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ECO-SYSTEM APPROACH FOR ASSESSING AGRARIAN SUSTAINABILITY IN BULGARIA

Ecosystem approach has been increasingly incorporated in the management and evaluation of sustainability levels in general and in agriculture in particular. Despite enormous progress in the theory and practice of this new area, still there is no consensus on how to assess the sustainability of agro-ecosystems due to diverse understandings, approaches, methods, employed data, etc. In Bulgaria there are practically no in-depth studies on sustainability level of diverse agro-eco-systems. This articles assesses the sustainability level of agro-ecosystems of different type in Bulgaria. A holistic hierarchical framework for assessing integral, economic, social and ecological sustainability of agro-ecosystems is suggested including 17 principles, 35 criteria, and 46 indicators and reference values. Assessment is made on overall and aspects sustainability of large (agro)ecosystems in four geographic regions, and particular main and specific types of agro-ecosystems of the country. The assessment is based on first-hand information collected though in-depth interviews with the managers of "typical" farms in the respective ago-ecosystems. The study has found out that there is a considerable differentiation in the level of integral sustainability in agricultural ecosystems of different types. There are also substantial variations in the levels of economic, social and ecological sustainability of agro-ecosystems of different type, and the critical indicators enhancing or deterring overall and particular sustainability of individual agro-ecosystems. Results of the integral agrarian sustainability level based on the micro agro-ecosystem (farm) data, are similar to the previous assessment based on the aggregate sectoral (statistical, etc.) data. Having in mind the importance of holistic assessments of this kind for improving agrarian sustainability, farm management and agrarian policies, they are to be expended and their precision and representation increased.

Key words: agro-ecosystem, sustainability, assessment, economic, social, ecological, Bulgaria.

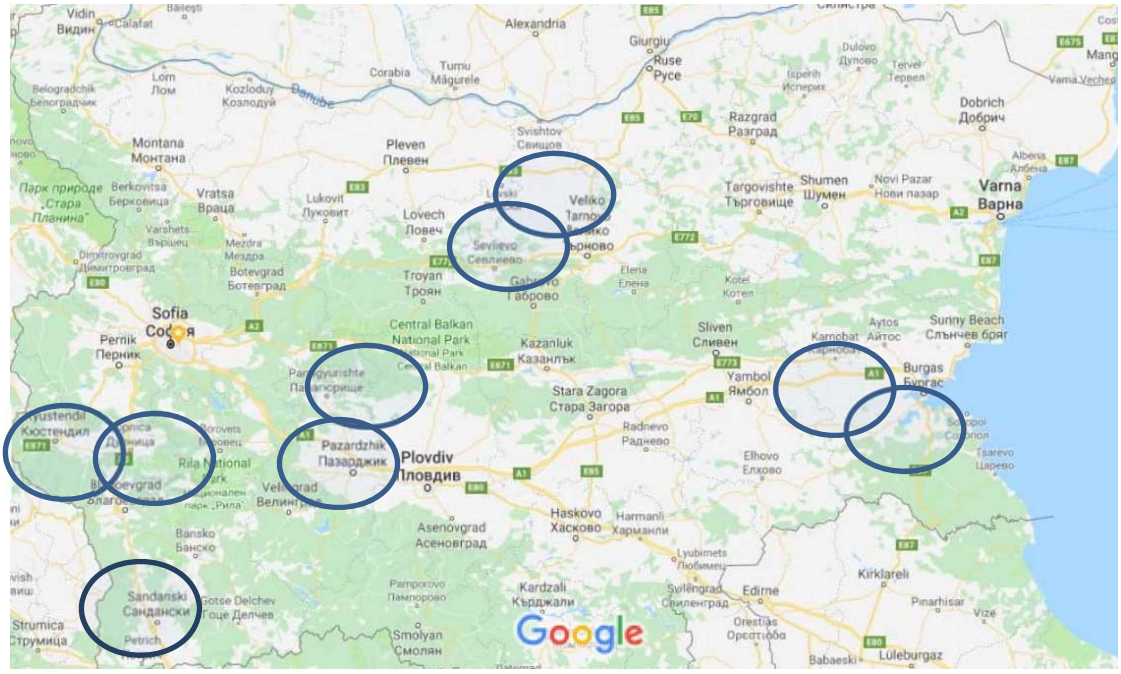
Introduction. Agro-ecosystems are ecosystems associated with agricultural (farming) activity and according to their specific characteristics and levels of analysis, the boundaries of an individual agro-ecosystem could be a part of a separate farm (e.g. a cultivated parcel, a meadow, a pond), located in numerous farms, or most commonly cover a larger region(s) of a country or beyond. Moreover, the individual agro-ecosystem could include, be a part, or overlap with other ecosystems – dryland, mountain, coastal, urban, etc. In recent years an "ecosystem approach" has been increasingly incorporated in the management and evaluation of sustainability levels (Bachev and Treziev, 2017, 2018; Belcher, 1999; Bohlen and House, 2009; Hanna et. al., 2016; MEA, 2005; De Oliveira, 2018; Ramírez-Carrillo et. al., 2018; Oelbermann, 2014; Sidle et al. 2013). Despite enormous progress in the theory and practice of this new evolving area, still there is no consensus on how to assess the sustainability of agro-ecosystems due to diverse understandings, approaches, methods, employed data, etc. (Bachev, 2009, 2010, 2016, 2017, 2018; Bachev et. al., 2016, 2017; Candido et al., 2018; FAO, 2013; Fuentes 2004; Hayati et. al., 2010; Ikerd, 2015; Ivanov et al, 2009; Gliessman, 2016; Gemesi, 2007; Gitau et al., 2009; Jalilian, 2012; Irvin et. al., 2016; Lopez-Ridauira et. al. 2002; Rezear et. al, 2018; Sauvenier et al., 2005; Terziev et al., 2018; Todorova and Treziyska, 2018; VanLoon et al. 2005; Zvyatkova and Sarov, 2018). In Bulgaria comprehensive sustainability assessments are mostly on sectoral (Bachev et. al., 2017) or farm (Bachev, 2017; Bachev and Treziev, 2017) levels while there is practically no in-depth study on sustainability agro-ecosystems. The goal of this paper is to assess the sustainability level of agro-ecosystems of different type in Bulgaria.

Framework of analysis. In order to assess sustainability level of agro-ecosystems in Bulgaria a hierarchical system is developed including 17 principles, 35 criteria, and 46 indicators and reference values. Principles are the highest hierarchical level associated with the "universal" functions of agricultural system and represent the state of sustainability in 3 main pillars (aspects) of sustainability – economic, social, and ecological. Criteria represent a resultant state when the relevant principle is realized. Indicators are quantitative and qualitative variables of different types (behavior, activity, input, effect, impact), which can be assessed allowing the measurement of compliance with particular criteria. Reference Values are the desirable levels (absolute, relative, qualitative) for each indicator according to the specific conditions of each agro-ecosystem which assist the assessment giving guidance for achieving (maintaining, improving) sustainability.

We have examined the available academic research, official documents, and experience in Bulgaria and other countries, and have carried out numerous consultations with leading national and international experts in the area. On this basis, a system that includes principles, criteria, indicators, and reference values relevant to contemporary conditions in Bulgaria has been formulated. An expert panel was set up with ten leading experts in the country discussed and evaluated the importance of the proposed principles, criteria, indicators, and reference values, and selected most appropriate to the contemporary conditions in Bulgaria. A number of criteria were used in selecting indicators: relevance to reflecting aspects of sustainability; discriminatory power in time and space; analytical soundness; intelligibility and synonymy; measurability, governance and policy relevance; and practical applicability (Sauvenier et al., 2005).

In Bulgaria, like in most countries, there are no official data for calculating socio-economic and (some parts of) ecological indicators at agro-ecosystem level. Agro-ecosystems are the ecosystems associated with the farming activity and the individual farm is the first level for governing of agrarian sustainability (Bachev, 2018). In order to assess the level of sustainability of agro-ecosystems in the country in-depth interviews with the managers of 80 farms of different types and locations in 4 major regions of Bulgaria were held in 2017. Following criteria were used for the selection of areas for farm surveys (map. 1): major administrative and geographic regions – Eastern, Northern, Western and Southern Bulgaria respectively North-Central, South-Eastern, South-Central and South-Western administrative and geographic regions of the country representing distinctive large (agro)ecosystems; particular

main types and specific (agro) ecosystems in the country – mountainous, plain-mountainous, plain, riparian (Struma, Maritza, Yantra), southern Black Sea, mountainous area with natural constraints, non-mountainous area with natural constraints, protected areas and reserves, Western Thracian Plain, Middle Danube Plain, Dupnitsa and Sandansko-Petrich Valley, Sredna Gora Mountains and Western Rila Mountains.



Map 1. Map of Bulgaria and surveyed agro-ecosystems

Source: Google maps.

