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SOCIO-ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY OF BULGARIAN FARMS

Evaluation of sustainability of agricultural farms is among the most topical academic and practical – farm, business and policies forwarded issues. Despite that there are practically no studies on overall, economic, social, ecological, etc. sustainability of Bulgaria farms during European Union (EU) Common Agricultural Policy (CAP) implementation. This article tries to fill the gap and presents results of a first large-scale study on integral, governance, economic, social, and environmental sustainability of market oriented farms in Bulgaria in general and for holdings of different juridical type, size, specialization and location. Initially, a holistic framework for assessing sustainability of Bulgarian farms is outlined, including a system of appropriate for the specific conditions of Bulgarian agriculture system of principles, criteria, indicators, and reference values for evaluating individual aspects and the integral sustainability of farming enterprises. Next, an assessment of made of the overall, governance, economic, social, and environmental sustainability of Bulgarian farms in general and holdings of different juridical type, size, specialization, ecological and geographical location. Finally, implications for further research and practices in sustainability assessment are withdrawn.

Key words: farm sustainability, governance, economic, social, environmental, Bulgaria.

Introduction and review of literature. Evaluation of sustainability of agricultural farms is among the most topical academic and practical (farm, agribusiness, policies forwarded) issues [Andreoli and Tellarini; Bachev, 2005, 2017; Bachev et al., 2017; Bachev and Petters, 2005; Bastianoni et al., 2001; FAO, 2013; Fuentes; Häni et al. 2006; OECD, 2001; Rigby et al., 2001; Sauvenier et al., 2005]. Despite that there are practically no studies on overall, economic, social, ecological, etc. sustainability of farms in general and holdings of different type in Bulgaria during EU CAP implementation.

The purpose of the article is to present results of a first large-scale study on integral, governance, economic, social, and environmental sustainability of Bulgarian farms in general and holdings of different type during current EU CAP implementation. Initially, a framework for assessing farm sustainability is outlined. After that an assessment is made on the overall, governance, economic, social, and environmental sustainability of Bulgarian farms in general and holdings of different juridical type, size, specialization and location. Finally, implications for further research and practices in sustainability assessment are withdrawn.

Results and discussion.

Framework for assessing sustainability of Bulgarian farms

Farm sustainability characterizes the ability (internal capability) of a particular

farm to exist in time and maintain in a long-term its governance, economic, ecological and social functions in the specific socio-economic and natural environment in which it operates and evolves [Bachev, 2005, 2016a]. Farm sustainability has four aspects (pillars), which are equally important: managerial (governance), economic, social, and environmental.

Hierarchical levels that we develop and which facilitate assessment of sustainability of Bulgarian farms includes selected by a Panel of Experts 12 Principles, 21 Criteria, and 45 Indicators and Reference values (Fig. 1, Table 1). Indicators selection criteria and process are presented in details by our previous publications [Bachev, 2016a,b].

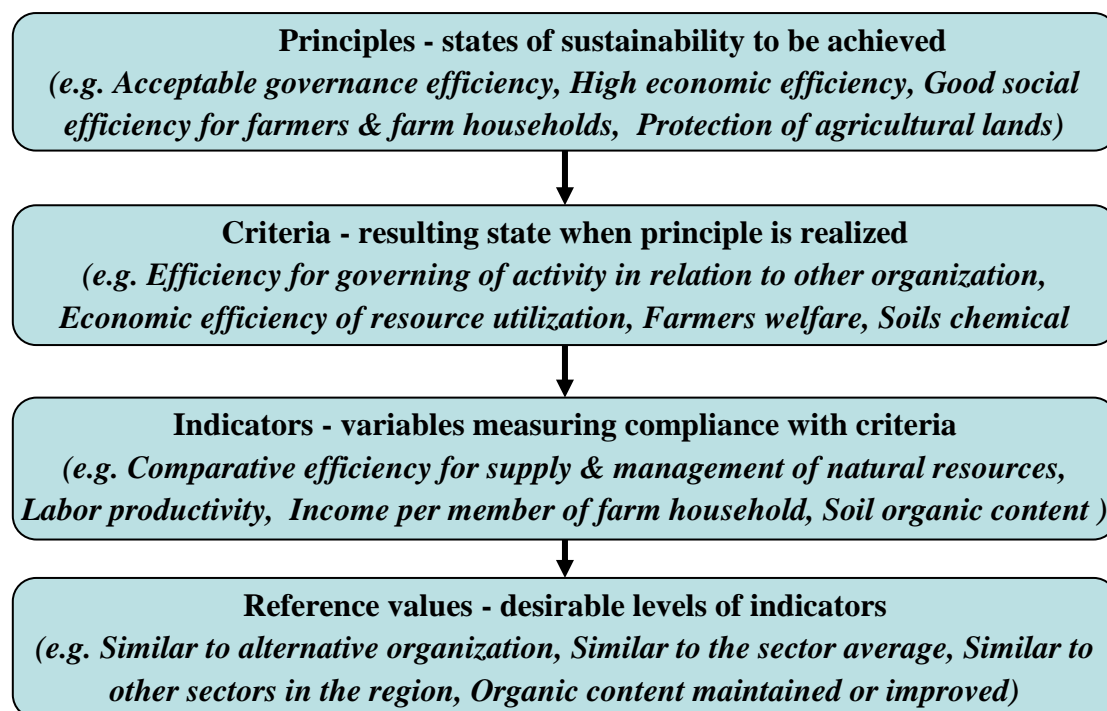


Fig. 1. Hierarchical levels of system for assessing sustainability of Bulgarian farms

Source: Bachev, 2016a.

Principles are the highest hierarchical level associated with the multiple functions of the agricultural farms. They are universal and represent the states of the sustainability, which are to be achieved in the four main aspects – managerial, economic, social and ecological.

Criteria are more precise from the principles and easily linked with the sustainability indicators. They represent a resulting state of the evaluated farm when the relevant principle is realized.

Indicators are quantitative and qualitative variables of different type (behavior, activity, input, effect, impact, etc.), which can be assessed in the specific conditions of the evaluated farms, and allow to measure the compliance with a particular criteria. The set of indicators is to provide a representative picture for the farm sustainability in all its aspects.

