9

[a] As in Table 1
[b] As in Table 1
[c] As in Table 3
Source: Authors' own calculations based on questionnaire survey, n=128

In spite of the fact that the concept of sustainable development concerns global issues, the experts thought it should mainly be considered at the national, regional, local and farm level (table 5). On the one hand, this approach exemplifies the slogan 'think globally, act locally', but on the other hand, it mainly confirms the significant role of politics in creation of the character of the concept of sustainable development. The levels where binding decisions concerning the creation of economic policy or local and regional development strategies are made were considered to be important. However, the significant rank given to the farm level may be intriguing, especially in view of the opinions about the small significance of farmers' individual decisions. A closer

look at the issue shows that this contradiction is not only apparent, but it also indicates the importance of political instruments in a certain way. It is a true fact that producers' autonomous decisions chiefly take into consideration their current economic interests, but they are made in a specific political and legal environment. Thus, they also concern such issues as the microeconomic consequences of the functioning of both support schemes and regulations limiting the freedom to make economic decisions or imposing certain standards in production procedures. In this case aid actions are particularly important, because due to their voluntary character, farmers will make decisions whether to use them. Although 'restrictive' instruments such as quality standards or a set of procedures which need to be followed are obligatory, it is also in this case that producers need to make a decision whether to abide by the regulations in force.

Conclusions

As results from the research, the opinions of most respondents representing selected branches of science are in general assumptions compatible with the commonly recognised interpretation of the concept of sustainable development. This proves the fact that as an idea the issue well describes both the current state of affairs and the desirable trends of actions. Both the representatives of life sciences and socioeconomic sciences mostly agreed that in spite of the holistic character of sustainable development, it is justified to make disaggregation and to refer the assumptions of sustainable development to particular sectors of the economy, including agriculture. Among the factors contributing to its development the respondents above all listed political decisions and scientific progress, which is also compatible with the common interpretation of the concept of sustainable development. Due to its long (multigenerational) perspective and possible conflicts between the current microeconomic needs and social purposes the practical implementation of the rules of sustainable development requires regulations. The multi-aspect character of the issue causes the need to provide theoretical background and new technological solutions, e.g. related with precision agriculture, the application of which with a proportionally large scale of production may not only reduce the costs of production but also reduce the impact on the environment by limited application of the means of production. The significant role of political factors was confirmed by the fact that the issue of sustainable development of agriculture needs to be considered above all at the national, regional, local and farm level, i.e. in those places where either autonomous decisions are made or where the effect of the instruments of agricultural policy can be observed (this applies to the farm).

There were bigger discrepancies between the representatives of socioeconomic sciences and life sciences in terms of the definition of the significance of individual disciplines in the process of implementation of the rule of sustainable development. In both cases the respondents indicated an important role of ecology, which on the one hand proves the high recognition of the environmental order and the need to consider the issue from a wider perspective than the point

of view of agricultural sciences only, on the other hand. However, the respondents representing socioeconomic sciences showed a more complex (holistic) approach, because among the significant disciplines they indicated those which investigate the environmental, productive, social and economic aspects of agriculture. On the other hand, the representatives of life sciences thought ecology and the disciplines related with applied biology (mostly agronomy and agricultural chemistry) to be the most important, which may point to the particular recognition of the need to scientifically explore the issues concerning the environmental order. At the same time, it is necessary to mention the fact that the views of the representatives of socioeconomic sciences are closer to the idea of sustainable development, which consists in the holistic approach to civilisation, especially to its economic, social and environmental aspects.

References

Fiedor B., Jończy R. (2009). *Globalne problemy interpretacji i wdrażania koncepcji sustainable development*. [in:] B. Fiedor, R. Jończy (eds.) Rozwój zrównoważony. Teoria i praktyka ze szczególnym uwzględnieniem obszarów wiejskich. Uniwersytet Ekonomiczny we Wrocławiu.

Majewski E. (2008). T*rwały rozwój i trwałe rolnictwo – teoria i praktyka gospodarstw rolniczych*. SGGW.

Paszkowski S., (2001). *Zrównoważony rozwój rolnictwa i obszarów wiejskich*. [in:] M. Kłodziński (ed.). Gospodarka, człowiek, środowisko na obszarach wiejskich. Instytut Rozwoju Wsi i Rolnictwa Polskiej Akademii Nauk, Wojewódzki Fundusz Ochrony Środowiska i Gospodarki Wodnej woj. Zachodniopomorskiego, Akademia Rolnicza w Szczecinie.

Piontek B. (2002). *Koncepcja rozwoju zrównoważonego i trwałego Polski*. PWN

Poczta W., Sadowski A. (2007). *Możliwości finansowania projektów związanych z ochroną przyrody w ramach zrównoważonego rozwoju*. [in:] Zasoby przyrodnicze szansą zrównoważonego rozwoju. Akademia Rolnicza im. Augusta Cieszkowskiego w Poznaniu.

Sadowski A. (2009). *Gospodarstwa rolne w koncepcji polityki równoważnego rozwoju obszarów wiejskich*. Journal of Agribusiness and Rural Development 2 (12).

Zbierska J. (2007). *Geneza idei i edukacja na rzecz zrównoważonego rozwoju*. Fragmenta Agronomica 4 (96).

Zegar J. S. (2012). *Współczesne wyzwania rolnictwa*. PWN.