In order to identify the "typical" for the different regions of the country farms, the co-operation of the main associations of farmers (National Association of Grain Producers, National Union of Gardeners, Union of Breeders, etc.), state agencies (National Agricultural Advisory Service, Executive Agency for Vine and Wine, etc.), processing, bio-certification and service organizations, and local government is used. Farmers of different types were surveyed covering the main types of farms in the regions concerned: different legal types of holdings – natural persons, sole traders, cooperatives, commercial companies, etc.; farms of different sizes – mainly for self-sufficiency, with small size for the sector, with average size for the sector, with large sizes for the sector; farms in different production specialization – arable crops, vegetables, flowers and mushrooms, perennials, grazing livestock, pigs, poultry and rabbits, mixed crops and mixed livestock breeding; farms in specific geographic and ecological locations. From farms originally identified for interviews only 5,61 % were not interviewed due to the extreme occupancy, unwillingness to participate or other reasons. The survey includes many questions in 5 major areas: general characteristic of farms; primary information for calculating economic indicators for agrarian sustainability at agro-eco-system level; primary information for calculating social indicators for agrarian sustainability at agro-eco-system level; primary information for calculating environmental indicators for agrarian sustainability at agro-eco-system level; impact of diverse socio-economic, policies, behavioral, personal, etc. factors on farmers actions for improving agrarian sustainability and its various aspects.

After that diverse quantitative and qualitative levels for each indicator are transformed into a unitless index of sustainability (ISi). After than the integral index for a particular criterion (SI(c)), principle (SI(p)), and aspect of sustainability (SI(a)), and the integral sustainability index (SI(o)) for each surveyed farm is calculated applying equal weight for each indicator in a particular criterion, of each criterion in a particular principle, and each principle in every aspect of sustainability. The composite sustainability index of a particular agri-ecosystem is an arithmetic average of the indices of relevant farms belonging to that agro-ecosystem.

For assessing the level of sustainability of agro-ecosystems the following scale defined by the experts is used: Index range 0,85–1 for a high level of sustainability; Index range 0.50–0,84 for a good level of sustainability; Index range 0,25–0,49 for a satisfactory level of sustainability; Index range 0,12–0,24 for an unsatisfactory level of sustainability; Index range 0–0,11 for non-sustainable.

Overall sustainability level of analyzed agri-ecosystems

The multi-indicator assessment of agricultural sustainability level in the four analyzed regions shows that the integral indicator of overall sustainability is 0,58, which expresses a good sustainability level of agriculture (fig. 1). The biggest value has the indicator of economic sustainability (0,64), the social sustainability shows lower value (0,57) and the ecological sustainability is close to the unsatisfying value level (0,53). Therefore, the improvement of the last two indicators is critical for maintaining the good agricultural sustainability of the country.

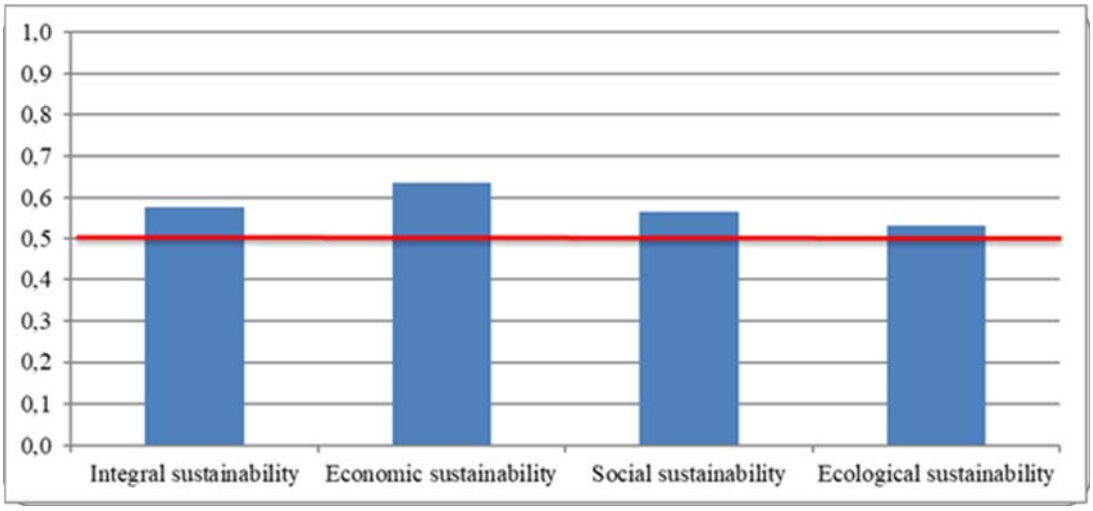


Fig. 1. Indicators of integral, economic, social and ecological sustainability of analyzed agri-ecosystems in Bulgaria

Source: survey with managers of farms, 2017 and author's calculations.

The analysis of private indexes on basic principles, criteria and indicators of the sustainability gives opportunity to identify components contributing for the levels of different aspects of agricultural sustainability in the country. The assessment ascertained that the ecological sustainability is relatively low due to the fact that the indicators for the principles "land quality" (0,44), "biodiversity" (0,38) and "organic production" (0,11) are low (fig. 2). Thus, the improvement of these low levels of above-mentioned principles is a factor for maintenance and raising of ecological and integral sustainability in the sector. Also it becomes clear that despite the relatively high integral economic sustainability, the indicator of adaptability to economic environment is relatively low (0,54) and critical for maintaining the reached level. Analogically, for the social sustainability improvement would contribute mostly the increase of low levels of indicators for the principles "farming conservation" (0,52), "gender equality" (0,40) and "social capital" (0,17).

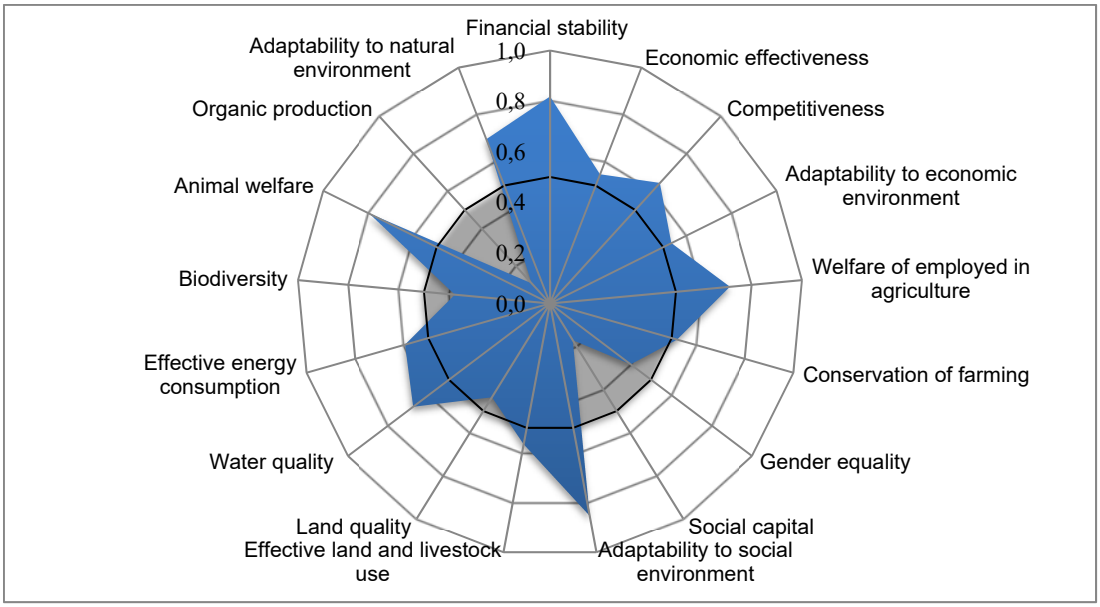
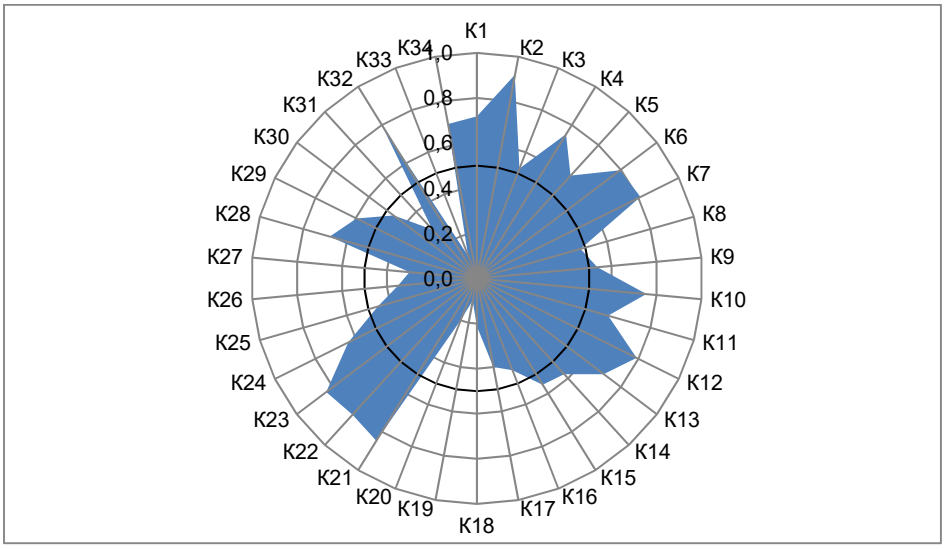


Fig. 2. Sustainability index according the main sustainability principles in analyzed agri-ecosystems in Bulgaria

Source: survey with managers of farms, 2017 and author's calculations.