Table 1

Principles, criteria, indicators and reference values for assessing sustainability of Bulgarian farms

Principles	Criteria	Indicators	Reference values
1	2	3	4
Managerial aspect			
Acceptable governance efficiency	Efficiency for governing of activity in relation to other feasible organization	Comparative efficiency for supply and management of workforce	Similar to alternative organization
		Comparative efficiency for supply and management of natural resources	Similar to alternative organization
		Comparative efficiency for supply and management of material inputs	Similar to alternative organization
		Comparative efficiency for supply and management of innovations	Similar to alternative organization
		Comparative efficiency for marketing of products	Similar to alternative organization
		Comparative efficiency for supply and management of finance	Similar to alternative organization
Sufficient adaptability	Farm adaptability	Level of adaptability to market environment	Good
		Level of adaptability to institutional environment	Good
		Level of adaptability to natural environment	Good
Economic aspect			
High economic efficiency	Economic efficiency of resource utilization	Level of labor productivity	Similar to the average for the sector
		Land productivity	Similar to the average for the sector
		Livestock productivity	Similar to the average for the sector
	Economic efficiency of activity	Profitability of production	Similar to the average for the sector
		Farm Income	Acceptable by the owner
Good financial stability	Financial capability	Return on own capital	Average for the sector
		Overall Liquidity	Average for the sector
		Financial autonomy	Average for the sector
Social aspect			
Good social efficiency for farmer and farm households	Farmers welfare	Income per a member of farm household	Similar to other sectors in the region
		Satisfaction of activity	Acceptable for the farmer
	Working conditions	Compliance with formal requirements for working conditions	Standards for working conditions in the sector
Acceptable social efficiency for not farmers	Preservation of rural communities	The extent farm contributes to preservation of rural communities	Overall actual contribution
	Preservation of traditions	The extent farm contributes to preservation of traditions	Overall actual contribution
Ecological aspect			
Protection of agricultural lands	Chemical quality of soils	Soil organic content	Similar to the typical for the region
		Soil acidity	Similar to the average for the region
		Soil soltification	Similar to the average for the region

Continuation of Table 1

1	2	3	4
	Soil erosion	Extent of wind erosion	Similar to the typical for the region
		Extent of water erosion	Similar to the typical for the region
	Agro-technique	Crop rotation	Scientifically recommended for the region
		Number of livestock per ha	Within limits of acceptable number
		Rate of N fertilization	Within limits of acceptable amount
		Rate of K fertilization	Within limits of acceptable amount
		Rate of P fertilization	Within limits of acceptable amount
		Extent of application of Good Agricultural Practices	Approved rules
	Waste management	Manure storage type	Rules for manure storage
	Water irrigation	Irrigation rate	Scientifically recommended rate for the region
Protection of waters	Quality of surface waters	Nitrate content in surface waters	Similar to the average for the region
		Pesticide content in surface waters	Similar to the average for the region
	Quality of ground waters	Nitrate content in ground waters	Similar to the average for the region
		Pesticide content in ground waters	Similar to the average for the region
Protection of air	Air quality	Extent of air pollution	Acceptance from rural community
Protection of biodiversity	Variety of cultural species	Number of cultural species	Similar to the average for the region
	Variety of wild species	Number of wild species	Similar to the average for the region
Animal welfare	Norms for animal welfare	Extent of compliance with animal welfare norm	Standards for animal breeding
Preservation of ecosystem services	Quality of ecosystem service	Extent of preservation of ecosystem services	Acceptance from communities

Source: author.

Reference Values are the desirable levels (absolute, relative, qualitative, etc.) for each indicator for the specific conditions of the evaluated farms. They assist the assessment of the sustainability level and give guidance for achieving (maintaining, improving) sustainability of the holding. Reference Values are determined by the science, experimentation, statistical, legislative or other appropriate ways.

Farms sustainability assessment in Bulgaria is based on a survey with the managers of 190 “typical” farms of different juridical type, size, specialization and location type carried out in summer of 2016. The managers were asked to give estimates for each indicator in four qualitative levels: High, Good/Average, Low, Unsatisfactory/Unacceptable. The estimates are later quantified and transformed into Indexes using following scales: 1 for “High”, 0,66 for “Good or Average”, 0,33 for “Low”, and 0 for “Unsatisfactory or Unacceptable”.

For integral assessment of sustainability of a farm for each Criteria, Principle,

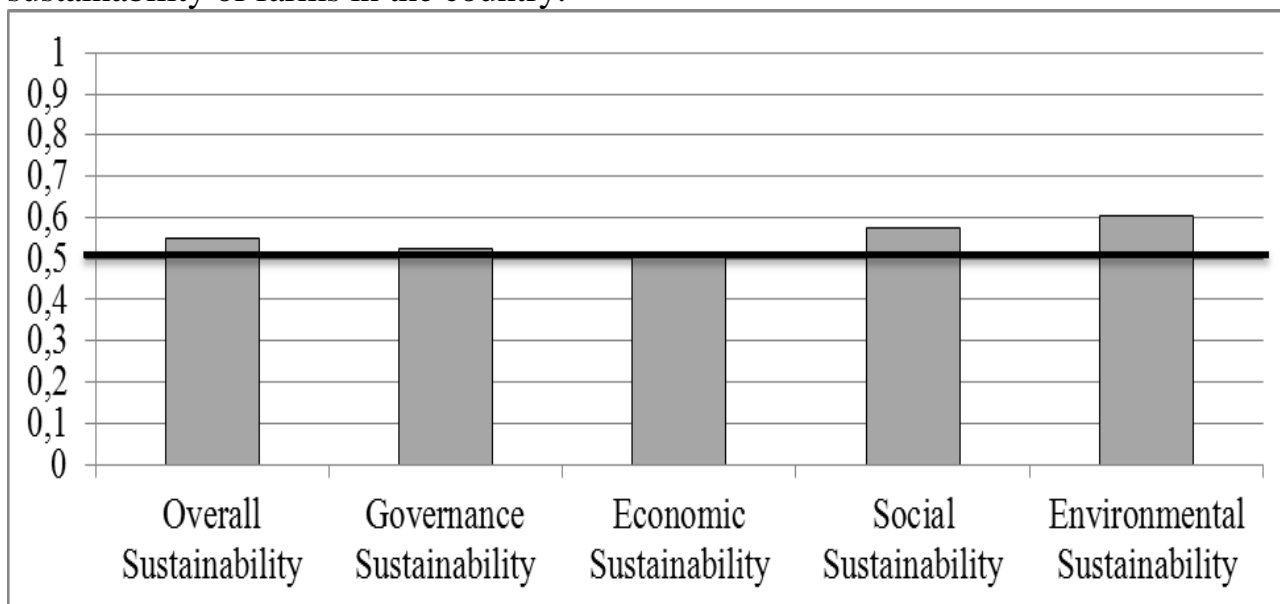
Aspect and Overall level equal weights are used for each Principle in a particular Aspect, and for each Criteria in a particular Principle, and for each Indicator in a particular Criteria. Individual Criteria ($SI_{(c)}$), Principle ($SI_{(p)}$), Aspect ($SI_{(a)}$), and Integral Sustainability Index ($SI_{(i)}$) are calculated by formulas:

$$\begin{aligned} SI_{(c)} &= \sum SI_{(i)} / n & n - \text{number of Indicators in a particular Criteria} \\ SI_{(p)} &= \sum SI_{(c)} / n & n - \text{number of Criteria in a particular Principle} \\ SI_{(a)} &= \sum SI_{(p)} / n & n - \text{number of Principles in a particular Aspect} \\ SI_{(i)} &= \sum SI_{(a)} / 4 \end{aligned}$$

For interpretation of quantitative levels following sustainability levels of farms are distinguished by Panel of experts: “High” – range between 0,84 and 1, “Good” – range between 0,5 to 0,82, “Low” – range 0,22 to 0,49, and “Non-sustainable” – between 0 and 0,2. The overall and particular (Aspect, Principle, Criterion, Indicator) sustainability of farms of a specific type and location is an arithmetic average of individual farms in that particular group.

Sustainability Levels of Bulgaria Farms

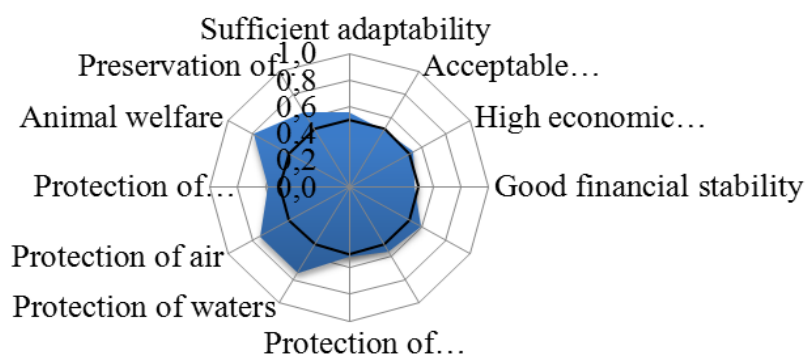
Multi-indicator assessment of the sustainability of Bulgarian farms demonstrates a *good* level (Fig. 2). Environmental and social sustainability of the holdings are highest, while governance and economic sustainability are at the border with the low level. Therefore, improvement of the later two is critical for maintaining the good sustainability of farms in the country.



Source: survey with farm managers, July 2016.

Fig. 2. Index of Sustainability of Bulgarian Farms

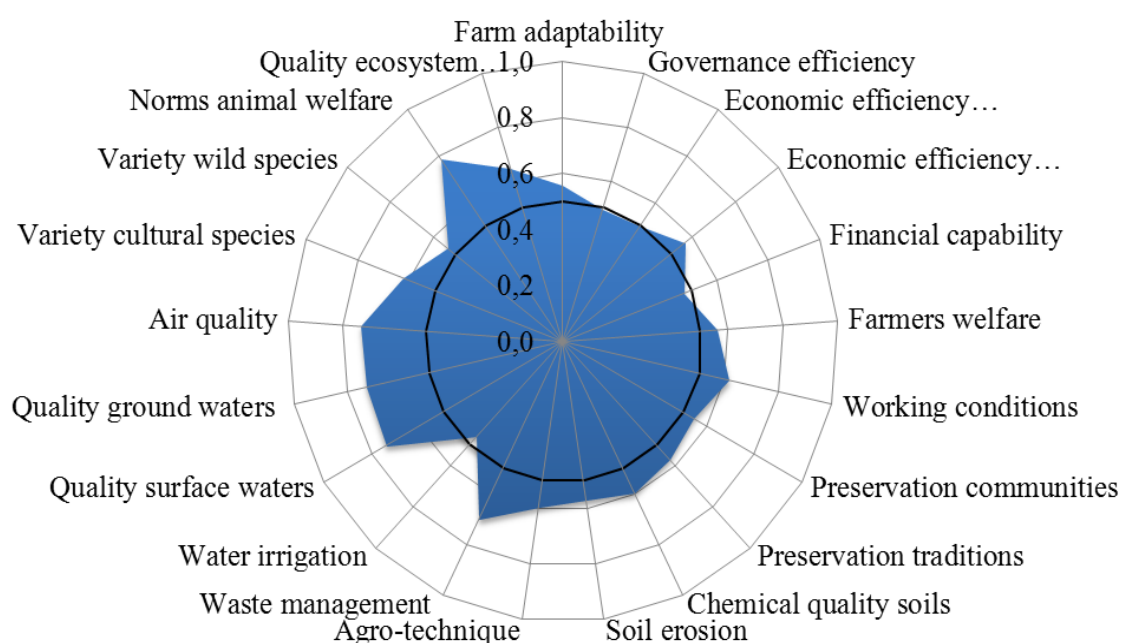
Analysis of sustainability levels for major principles, criteria and indicators let us identify components contributing to individual aspects of farms' sustainability. For instance, governance and economic sustainability of Bulgarian farms are low because of fact that Governance Efficiency and Financial Stability of holdings are low (Fig. 3). Similarly, it is clear that despite the overall environmental sustainability is relatively high, the Preservation of Agricultural Lands and of Biodiversity are relatively low and critical for maintaining the achieved level.



Source: survey with farm managers, July 2016.

Fig. 3. Index of Sustainability of Bulgarian Farms for Major Principles

In depth analysis for individual criteria and indicators allow to specify the elements, which enhance or reduce farms' sustainability level. For instance, low levels of the Comparative Governance Efficiency and Financial Capability (Fig. 4) are determined accordingly by low Comparative Efficiency of Supply of Short-term Inputs in relations to alternative organization, and unsatisfactory Profitability of Own Capital and Overall Liquidity of farms (Fig. 5). Similarly, low levels of the Preservation of Agricultural Lands and of Biodiversity are determined accordingly by the insufficient Application of Recommended Irrigation Norms, the high level of Soils Water Erosion, and lowered Number of Wild Animals on farm territory.



Source: survey with farm managers, July 2016.

Fig. 4. Level of Sustainability of Bulgarian Farms for Individual Criteria

Low levels of indicators also specify the specific areas for improvement of sustainability levels of farms through adequate change of management strategy and/or public policies for agrarian structures. For instance, despite that the overall Adaptability of Farms is relatively high, the Adaptability of Farms to Changes in Natural Environment (climate, extreme events, etc.) is relatively low. Therefore, measures are to be undertaken to improve that type of adaptability through education, training, information, amelioration of agro-techniques, structure of production and varieties, technological and organizational innovations, etc.