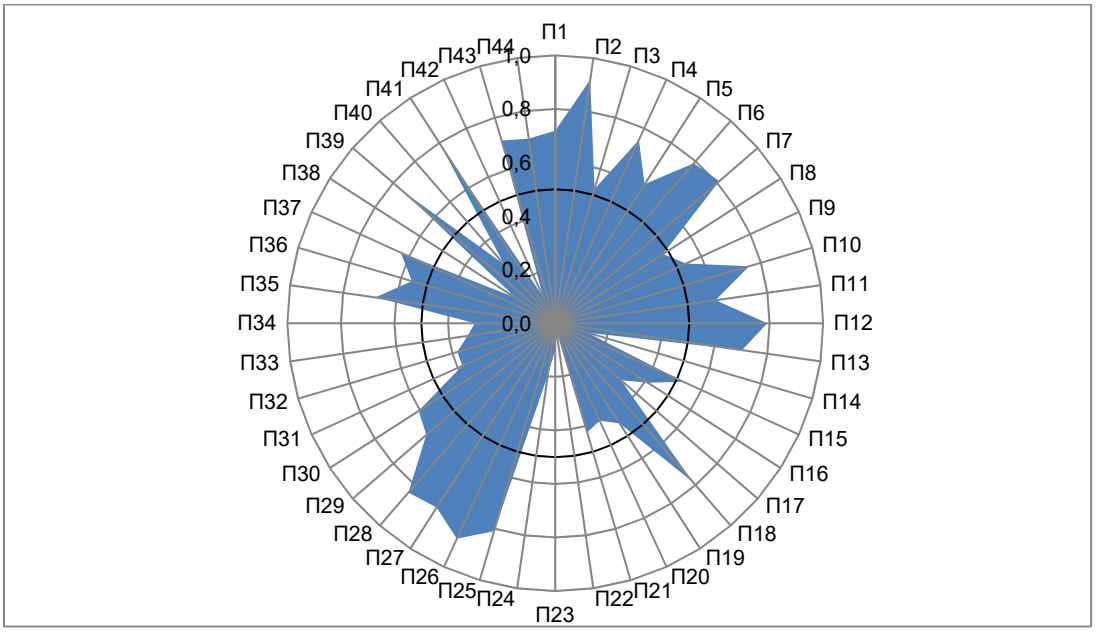
The profound analysis according different criteria and indicators gives opportunity for detailed analysis of elements contributing for/or decrease the agricultural sustainability level. For example, the low levels of ecological sustainability are determined from the low criteria "conservation and improving of soil fertility" (0,46); "balanced land use structure maintenance" (0,35; "landscape elements conservation" (0,30); "natural biodiversity maintenance and improvement" (0,46); "cultural biodiversity maintenance and improvement" (0,29) and "organic production increase" (0,11) (fig. 3). The unsatisfying levels according these criteria for ecological sustainability are (pre)determined of low levels of indicators for eco-sustainability, as: insufficient conformity of norms for fertilization with potassium (0,38) and phosphorus (0,38), high share of arable land in the total agricultural land (0,33), low degree of compliance with practices for landscape conservation (0,3), insufficient protected species on farms' territory (0,18), limited number of cultural species in farms (0,29) and low degree of application of organic production principles (0,11) (fig. 4).



* К1-Decrease of dependence on subsidies; К2-Minimization of dependence on exterior capital; К3-Positive or high profitability; К4-Maximal or increasing labour productivity; К5-Maximal or increasing land productivity; К6-Maximal or increasing livestock productivity; К7-Conservation or increase of sold output share ; К8-Conservation or increase of sales; К9-High investment activity; К10-Incomes parity with other sectors; К11-Equitable distribution of income in agriculture; К12-Sufficient satisfaction of farmer activity; К13-Satisfying labour conditions; К14-Keeping the number of family farms; К15-Knowledge and skills increase; К16-Conservation and improvement of agricultural education; К17-Equality of relations man-woman; К18-Participation in professional organizations and initiatives; К19-Participation in public management; К20-Contribution for the development of region and communities; К21-Sufficient potential for reaction to activity cession and to demographic crisis; К22-Keeping or increase of UAA size; К23-Keeping or increase of livestock number; К24-Minimization of soil losses; К25-Keeping and improvement of soil fertility; К26-Keeping of balanced land-use structure; К27-Protection of landscape elements; К28-Keeping and improvement of water quality; К29-Minimization of conventional energy use; К30-Keeping and improvement of natural biodiversity; К31-Keeping and improvement of cultural biodiversity; К32-Implementation of principles of animal welfare; К33-Organic production increase; К34-Sufficient adaptability to climatic changes.

Fig. 3. Sustainability index according the main criteria* in analyzed agri-ecosystems in Bulgaria

Source: survey with managers of farms, 2017 and author's calculations.



*П1-Direct payments in the net income; П2-Share of own capital in the total one; П3-Profit/production costs; П4-Labour productivity; П5-Land productivity; П6-Livestock productivity; П7-Share of sold production in the total one; П8-Sales growth in the last three years; П9-Investments growth in last 5 years; П10-Net farmer's income/ average income in the region; П11-Payment of hired labour/ average income in the region; П12-Degree of satisfaction from farmer's activity; П13-Degree of compliance to normative labour conditions; П14-Presence of a family member ready to take the farm; П15-Number of family members working in the farm; П16-Age of manager; П17-Participation of training programs in the last 3 years; П18-Education level of manager; П19-Share of occupied with special agricultural education / qualification; П20-Degree of participation of women in the farm management; П21-Number of participation in professional organizations and initiatives; П22-Share of hired workers, members of trade unions; П23-Public positions occupied from the farmer, manager and owner; П24-Participation in local initiatives; П25-Share of non-occupied permanent work positions in the total number of employed; П26-Share of non-occupied seasonal work positions in the total number of employed; П27-Change of UAA in last 5 years; П28-Change of livestock number in last 5 years; П29-Soil erosion; П30-Compliance of nitrate fertilization to norms; П31-Compliance of potassium fertilization to norms; П32-Compliance of phosphorus fertilization to norms; П33-Share of arable land in the total UAA; П34-Keeping the practices of landscape maintenance; П35-Degree of pollution of underground waters with nitrates; П36-Level of fuel consumption; П37-Level of electricity consumption; П38-Presence of protected species on the farm territory; П39-Natural biodiversity protection; П40-Number of cultural species; П41-Respecting of animal welfare norms; П42-Implementation of principles for organic production; П43-Yield variation of main crops for 5 years; П44-Percentage of mortality of livestock for 5 years.

Fig. 4. Indicators* for sustainability in analyzed agro-ecosystems in Bulgaria

Source: survey with managers of farms, 2017 and author's calculations.

Social sustainability in agriculture is usually decreased almost by: lack of family member, ready to continue the farm work (for individual and family farms) (0,13), elderly age of managers and farm owners (0,41), insufficient participation in training programs in the last years (0,33), low share of employed with special agricultural education and qualification (0,44), insufficient participation of women in the farm management (0,4), low participation of farms in professional organizations and initiatives (0,43), lack of membership of hired workers in trade unions (0), weak participation in the public governance from the side of farmers, managers and owners (0,1), and insufficient involvement of farms in local initiatives (0,2).

Critical for the keeping and improvement of the sector's economic sustainability are the increase of production profitability (0,52) and the keeping and increase of sales (0,48). The low levels of indicators for sustainability show also the specialized areas for agricultural sustainability improvement through adequate change of farms strategies and/or of public policies in relation to the sustainable development of the sector, of different sub-sectors, ecosystems and farms types. On the other hand, the high levels of some indicators express the absolute and relative advantages of Bulgarian agriculture regarding the sustainable development. On the actual stage they are expressed in: high share of own capital in the total capital of farms (0,92), high share of sold production in the total output (0,81), lower share of non-occupied permanent (0,81) and seasonal (0,88) work places in the total number of employed, increase of UAA (0,82) and livestock number (0,84) in the last years and respect of norms for animal welfare (for the livestock breeding farms) (0,8).