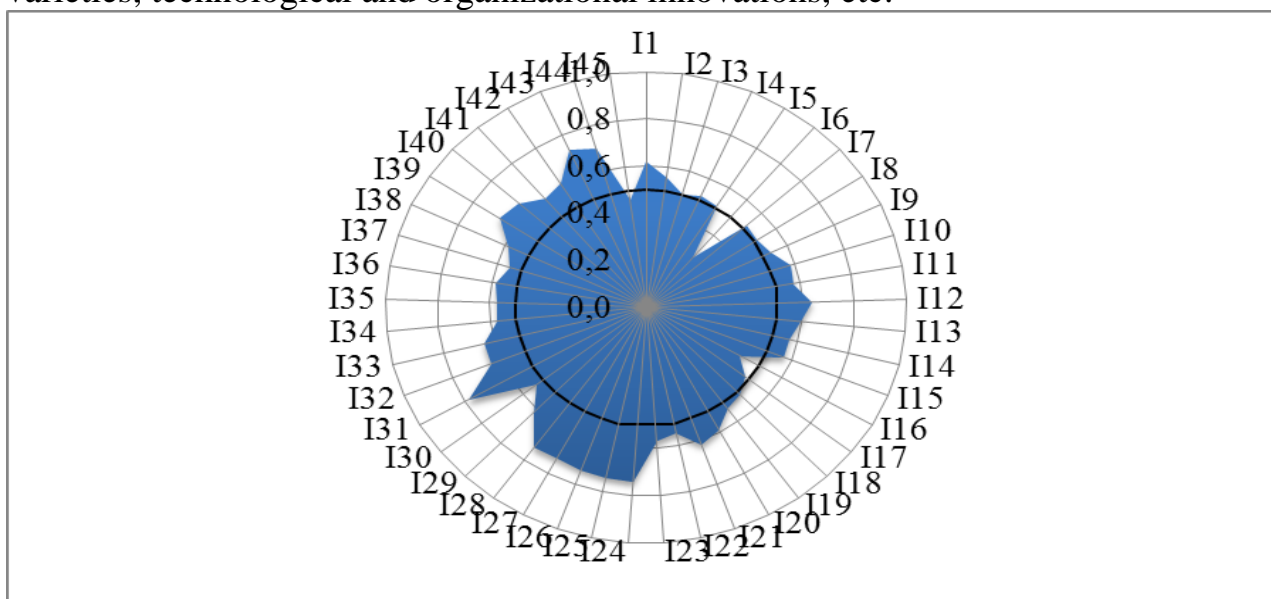


Fig. 5. Indicators of Assessing Sustainability of Bulgarian Farms*

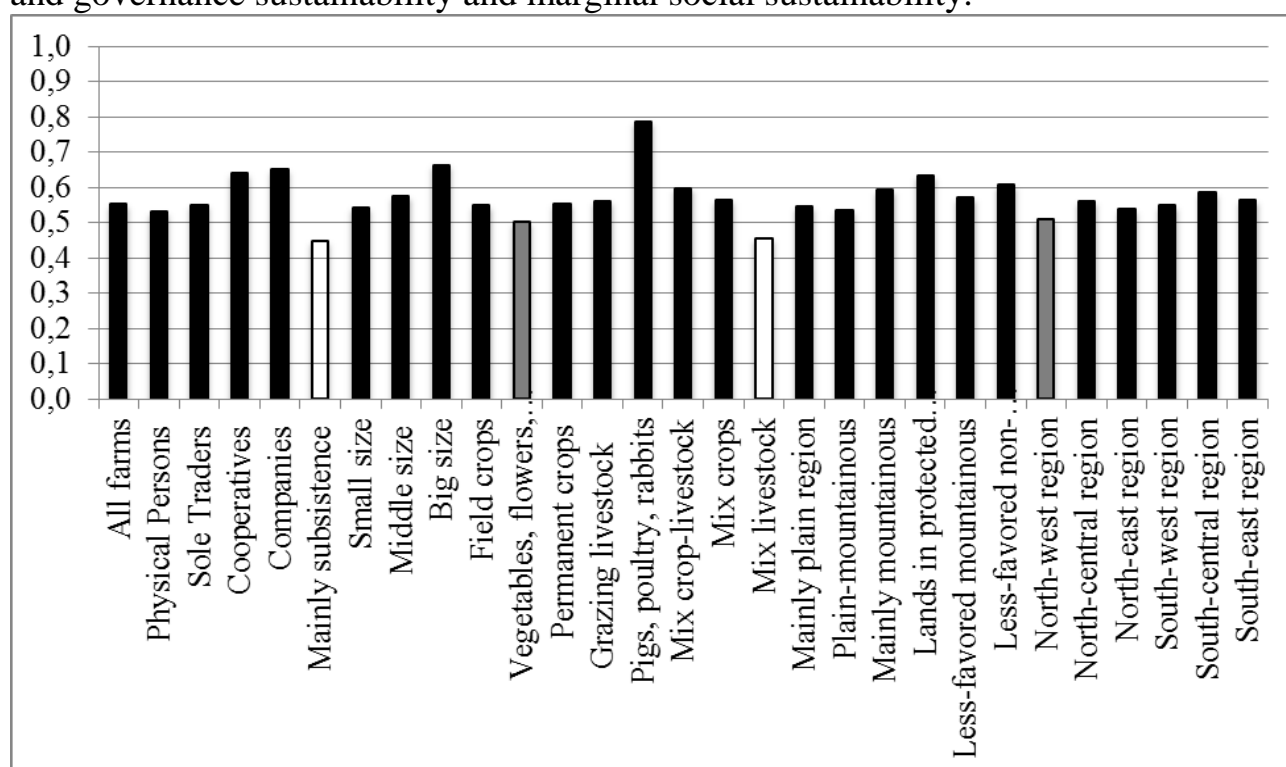
*I1-Level of Adaptability to Market Environment; I2-Level of Adaptability to Institutional Environment; I3-Level of Adaptability to Natural Environment; I4-Comparative Efficiency of Supply and Governance of Labor Resources; I5-Comparative Efficiency of Supply and Governance of Natural Recourses; I6-Comparative Efficiency of Supply and Governance of Short-term inputs; I7-Comparative Efficiency of Supply and Governance of Long-term Inputs; I8-Comparative Efficiency of Supply and Governance of Innovation; I9-Comparative Efficiency of Supply and Governance of Finance; I10-Comparative Efficiency of Governance of Marketing of Products and Services; I11-Land productivity; I12-Livestock Productivity; I13-Level of Labor productivity; I14-Rate of Profitability of Production; I15-Income of Enterprise; I16-Rate of Profitability of Own Capital; I-17-Overall Liquidity; I18-Financial Autonomy; I19-Income per Farm-household Member; I-20-Satisfaction of Activity; I21-Compliance with Working Conditions Standards; I22-Contribution to Preservation of Rural Communities; I23-Contribution to Preservation of Traditions; I24-Nitrate Content in Surface Waters; I25-Pesticide Content in Surface Waters; I26-Nitrate Content in Ground Waters; I27-Pesticide Content in Ground Waters; I28-Extent of Air Pollution; I-29-Number of Cultural Species; I30-Number of Wild Species; I31-Extent of Respecting Animal Welfare; I32-Extent of Preservation of Quality of Ecosystem Services; I33-Soil Organic Content; I34-Soil Acidity; I35-Soil Soltification; I36-Extent of Wind Erosion; I37-Extent of Water Erosion; I38-Crop Rotation; I39-Number of Livestock per ha of Farmland; I40-Norm of Nitrogen Fertilization; I41-Norm of Phosphorus Fertilization; I42-Norm of Potassium Fertilization; I43-Extent of Application of Good Agricultural Practices; I44-Type of Manure Storage; I45-Irrigation Rate.

Source: survey with farm managers, July 2016.

Superior levels of certain indicators show the absolute and comparative

advantages of Bulgarian farms related to sustainable development. At the current stage of development they are associated with the respecting Animal Welfare standards, Preservation of Quality of Surface and Ground Waters in respect of contamination with nitrates and pesticides, Preservation of Air Quality, implementation of Good Agricultural Practices, reduced Number of Livestock per unit of Farmland, acceptable Labor Conditions and comparative Satisfaction from Farming Activity, optimal Productivity of Livestock, good Adaptability to Market (prices, competition, demands), and Comparative Governance Efficiency of Marketing of Products,

There is a great variation in sustainability levels of farms of different type and location (Fig. 6). Only holdings Predominately for Subsistence and Mix Livestock are with low sustainability. Economics, governance, and social sustainability of first ones are particularly low (Fig. 7). The second group is with low economic, environmental and governance sustainability and marginal social sustainability.



Source: survey with farm managers, July 2016.

Fig. 6. Index of Sustainability of Bulgarian Farms of Different Type and Location

Another category of farms is with a good sustainability, but with levels on or close to the border with inferior (low) level. In the latter group are holdings specialized in Vegetables, Flowers and Mushrooms having a low governance and economic sustainability, and not a particularly good social and environmental sustainability. In that group are Physical Persons and farms located in Northwest region of the country. Former are with a low economic sustainability and a marginal social and governance sustainability. The latter are with a economic sustainability and not particularly good social, governance and environmental sustainability. For all

these farms measures have to be undertaken for improvement all aspects of sustainability.

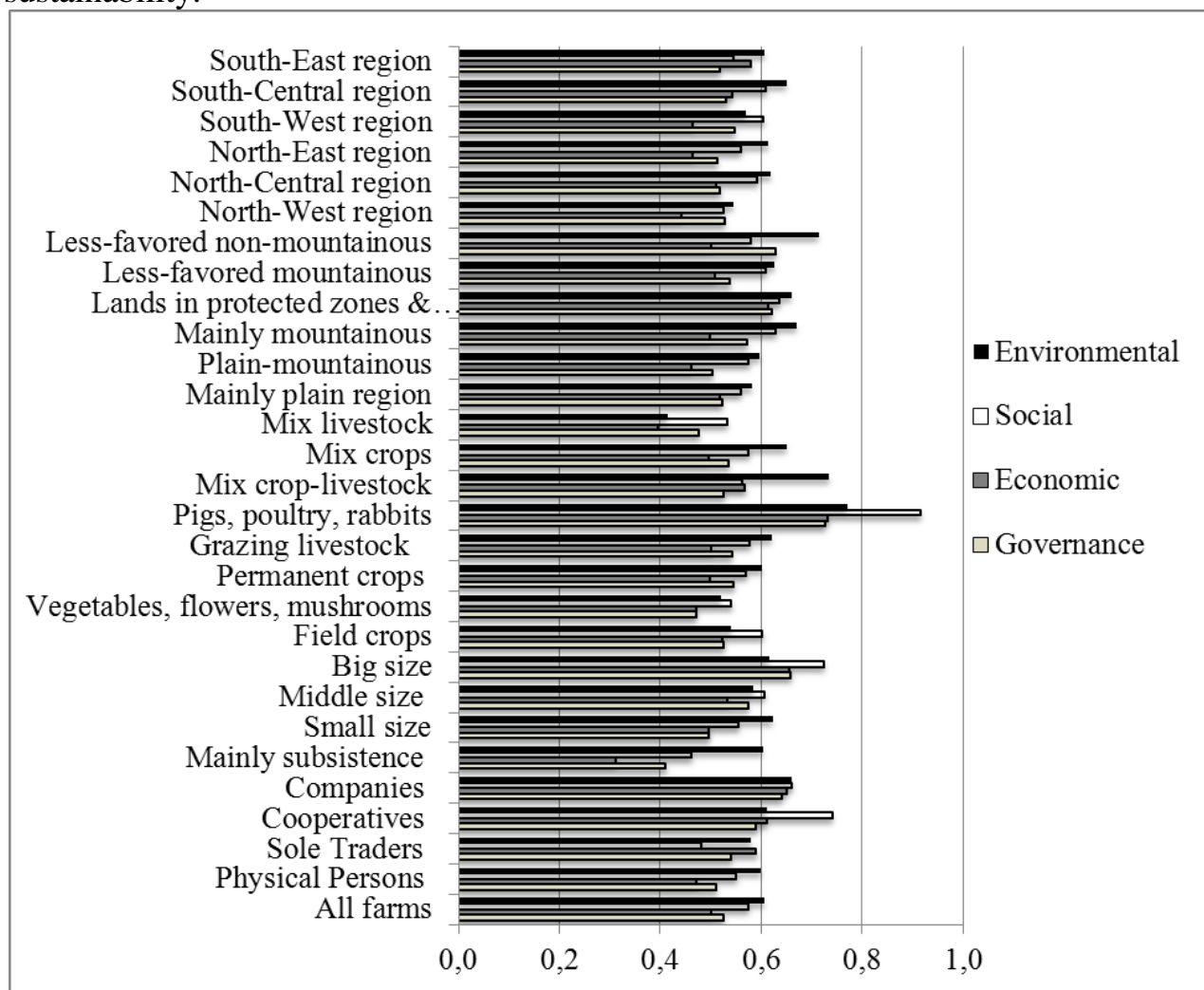


Fig. 7. Governance, Economic, Social and Environmental Sustainability of Bulgarian Farms

Source: survey with farm managers, July 2016.

With a low economic sustainability are also farms with Small size, specialized in Mix Crops and Permanent Crops, and those situated in Mountainous Regions, and in Northeast and Southwest regions of the country. Consequently, the overall sustainability of these farms is close to the border with the low level. For all these holdings measures are to be undertaken for increasing their economic sustainability in order to improve the overall level of long-term sustainability. With a low social sustainability are merely farms of Sole Traders, for which adequate measures are to be introduced for improvement of that aspect of their activity such as training, stimulation, regulation, support, etc.

With the best overall sustainability are Companies, Cooperatives and farms with Big size, all having high levels of governance, economic, social and environmental sustainability. Holdings specialized in Pigs, Poultry and Rabbits are with the highest sustainability, having very good levels for governance, economic and environmental aspects. Farms with Lands in Protected Zones and Territories, and those located in

Non-mountainous Regions with Handicaps and in South-Central region are with the superior levels of sustainability. Former group are with a high governance, economic, social and environmental sustainability. Holdings in Non-mountainous Regions with Handicaps and in South-Central region are with relatively good levels of certain aspects of sustainability – governance and environmental for the first ones, and environmental and social for the latter. The rest aspects of sustainability of all these farms are with relatively low levels – accordingly for the former ones economic and social sustainability, and for the latter governance and economic sustainability. Similarly, Mix Crop-livestock farms are with a relatively high environmental sustainability, but with a lower level of governance sustainability. The latter necessitates to undertake measures to improve sustainability in aspects with critical inferior levels for these types of farm.