Level of agricultural sustainability in the main types of agro-ecosystems

Our assessment determined that there is a considerable differentiation of the level of integral and aspect sustainability in agricultural ecosystems main types (fig. 5). The highest integral sustainability has the agriculture in the plane regions (0,63), which have also the highest economic sustainability, with the ecosystems in protected zones and territories (0,74). On the other hand, the integral sustainability in mountain regions with natural restrictions is the lowest (0,56). These ecosystems' type has also the lowest (and close to the limits of satisfying level) levels for social sustainability, with the ecosystems in non-mountain regions with natural restrictions (0,52). Nevertheless, the ecological sustainability of agro-systems in mountain areas with natural restrictions is relatively high (0,58).

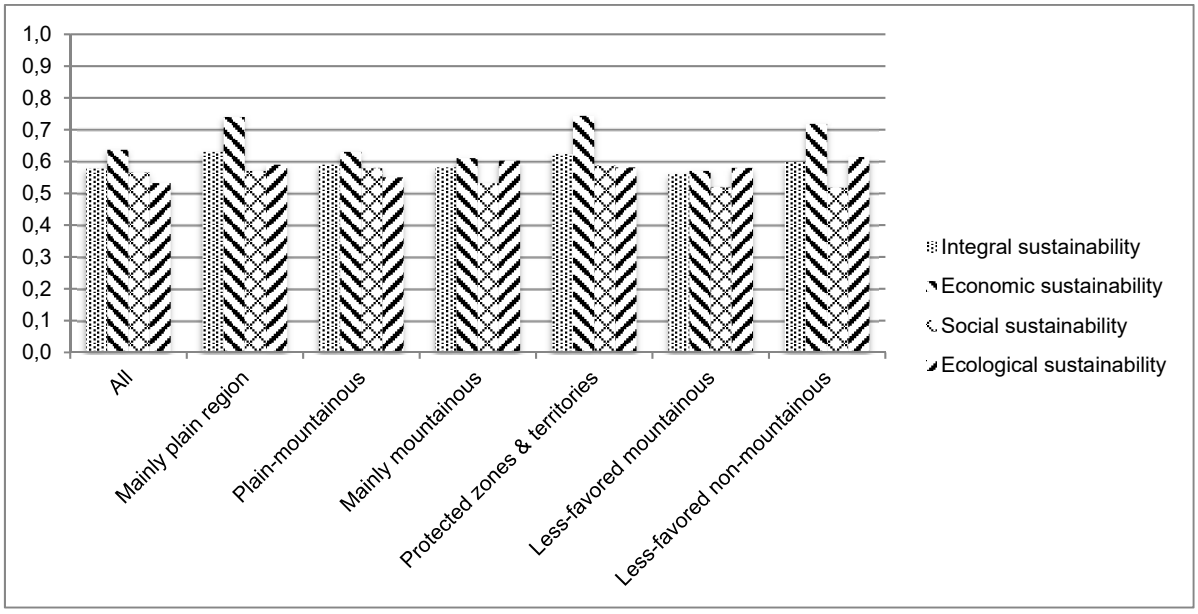


Fig. 5. Level of sustainability in the main types of agro-ecosystems in Bulgaria

Source: survey with managers of farms, 2017 and author's calculations.

The integral sustainability of mountain ecosystems is on a medium level (0,58), but while its economic and social aspects are below the average for the country (respectively 0,61 and 0,53), the level of ecological sustainability is among the highest (0,6). The agricultural sustainability in the protected zones and territories is above the average for the country (0,62), these ecosystems having relatively high economic sustainability (0,74; the highest level of social sustainability (0,59) and good levels for ecological sustainability (0,58). the ecological sustainability in the plane-mountainous regions is the lowest in the country (0,55), and for the non-mountainous regions with natural restrictions it is the highest (0,61).

The agriculture of ecosystems in the plane regions has high significances for economic sustainability for the indicators: share of own capital in the total capital (0,96), labour productivity (0,84), livestock productivity (0,9) and share of sold production in the total output (0,89) (fig. 6). The social sustainability of the sector in these regions is high in relation to degree of correspondence to the normative labour conditions (0,84), education level of manager (0,94) and share of unoccupied seasonal labour positions in the total number of employed (0,87). Agriculture in such regions is with ecologically strong sustainability for the dynamics of UAA in the last 5 years (0,83), the dynamics of the raised livestock number In the last 5 years (0,83) and keeping the norms of animal welfare (1).

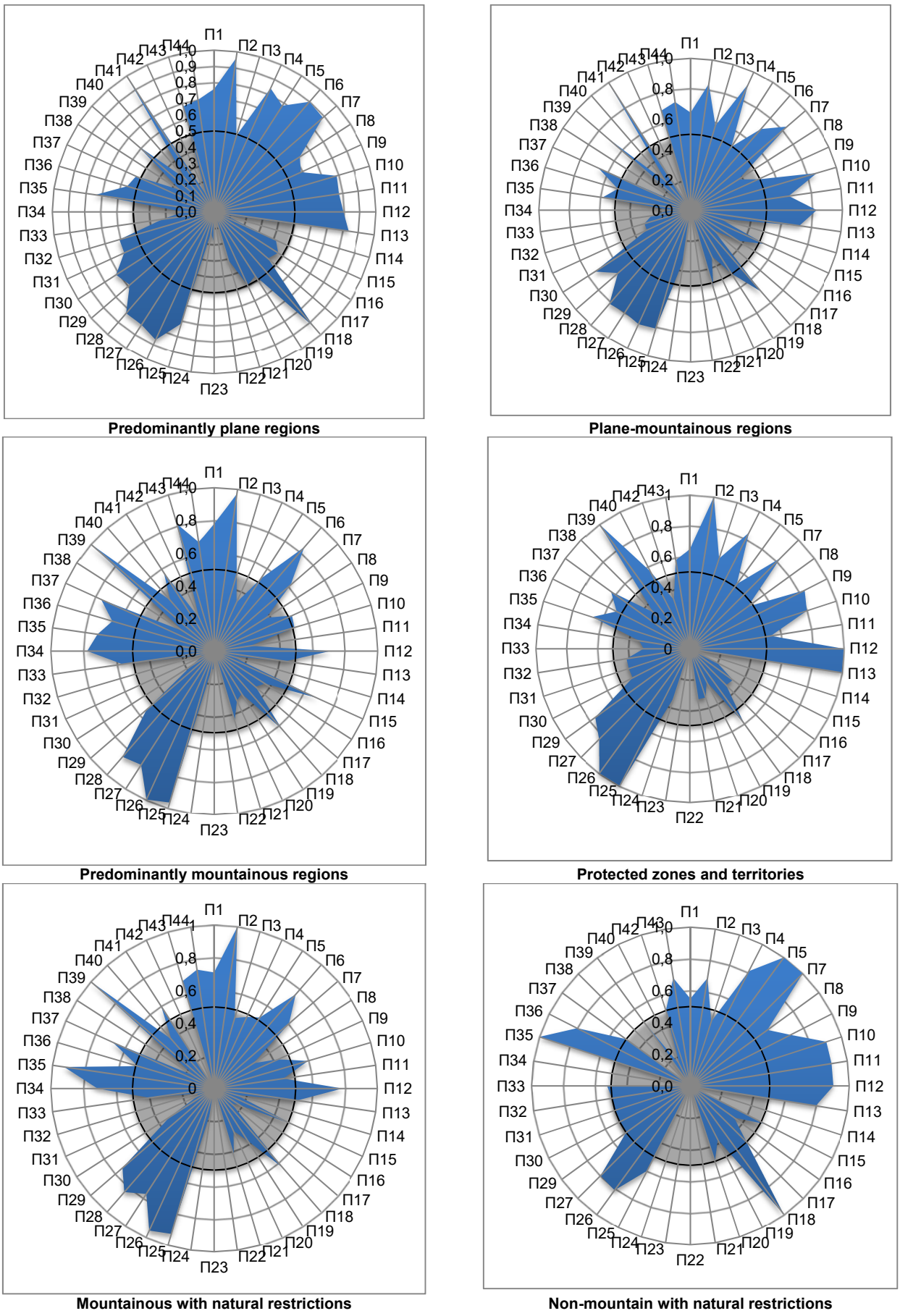


Fig. 6. Indicators for in the main agro-ecosystems types in Bulgaria

Source: survey with managers of farms, 2017 and author's calculations.

Simultaneously, the levels of some indicators in the plane agro-ecosystems have low levels. While the economic sustainability is satisfying only regarding the relation profit/ production costs (0,49), for the social sustainability satisfying are the levels for number of family members working in the farm (0,42), manager's age (0,47), participation in training programs in the last 3 years (0,44), share of employed with special agricultural education/ qualification (0,47) and number of participation in professional organizations and initiatives (0,31). Along with that, regarding the public position of the farmer, manager or owner (0,19) and participation in local initiatives (0,13) the state is unsatisfying and for presence of family member ready to take the farm (0,06), on the limit of the unsustainability. Moreover, according the indicator share of hired workers, members of trade unions, the state is unsustainability. The ecological sustainability of the sector in these regions is satisfying in relation to the share of arable land in the total agricultural land (0,32), presence of protected species on the farm territory (0,25) and number of cultural species (0,27); and unsatisfying for the keeping of practices for landscape maintenance (0,19) and implementation of principles for organic production (0,11).