Furthermore, there is a significant differentiation in the levels of sustainability indicators for farms of different juridical type, size, specialization and location. For instance, levels of sustainability indicators for farms of different juridical type are presented in Fig. 8.

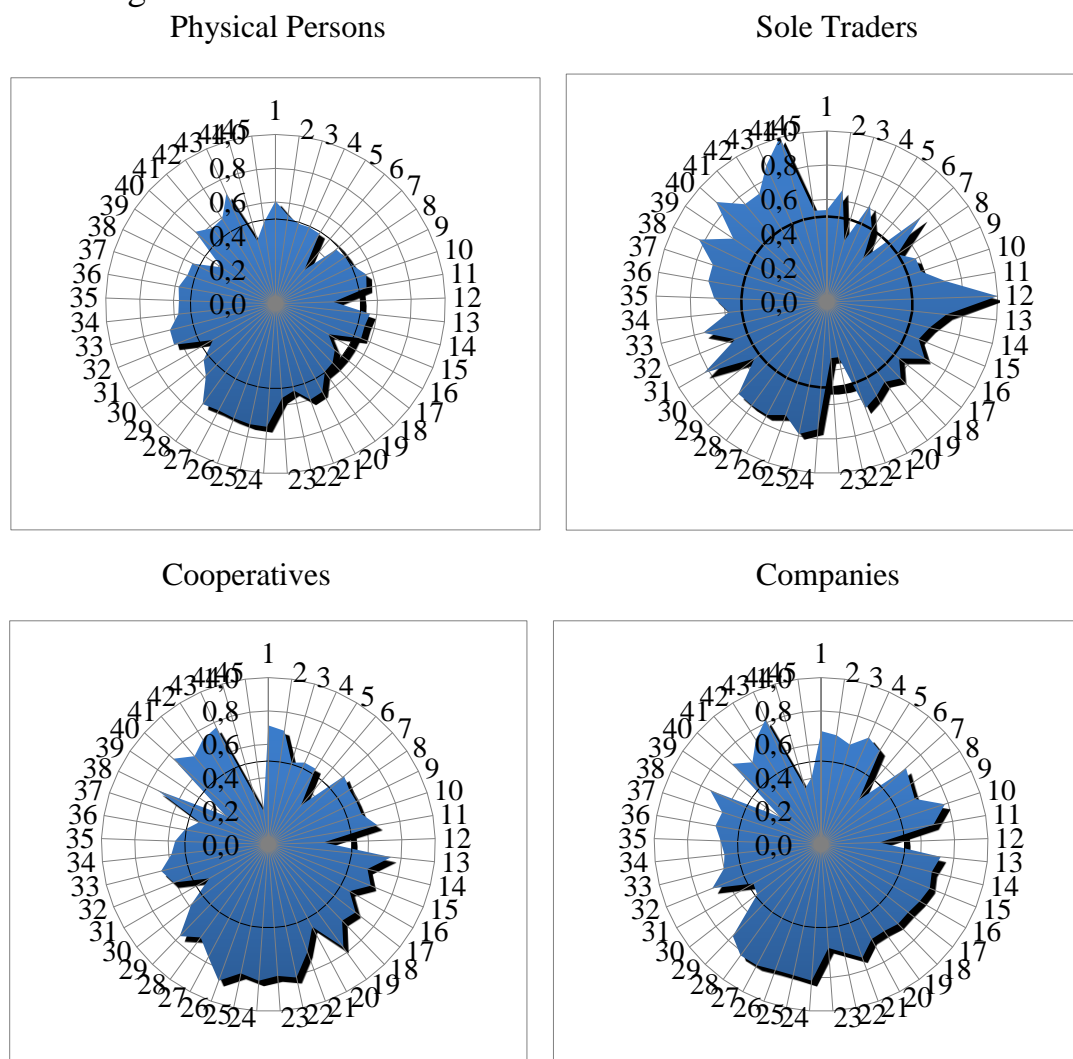


Fig. 8. Sustainability Indicators of Farms of Different Juridical Type in Bulgaria
 Source: survey with farm managers, July 2016.

Furthermore, assessment of sustainability of individual holdings indicates, that there is a great variation in the share of farms with different levels of sustainability. The biggest portion of Bulgarian farms is with a good sustainability and only an insignificant part is with superior sustainability (Fig. 9). At the same time, 30% of agricultural farms in the country are with low sustainability (26%) or unsustainable at all (4%).

The greatest share of farms with a good and high sustainability is among Companies, following by Cooperatives, and Sole Traders, while the smallest share among Physical Persons. More than a third of latter farms are with a low sustainability or unsustainable at all. Also every fourth of Sole Traders is with low sustainability, like 15% of Cooperatives, and merely 6% of Companies.

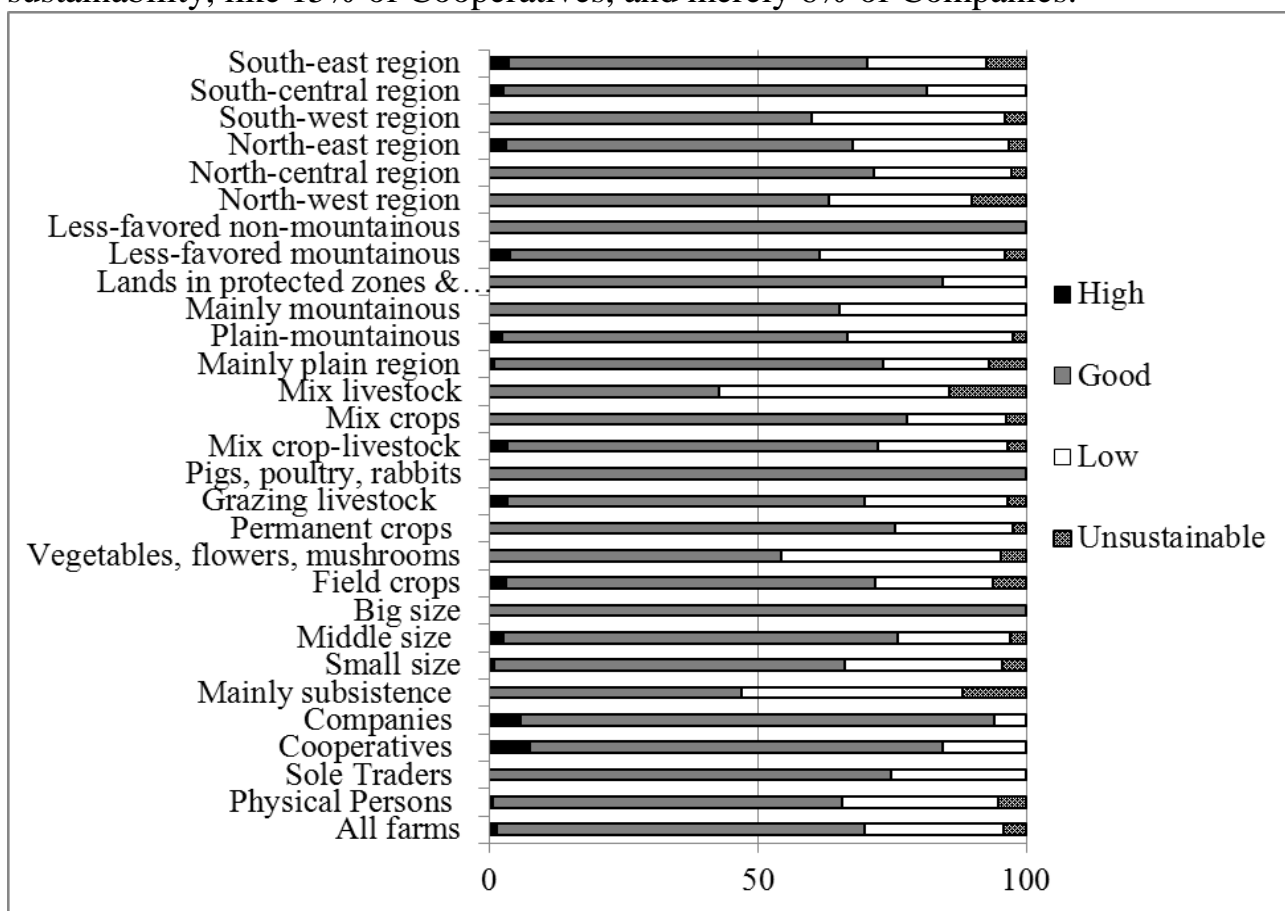


Fig. 9. Share of Bulgarian Farms with Different Levels of Integral Sustainability (percent)

Source: survey with farm managers, July 2016.

There are also considerable differences in the portion of holdings with unlike sustainability depending of farm size. While all farms with Big size are with a good sustainability, more than a half of holdings Predominately for Subsistence are with low sustainability or unsustainable. Around a third of farms with Small size and almost a quarter with Middle size are with low sustainability or unsustainable.

Among farms with diverse specialization, the share of holdings with a good and high sustainability is greatest for Pigs, Poultry and Rabbits, Mix-crops, Permanent Crops, Mix Crop-livestock, Field Crops, and Grazing Livestock. On the other hand,

majority of holdings in Mix-livestock are with a low sustainability or unsustainable. A good portion of the farms specialized in Vegetables, Flowers and Mushrooms is also low sustainable or unsustainable.

The share of farms with a good and high sustainability is significant among those located in Non-mountainous Regions with Handicaps, With Lands in Protected Zones and Territories, in Plain Regions, in South-Central, North-Central, and South-East regions of the country. Simultaneously, 40% of holdings in South-West region with low sustainability or unsustainable, similar to 37% in North-West and 32% in North-East region. North-West region is the leader in segment of unsustainable farms, where every tenth is unsustainable. Many farms in Mountainous Regions with Handicaps and Mountainous Regions, and a third in Plain-mountainous Regions are low sustainable or unsustainable.

Data for dispersion of farms of different type in groups with diverse level of sustainability has to be taken into account when forecast the number and importance of holdings of each kind, and modernize public (structural, sectorial, regional, environmental etc.) policies for supporting agricultural producers of certain type, sub-sectors, eco-systems and regions of the country.

Analysis of structure of farms with different level for each sustainability aspects gives an important information about the long-term sustainability of farms and factors for its improvement. Our assessment shows that 40% of holdings in the country are with a low governance sustainability (35%) or managerially unsustainable (5%). That means that comparative governance efficiency for supply of labor, land, finance, etc. and/or marketing of produce in these farms is lower than other feasible organization, and adaptability to evolving socio-economic, institutional and natural environment is insufficient. At the same time, 42% of all farms are with a low economic sustainability (34%) or unsustainable at all (8%). That means that economic and financial efficiency of activity and resource utilization in a good portion of Bulgarian farms is low and do not correspond to modern management and competition requirements.

The share of farms with a good and high governance sustainability is the biggest among Companies (94%) and Cooperatives (77%), holdings with Big (89%) and Middle (75%) size, specialized in Pigs, Poultry and Rabbits (100%), Permanent Crops (63%), Mix Crops (63%), Field Crops (63%) and Mix Crop-Livestock (62%), and those located win Non-mountainous Regions with Handicaps (100%), with Lands in Protected Zones and Territories (77%), Plain Regions (63%), Mountainous Regions with Handicaps (62%), and in North-Central (67%), South-East (63%), North-West (60%) and South-West (60%) regions of the country. The greatest portion of farms with a low or absence of governance sustainability are among Sole Traders (50%) and Physical Persons (45%), holdings Predominately for subsistence (65%) and Small size (49%), specialized in Vegetables, Flowers and Mushrooms (50%), and located in Plain-mountainous Regions (48%), and in North-East (45%) and South-Central (45%) regions. Thus, a significant part of Bulgarian farms are with insufficient governance sustainability for meeting contemporary socio-economic,

institutional and natural challenges, and they have to modernize or will cease to exist in middle term.

The section of farms with a good and high economic sustainability is the biggest among Companies, (88%), Cooperatives (85%), and Sole Traders (62%). A considerable portion of firms is with a high economic sustainability (18% of Companies and 12% of Sole Traders), and all farms with Big size are with a good economic sustainability. All these prove the comparative economic advantages of registered and large holdings. The share of farms with a good and high economic sustainability is also significant for holdings with Middle size (66%), specialized in Pigs, Poultry and Rabbits (100%), Crop-Livestock (66%), Field Crops (59%), Mix-Crops (59%), and Permanent Crops (59%), and those with Lands in Protected Zones and Territories (77%), in Plain Regions (63%) and Mountainous Regions with Handicaps (62%), and in South-East (78%), South-Central (66%) and North-Central (62%) regions of the country.

The greatest portion of holdings with a low or none of economic sustainability is among Physical Persons (48%), most farms Predominately for Subsistency (88%), and among specialized in Mix-Livestock (57%), Grazing Livestock (47%), and Vegetables, Flowers and Mushrooms (45%), and located in Mountainous (54%) and Plain-mountainous (45%) regions, and North-East (58%) and South-West (52%) regions of the country. A significant portion of all these groups of holdings are economically unsustainable, which concerns almost every tenth of Physical Person, 29% of farms with Mix-livestock, each fifth one North-West region and 12% in South-West region, 18% of holdings Predominately for Subsistence, 9% of farms specialized in Vegetables, Flowers, and Mushrooms, 9% of Small farms, and 7% of those located in Plain-mountainous regions. That indicates that a considerable fraction of Bulgarian farms are currently with inferior economic sustainability or economically unsustainable, and most likely will cease to exist in near future unless effective measures are taken (public support, regulations, etc.) for amelioration of their economic sustainability.