In ecosystems of plane-mountain regions the economic sustainability of agriculture is high regarding the: share of own capital in the total (0,84), labour productivity (0,91) and share of sold production in the total output (0,84) (fig. 6). The highest in social aspect in these regions are the indicators: net farm income/ average income in the region (0,87), degree of satisfaction from the farming activity (0,83), share of non-occupied permanent work positions in the total number of employed (0,81) and share of unoccupied seasonal work positions in the total number of employed (0,83). From ecological aspect, the best of these ecosystems are only the dynamics of the number of livestock in the last 5 years (0,82) and the keeping of norms of animal welfare (1).

At the same time agro-ecosystems in the plain-mountainous regions have satisfying values of economic sustainability for the growth of sales in the last 3 years (0,38) and investments growth in the last 5 years (0,49). The social sustainability in these regions is on satisfying levels in relation to manager's age (0,37), degree of participation of women in the farm management (0,33) and participation in local initiatives (0,33); unsatisfying regarding the presence of family member, ready to take the farm (0,2) and participation in training programs in last 3 years (0,2); and socially unstable for the share of hired workers, members of trade unions and public positions of the farmer, manager or owner. In the plane-mountain ecosystems the ecological sustainability is satisfying regarding the compliance with the norms of the fertilization with potassium (0,32), compliance with the norms of phosphorus fertilization (032) and share of arable land in the total agricultural land (0,26); unsatisfying for the keeping of practices for landscape maintenance (0,13), presence of protected species on the farm territory (0,07), and number of cultural species (0,24); and unstable for the implementation of principles for organic production.

The agricultural sustainability in ecosystems in mountain regions has the highest values for the economic indicators: share of own capital in the total capital (0,97)and livestock productivity (0,84); the social indicators of the share of non-occupied permanent work positions in the total number of employed (0,97), and share of unoccupied seasonal work positions in the total number of employed (1); and ecological indicators: dynamics of UAA in last 5 years (0,83), dynamics of raised livestock in last 5 years (0,86), natural biodiversity protection (1), and yield variation of the main crops for 5 years (0,81) (fig. 6). In mountain regions with satisfying values for sustainability are the economic relation profit/ production costs (0,49), labour productivity (0,33), and sales' growth in last 3 years (0,38). The social sustainability of this type of ecosystems is satisfying in lots of indicators: degree of compliance with normative labour conditions (0,44), manager's age (0,37), participation in training programs in last 3 years (0,33), share of employed with special agricultural education/ qualification (0,31), degree of participation of women in the farm management (0,33), and number of participations in professional organizations and initiatives (0,44). Furthermore, the social sustainability is unsatisfying in relation to the payment of hired labour/ average income in the region (0,22), presence of a family member, ready to take the farm (0,11), public position of the farmer, manager or owner (0,11), and participation in local initiatives (0,11). In relation to the share of hired workers, members of trade unions, there is a social instability. In the mountain agro-ecosystems the ecological sustainability is on a satisfying level for the number of cultural species (0,41), and unsatisfying for the compliance with the norms of nitrate fertilization (0,17), compliance with the norms for potassium fertilization (0,08), compliance of phosphorus fertilization with the norms (0,08), presence of protected species on the farm territory (0,22), and implementation of principles for organic production (0,22).

The ecosystems' agricultural sustainability in the protected zones and territories is economically high regarding the share of own capital in the total one (1), labour productivity (0,85), share of sold production in the total output (0,83), and investments' growth in the last 5 years (0,84) (fig. 6). This ecosystem type has strong social stability for the degree of satisfaction of the farming activity (1), degree of compliance with the normative labour conditions (1), share of unoccupied permanent work positions in the total number of employed (1), and share of non-occupied seasonal work positions in the total number of employed (1). In ecological aspect the agricultural sustainability in the protected zones and territories is high only regarding the dynamic of UAA in last 5 years (0,83), and natural biodiversity protection(1). On the other hand, the economic sustainability of agro-ecosystems with protected zones and territories is satisfying for the sales' growth in the last 3 years (0,47), while for the livestock productivity there is an instability. The social sustainability in these zones and territories is on satisfying level in relation to manager's age (035), participations in training programs in last 3 years (0,33), degree of participation of women in the farm management (0,33), number of participations in professional organizations and initiatives (0,33), and participation in local initiatives (0,33). For the social indicators the number of family members working in the farm (0,2), and share of employed with special agricultural education/ qualification (0,24) the sustainability level is unsatisfying. Moreover, regarding the presence of family member ready to take the farm, the share of hired workers, members in trade union and the public position of the farmer, manager or owner, the ecosystems are unsustainable. In protected zones and territories some ecological indicators are also relatively low (unsatisfying): compliance to norms of the fertilization with potassium (0,42), compliance to norms of the fertilization with phosphorus (0,42), share of arable land in the total agricultural land (0,3), keeping of practices for landscape maintenance (0,33), presence of protected species on the farm territory (0,33) and implementation of principles for organic production (0,33).

Agricultural sustainability in ecosystems of mountain regions with natural restrictions are highly economically sustainable just in relation to the share of own capital in the total (1); strongly socially sustainable for the share of

unoccupied permanent work positions in the total number of employed (0,93) and share of unoccupied seasonal work positions in the total number of employed (0,96); and highly ecologically sustainable according the dynamics of livestock number in last 5 years (0,84), degree of pollution of underground waters with nitrates (0,93) and protection of natural biodiversity (1) (fig. 6). At the same time, some economic indicators of sustainability in these ecosystems are on satisfying level, as: profit/ production costs (0,45), labour productivity (0,48), sales' growth in last 3 years (0,29), and investments' growth in last 5 years (0,43). Similarly, the social sustainability of this ecosystems' type is satisfying regarding: payment of hired labour/ average income in the region (0,43), share of employed with special agricultural education/ qualification (0,38), degree of participation of women in the farm management (0,29) and number of participations in professional organizations and initiatives (0,43). The level of social sustainability in such regions is unsatisfying for presence of family member, ready to take the farm (0,14), manager's age (0,19), participation in training programs in last 3 years (0,14) and participation in local initiatives (0,14). In relation to the share of hired workers, members of trade unions and public position of manager, farmer and owner, the mountain regions with natural restrictions are socially unsustainable. In these regions some indicators for ecological sustainability have satisfying levels, as the compliance to norms of the nitrate fertilization (0,32), share of arable land in the total agricultural land (0,4), level of fuel consumption (0,49) and number of cultural species (0,4). The ecological sustainability is unsatisfying for the compliance to the norms of potassium fertilization (0,11), compliance to norms of phosphorus fertilization (0,11) and presence of protected species on the farm territory (0,14), while for the principles of organic production implementation, they are unsustainable.

The agricultural sustainability in the non-mountain regions with natural restrictions is economically high regarding the labour productivity (0,81), land productivity (1) and share of sold output in the total one (1) (fig. 6). In relation to the social sustainability, the indicators are high for: net farm income/average income in the region (0,9), payment of hired work in the region (0,9), degree of satisfaction from the farming activity (0,9), education level of manager (1) and share of unoccupied seasonal work positions in the total number of employed (0,81). The ecological sustainability in these regions is high only for the pollution of underground waters with nitrates (1). The agro-ecosystems in the non-mountain regions with natural restrictions have satisfying economic sustainability only regarding the ratio profit/ production costs (0,43). The social sustainability of these agro-ecosystems is satisfying for the age of manager (0,34) and share of employed with special agricultural education/ qualification (0,38). As regards to the presence of family member ready to take the farm; number of participation in professional organizations and initiatives; share of hired workers, members of trade unions; public position of farmer, manager or owner and participation in local initiatives, these ecosystems are unsustainable. Non-mountain regions with natural restrictions have unsatisfying level of ecological sustainability for the indicator number of cultural species (0,15) and they are ecologically unsustainable as regards the keeping of landscape maintenance practices (0) and presence of protected species on the farm territory (0).

Level of agricultural sustainability in the specific agro-ecosystems

In the fourth geographical regions of the country have been identified and analyzed the following important for the respective region and for the country, as a whole, agro-ecosystems: the ecosystems alongside the rivers Yantra, Maritsa and Struma, West Thrace valley, Middle Danube plane, Doupnitsa and Sandanski-Petrich hollows, South- cost Black sea, Sashtinska Sredna Gora and West Rila mountain.

The assessment postulated that there is a big variation in the levels of integral, economic, social and ecological sustainability of agriculture in the specific ecosystems. From the analyzed 10 agro-ecosystems, the highest integral sustainability has Sandanski-Petrich hollow (0,61), with economic sustainability with highest values (0,73), social sustainability with also high values (0,61), while the ecological sustainability is among the lowest in the country and on satisfying level (0,47) (fig. 7). On the other hand, the integral sustainability of agriculture in Dupnitsa hollow is on the lowest level (0,49) and the only one with satisfying level among the analyzed ecosystems. In this ecosystems the levels of social (0,45) and ecological (0,45) sustainability are satisfying and the lowest among the analyzed.

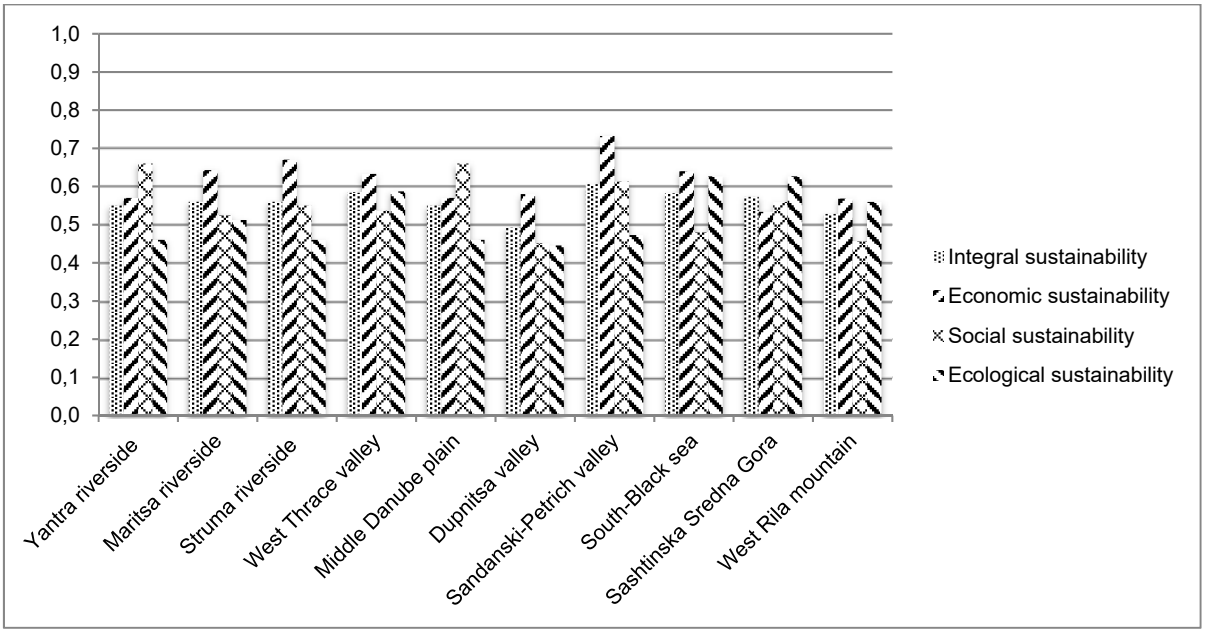


Fig. 7. Levels of sustainability in the specific agro-ecosystems in Bulgaria

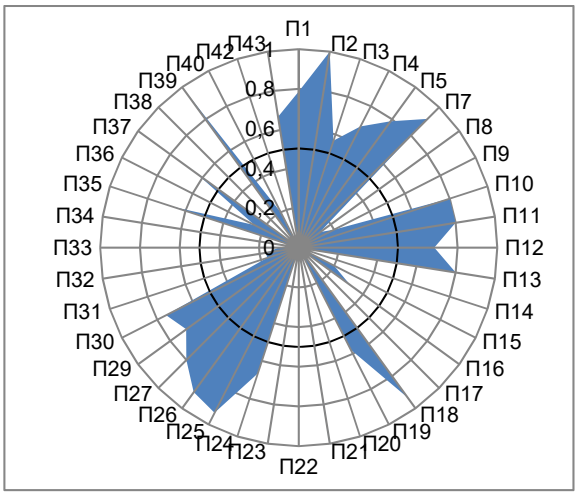
Source: survey with managers of farms, 2017 and author's calculations.

The integral sustainability of agro-ecosystems in the areas alongside the rivers Yantra, Maritsa and Struma is on a relatively low (under the average) level – respectively 0,55, 0,56 и 0,56. However, there is a big differentiation of different aspects of sustainability in these specific ecosystems. For the eco-system alongside Struma river the economic sustainability is on a high level (0,67), while for Yantra riverside it is slightly below the average for the country. On the other hand, the area alongside Yantra has the highest level of social sustainability (0,66), whereas the area alongside Maritsa has the lowest social sustainability and close to the limit of the satisfying level (0,52). For the three riverside ecosystems the ecological sustainability of the sector is below the average values for the country, as for Maritsa riverside the value is on the border of the satisfying level (0,51), and for the other riverside ecosystems – on satisfying level (by 0,46).

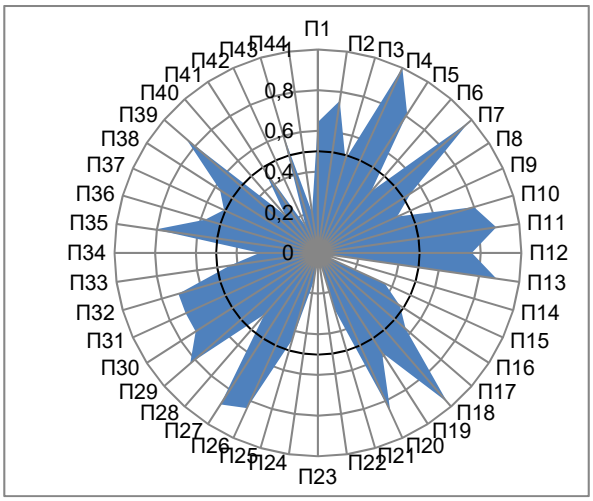
The agro-ecosystem Middle Danube plain has relatively low integral sustainability (0,55), with levels of social sustainability among the highest in the country (0,66), and from ecological aspect on the satisfying level (0,46) and among the lowest for the country. The agriculture in the West Thrace valley has integral sustainability on a relatively high level and over the average for the country (0,59). This agro-ecosystem has good economic sustainability, over the average (0,67), with one of the highest levels of ecological sustainability (0,59), but relatively low and under the average social sustainability (0,54).

Both analyzed specific mountain agro-ecosystems have lower integral sustainability than the average – respectively 0,57 for Sashtinska Sredna Gora, and 0,53 for West Rila mountain. The social (0,56) and the ecological (0,63) sustainability of Sashtinska Sredna Gora are higher than the values of West Rila mountain (respectively on satisfying level 0,46 and good level 0,56), whereas for the economic sustainability is the opposite (0,53 and 0,57). Sashtinska Sredna Gora and South Black sea cost have the highest indicators for ecological sustainability among all analyzed specific ecosystems in the country. The integral sustainability of agriculture of South Black sea is on the average level for the country – 0,58, while the economic sustainability is on a middle level (0,64), the social sustainability is satisfying (0,48), and the ecological is the best of all analyzed (0,63).

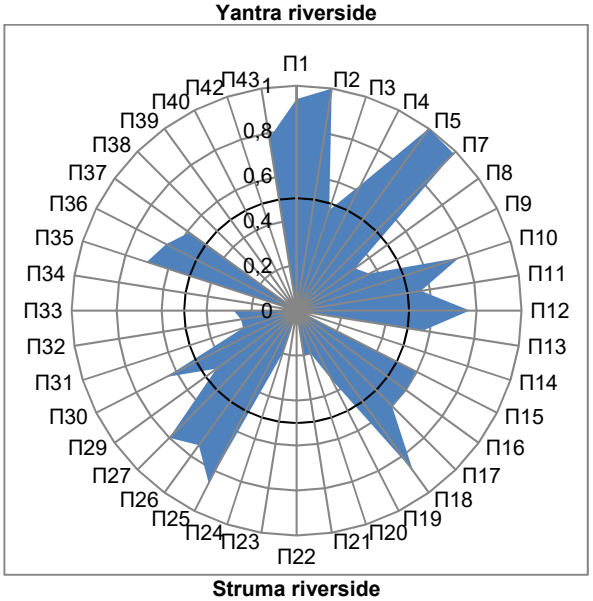
There is a considerable variation of different indicators' levels in the specific agro-ecosystems. Three specific riverside ecosystems in North Central, South Central and South-West regions were analyzed. In the agro-ecosystem of Yantra river high levels have only the indicators for economic sustainability – share of own capital in the total one (1) and share of sold production in the total output (0,91); the indicators for social sustainability – level of education of the manager (0,93), number of participations in professional organizations and initiatives (1), share of unoccupied permanent work positions in the total number of employed (0,93), and share of unoccupied seasonal work positions in the total number of employed (0,9); and for the ecological sustainability – natural biodiversity protection (1) (fig. 8).