As far as social aspect is concerned the majority of farms (77%) are with a good (71%) or high (6%) sustainability. Despite that holdings with a low social sustainability are numerous (18%), and each tenth one is socially unsustainable. That means, that the social efficiency of holdings for farmers, communities and society does not correspond to modern demands and standards.

A good portion of Cooperatives is with a good sustainability (77%), and the rest part (23%) is highly socially sustainable. The share of Companies with a good (82%) and high (12%) social sustainability is enormous, and only 6% are low sustainable in social respect. A significant part of Physical Persons is with a good (70%) or high (4%) social sustainability. Nevertheless, more than a quarter of these holdings are with a low sustainability (20%) or unsustainable (7%) in social term. With the greatest portion of low sustainable in social aspect are Sole Traders – 38% of total number.

The level of social sustainability increases along with the size of holdings. Each

third farm with Big size is with a high social sustainability, and another major part are with a good social sustainability (56%), while the share of low socially sustainable is 11%. Among Middle size holdings dominates fraction with a good (72%) and high social sustainability, while almost every fifth one is with low social sustainability (15%) or unsustainable at all (4%). With the greatest share (35%) of low sustainable or unsustainable in social respect are holdings Predominately for Subsistence (including 18% social unsustainable) and every forth farm with Small size (4% socially unsustainable). In groups with different product specialization, the biggest portion of farms with a good or high social sustainability is in Pigs, Poultry and Rabbits, Field Corps and Mix-crops. On the other hand, 37% of holdings specialized in Vegetables, Flowers and Mushrooms are with a low social sustainability (32%) or socially unsustainable (5%), followed by farms in Mix-livestock where 29% are with inferior level of social sustainability (including 14% socially unsustainable).

The farms with a good and high social sustainability are located in Mountainous regions and in Protected Zones and Territories, in Southwest, South-Central and North-Central regions. The most numerous are socially low sustainable or unsustainable holdings in Plain (accordingly 21% and 8%) and in Plain-mountainous (19% and 5%) regions, in North-West (23% and 10%), South-East (22% and 7%) and North-East (26% and 3%) regions. These data show, that a good portion of Bulgarian farms currently are with a low social sustainability or socially unsustainable, which compromises their overall middle and long-term sustainability. Therefore, measures have to be undertaken to improve income, labor and living conditions of farmers and farm households as well as their importance for preservation of rural communities and traditions.

Environmental sustainability of the majority of Bulgarian farms is good (69%) or superior (9%), while a considerable portion is with a low sustainability (18%) or environmentally unsustainable (4%). These figures clarify that eco-efficiency in a large number of farms do not meet contemporary norms and standards for preservation of lands, waters, air, biodiversity, ecosystem services, and animal welfare. A great potion of Companies (18%) and a good part of Physical Person (9%) and Cooperatives (8%) are with a high environmental sustainability, while the majority of holdings in these groups are with a good eco-effectiveness (59%, 68% and 69% accordingly). Despite that a main fraction of above farms are with a low eco-sustainability (24%, 18% and 23% accordingly), as every twentieth of Physical Parsons is environmentally unsustainable. The biggest is the share of farms with a good and high eco-sustainability among Predominately for Subsistency (76% and 12% accordingly), with Small size (71% and 10%), and Big farms (67% and 11%). The greatest portion of holdings with low or unacceptable eco-effectiveness is for Middle (27%) and Big (22%) size groups.

The share of farms with a strong environmental sustainability is significant for holdings specialized in Crops-Livestock (21%), Grazing Livestock (17%), Mix-crops (11%) and Permanent Crops (7%). All farms specialized in Pigs, Poultry and Rabbits,

the majority in Mix-crops (81%), and by three-quarters in Crops-livestock and Permanent Crops are with a good environmental sustainability. At the same time, a considerable part of farms specialized in Vegetables, Flowers and Mushrooms is with a low eco-sustainability (32%) or ecologically unsustainable (14%), similarly to these in Mix-livestock (correspondingly 29% and 14%) and Field Crops (31% and 3%). For farms specialized in Permanent Crops is also considerable portion of environmentally unsustainable holdings (7%), while for those with Grazing Livestock for low sustainable in environmental respect units.

All farms located in Non-mountainous Regions with Handicaps are with a good environmental sustainability as well as the majority of those with Lands in Protected Zones and Territories (93%). Most holdings with a high eco-sustainability are in Plain-mountainous (12%) and Mountainous (12%) regions of the country, and a major part of those situated in Mountainous Regions and Mountainous Regions with Handicaps (each 77%). At the same time, the biggest fraction of holdings with a low eco-sustainability or environmentally unsustainable are in Plain-Mountainous (26%) and Plain (25%) regions, and in Mountainous Regions with Handicaps (19%). The greatest share of farms with a high and good sustainability are in North-Central (3% and 87%) and South-Central (18% and 63%) regions, while with a low eco-sustainability or environmentally unsustainable in South-West (28% and 4%), North-West (17% and 10%), South-East (26% and 0%), and North-East (23% and 3%) regions. That indicates, that a good number of Bulgarian farms are with a low eco-sustainability or environmentally unsustainable, which also compromises their overall long-term sustainability. Therefore, measures have to be undertaken for improving the eco-efficiency in these groups of farms through training, informing, stimulation, sanctions, etc.

Conclusions. Application of our holistic framework gives a possibility for assessing, analyzing and improvement of farms' sustainability level and it has to be further discussed, experimented, improved and adapted to specific conditions of functioning and evolution of farms, and the specific needs of decision-makers in different levels.

Our initial assessment on farm sustainability in Bulgaria has found out that the overall sustainability of Bulgarian farms is at a good level, with superior levels for environmental and social sustainability, and close to the border with the low level for governance and economic sustainability. With the best sustainability are Companies, Cooperatives, and farms with Big size, holdings specialized Pigs, Poultry and Rabbits, with Lands in Protected Zones and Territories, and these located in Non-mountainous Regions with Handicaps, and in South-Central region, while holdings which are Predominately for Subsistency and with Mix-livestock specialization are with a low sustainability. Furthermore, there is a great variation in the share of farms with different levels of sustainability as each forth one is with a low sustainability and 4% unsustainable at all.

Having in mind the importance of farms' sustainability assessments, such calculations have to be expended and their precision and representation increased.

The latter requires a closer cooperation of all related parties and involvement of farmers, agrarian organizations, local and state authorities, interest groups, research institutes and experts. What is more, the precision of evaluations has to be improved, and in addition to assessments of farms managers they are to be based on other adequate information from field studies and tests, statistical, etc. data, and expertise of specialists in the area.

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