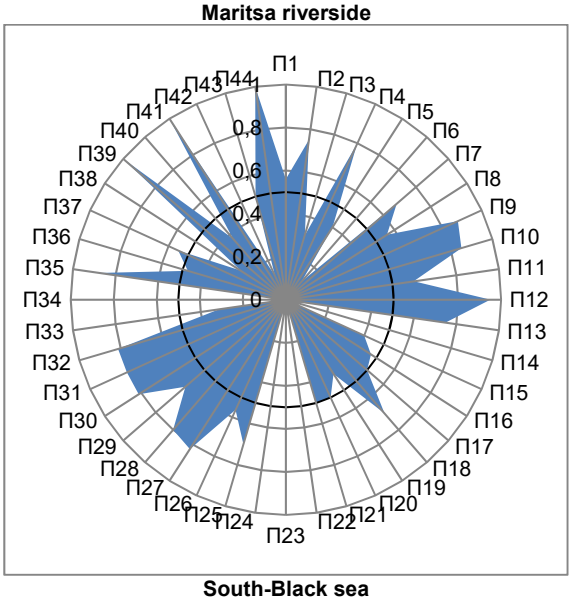
Yantra riverside



Maritsa riverside



Struma riverside



South-Black sea

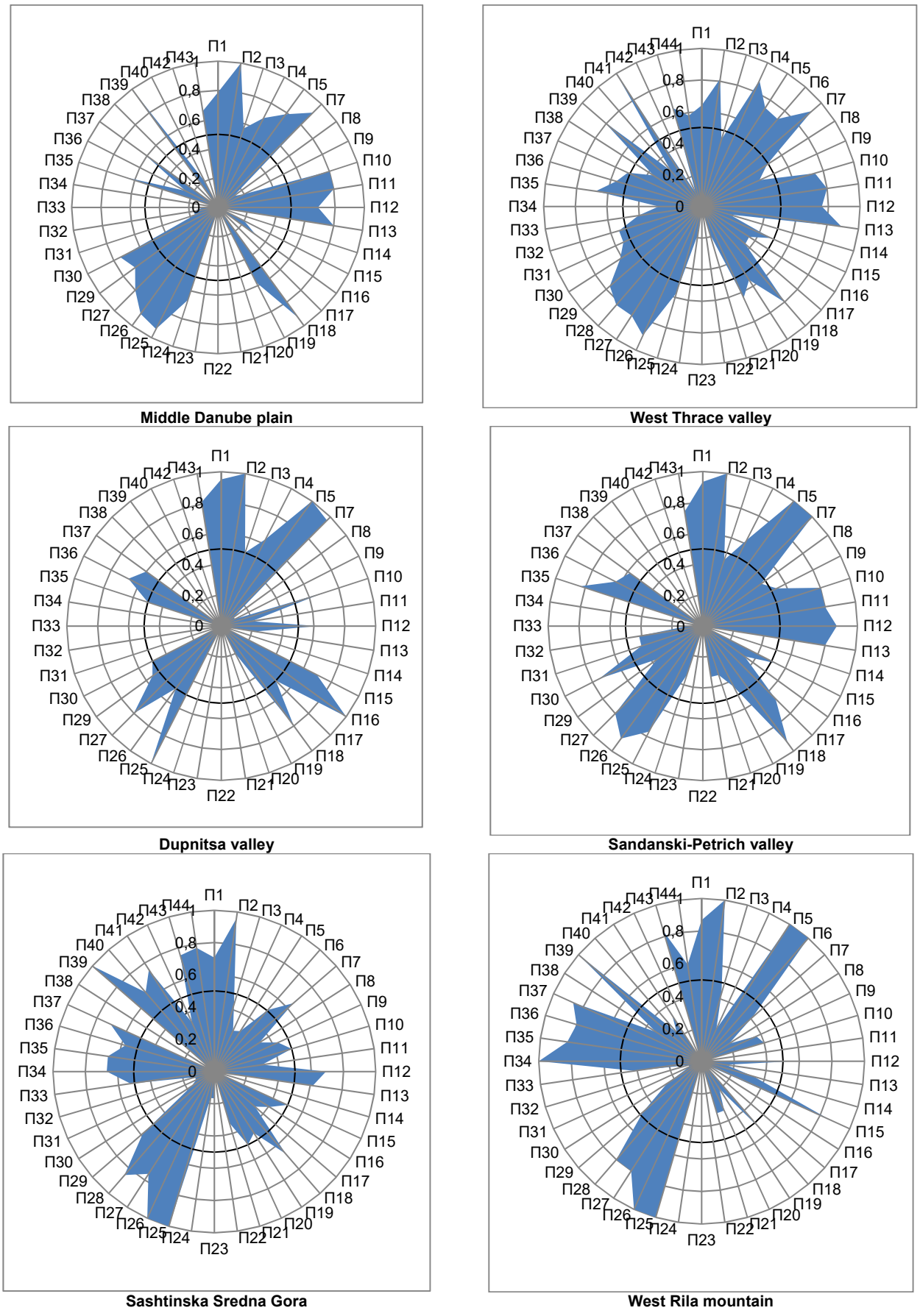


Fig. 8. Indicators for sustainability in the specific agro-ecosystems in Bulgaria

Source: survey with managers of farms, 2017 and author's calculations.

The agriculture of Yantra riverside has unsatisfying sustainability for lots of indicators: economic growth of sales in the last 3 years (0,13) and investments' growth in the last 5 years (0,2); social number of family members, working in the farm (0,2); and ecological: compliance of potassium fertilization to the norms (0,17), compliance to the norms of phosphorus fertilization (0,17), level of fuel consumption (0,25) and number of cultural species (0,2). Moreover, this system is unsustainable due to lots of social and ecological indicators: presence of a family member, ready to take the farm; participation in training programs in last 3 years; degree of participation of women in the farm management, share of hired workers, members of trade unions; public position, occupied by the farmer, manager or owner; share of arable land in the total agricultural land; keeping of practices for landscape maintenance; presence of protected species on the farm territory; implementation of principles for organic production. In relation to the age of manager, the social sustainability is satisfying (0,32). Similar to indicators of the agro-ecosystem along Yantra riverside are the indicators for the sustainability of Middle Danube plain.

The agriculture in the other analyzed riverside ecosystem, of Maritsa, is characterized by several indicators for levels of high sustainability: economic – labour productivity (1), land productivity (0,81) and share of sold production in the total production (0,98); social – payment of hired labour/average income in the region (0,88), degree of compliance to normative labour conditions (0,88), education level of the manager (0,97), degree of participation of women in the farm management (0,86), share of unoccupied seasonal work positions in the total number of employed (0,84); and ecological – dynamics of UAA in the last 5 years (0,88), soil erosion (0,83), degree of pollution of underground waters with nitrates (0,81) and natural biodiversity protection (0,86) (fig. 8).

The agro-ecosystems from the riverside of Maritsa have satisfying sustainability of economic indicators: profit/ production costs (0,48), livestock productivity (0,4) and investments' growth in the last 5 years (0,43). The level of social indicators is also satisfying: number of family members, working in the farm (0,36), manager's age (0,48), number of participations in professional organizations and initiatives (0,29) and share of unoccupied permanent work positions in the total number of employed (0,44). Similar is the level of ecological indicators: dynamics of the arable land in the last 5 years (0,4) and share of arable land in the total agricultural land (0,44). The agricultural sustainability alongside Maritsa river is on unsatisfying level about the social and ecological indicators: participation in local initiatives (0,14), keeping of practices for landscape maintenance (0,29), number of cultural species (0,24), implementation of principles for organic production (0,14) and percentage of mortality of the livestock for 5 years (0,2). In relation to social dimensions there is a state of unsustainability: presence of family member ready to take the farm, share of hired workers, members in professional organizations and public position of the farmer, manager or owner.

Unlikely the other two riverside agro-ecosystems, this of Struma river has high economic levels of sustainability for the share of direct payments in the net income (0,94), share of own capital in the total one (1), land productivity (1) and share of sold production in the total output (0,99) (fig. 16). The social sustainability in this agro-ecosystem is high only regarding the education level of the manager (0,88) and share of unoccupied work positions in the total number of employed (0,86). On the other hand, some indicators of economic sustainability in this agro-ecosystem have satisfying levels, as: profit/ production costs (0,47), growth of sales in the last 3 years (0,32) and investments' growth in the last 5 years (0,36). Similar is the level of sustainability regarding the social and ecological indicators for the employed with special agricultural education/qualification (0,34), soil erosion (0,44) and share of arable land in the total agricultural land (0,28).

Moreover, the agricultural sustainability of Struma riverside is unsustainable in relation to the social measurers: degree of participation of women in the farm management (0,2), number of participation in professional organizations and initiatives (0,2) and participation in local initiatives (0,2); and ecological indicators: compliance to the norms of potassium fertilization (0,25), compliance to the norms of phosphorus fertilization (0,25) and number of cultural species (0,12). This agro-ecosystem is socially unsustainable in relation to the participation of a family member, ready to take the farm; share of hired workers, members in trade unions and public position of the farmer, manager or owner. The ecosystem is also in state of ecological unsustainability regarding the keeping of practices for landscape maintenance, presence of protected species on the farm territory, protection of the natural biodiversity and implementation of principles of organic production.

The agricultural sustainability in the South-Black sea ecosystem has high levels for the economic indicator – investments' growth in the last 5 years (0,88) and for the social indicators: net farm income /average income in the region (0,85) and degree of satisfaction from farming activity (0,95) (fig. 10). The agro-ecosystem is also ecologically sustainable with lots of indicators: dynamics of UAA in the last 5 years (0,82), compliance to the norms of nitrate fertilization (0,81), compliance to the norms of the potassium fertilization (0,81), compliance to the norms of the phosphorus fertilization (0,81), degree of pollution of underground waters with nitrates (0,87), natural biodiversity protection (1), keeping the norms of animal welfare (1) and percentage of mortality for the livestock for 5 years (1). The agro-ecosystem South-Black sea has satisfying sustainability concerning the economic indicator profit, production costs (0,31); several social indicators, as: number of family members working in the farm (0,4), manager's age (0,47) and share of employed with special agricultural education/ qualification (0,47); and ecological indicators for: share of arable land in total agricultural land (0,31), level of fuel consumption (0,47) and number of cultural species (0,37).

This specific ecosystem has unsatisfying sustainability of agriculture regarding the economic aspect for livestock productivity (0,11) and from ecological aspect: for the presence of protected species on the farm territory (0,25) and implementation of organic production principles (0,12). The agriculture of South-Black sea is socially unsustainable regarding the presence of a family member ready to take the farm; share of workers, members of trade unions; public position of the farmer, manager or owner and participation in local initiatives, and in ecological aspect, for the keeping of practices for landscape maintenance.

The agriculture in the West Thrace valley has high economic sustainability regarding the indicators share of own capital in the total one (0,82), labour productivity (0,88) and share of sold production in the total (0,92); high social sustainability for compliance to the normative labour conditions (0,89) and share of unoccupied seasonal work places in the total number of employed (0,89); and high ecological sustainability for the dynamics of UAA in the last 5 years (0,82), dynamics of the livestock number in the last 5 years (0,82), natural biodiversity protection (0,82), and keeping of norms for animal welfare (1) (fig. 10). The agriculture of this ecosystem has satisfying levels of economic sustainability for: profit/ production costs

(0,44)and investments' growth in the last 5 years (0,4); social sustainability for: number of family members working in the farm (0,48), manager's age (0,36), participation in training programs in last 3 years (0,36); and ecological sustainability for: share of arable land in the total agricultural land (0,4), keeping of practices for landscape maintenance (0,27), presence of protected species on the farm territory (0,36) and number of cultural species (0,3).

The social sustainability is unsatisfying for indicators: presence of family member ready to take the farm (0,18), number of participations in professional organizations and initiatives (0,18) and participation in local initiatives (0,18), and regarding the share of hired, members of trade unions, and public position of farmer, manager or owner the state is unsustainable. The same state has the ecological sustainability regarding the implementation of principles for organic production (0,09).

In the South-West region of the country have been analyzed two specific agro-ecosystems of Dupnitsa valley and of Sandanski-Petrich valley. Dupnitsa valley has high economic sustainability of indicators: share of direct payments in the net income (0,95), share of own capital in the total one (1), land productivity (1) and share of sold output in the total (0,97) (fig.16). The agriculture in this ecosystem has high social and ecological sustainability only regarding the age of the manager (1), share of unoccupied permanent work positions in the total number of employed (1) and variation of yields of the main crops for 5 years (0,81).

Under two economic, several social and one ecological indicator, the sustainability of this agro-ecosystem is unsatisfying: sales growth in last 3 years (0,1), investments' growth in last 5 years (0,1), payment of hired labour/average income in the region (0,2), degree of compliance to normative labour conditions (0,22), and share of employed with specific agricultural education/qualification (0,2), and number of cultural species (0,1). Under many social and ecological indicators the level is unsustainable: presence of a family member ready to take the farm; degree of participation of women in the farm management; number of participations in professional organizations and initiatives; share of hired workers, members of trade unions; public position of the farmer, manager or owner; participation in local initiatives; compliance to the norms of potassium fertilization; compliance to the norms of phosphorus fertilization; respecting of practices for the landscape maintenance; presence of protected species on the farm territory; protection of natural biodiversity and implementation of organic production principles.

Other analyzed agro-ecosystem is Sandanski-Petrich valley, which is characterized by high sustainability of economic indicators: share of direct payments in the net income (0,93), share of own capital in the total (1), land productivity (1) and share of sold output in the total output (1); social measurers: degree of satisfaction from farm activity (0,86), education level of manager (0,93) and share of unoccupied seasonal work positions in the total number of employed (0,9); and ecological indicator: degree of pollution of underground waters with nitrates (0,83). In this ecosystem the agricultural sustainability has relatively low (satisfying) economic sustainability according two indicators: profit/ production costs (0,45) and growth of sales in the last 3 years (0,47). Similarly, the social sustainability in the agro-ecosystem has satisfying levels in relation to: manager's age (0,33); share of employed with special agricultural education/ qualification (0,44); degree of participation of women in the farm management (0,33); number of participation in professional organizations and initiatives (0,33) and participation in local initiatives (0,33). The agriculture in this area is socially unsustainable regarding the presence of a family member, ready to take the farm; share of hired workers, members of trade unions and public position of the farmer, manager or owner.

Apart this, the ecological sustainability of Sandanski-Petrich valley is satisfying for the soil erosion (0,37); compliance to norms of potassium fertilization (0,42) and compliance to norms of phosphorus fertilization (0,42); unsatisfying regarding the share of arable land in the total agricultural land (0,1) and number of cultural species (0,13); and ecologically unsustainable regarding the keeping of practices for landscape maintenance; presence of protected species on the farm territory; protection of natural biodiversity and implementation of organic production principles.

Two mountain agro-ecosystems have been analyzed – Sashtinska Sredna Gora and Western Rila mountain. The agriculture in Sashtinska Sredna Gora is economically sustainable regarding the share of own capital in the total (0,96); strongly socially sustainable for the share of unoccupied permanent work positions in the total number of employed (1) and share of unoccupied seasonal work positions in the total number of employed (1); and highly ecologically sustainable for the dynamics of the livestock number in the last 5 years (0,85) and for the natural biodiversity protection (1) (fig. 8). The agricultural production in this ecosystem has satisfying levels of many economic and social indicators: profit/production costs (0,43), labour productivity (0,27), land productivity (0,3), sales growth in last 3 years (0,33), investments growth in last 5 years (0,43), payment of hired labour/average income in the region (0,3), manager's age (0,41), participation in education programs in last 3 years (0,33), share of employed with special agricultural education/qualification (0,45) and number of participations in professional organizations and initiatives (0,33). This agro-ecosystem has satisfying ecological sustainability in relation to the implementation of organic production principles (0,33).

Moreover, according several social and ecological indicators the agriculture in Sashtinska Sredna Gora is with unsatisfying sustainability: public position of the farmer, manager or owner (0,17), participation in local initiatives (0,17), compliance to norms of the nitrate fertilization (0,17), compliance to norms of the potassium fertilization (0,12), compliance to norms of the phosphorus fertilization (0,12). This agro-ecosystem is socially and ecologically unsustainable in relation to the presence of a family member, ready to take the farm; share of hired workers, members of trade unions and presence of protected species on the farm territory.

The other mountain agro-ecosystem Western Rila mountain has high economic sustainability in relation to the share of direct payments in the net income (0,87), share of own capital in the total (1), land productivity (1) and livestock productivity (1) (fig. 8). The social sustainability is strong regarding the indicators: number of family members working in the farm (0,86), share of unoccupied permanent work positions in the total number of employed (1) and share of unoccupied seasonal work positions in the total number of employed (1).The agriculture in Western Rils mountain is ecologically sustainable for the respecting of practices for landscape maintenance (1), degree of pollution of underground waters with nitrates (0,83), level of consumption of electricity (0,87), protection of natural biodiversity (1) and variation of yields of main crops for 5 years (0,83). This agro-ecosystem has satisfying economic sustainability in relation to profit/production costs (0,43), share of sold output in the total output (0,41) and investments growth in last 5 years (0,37). The level of social sustainability is satisfying for the net farm income/average income in the region (0,4), presence of a family member,

ready to take the farm (0,33), degree of participation of women in the farm management (0,33) and number of participation in professional organizations and initiatives (0,33). The agricultural sustainability is unsatisfying regarding the economic indicators labour productivity (0,22) and sales growth in the last 3 years (0,2); and social indicators degree of compliance to normative labour conditions (0,15) and share of employed with special agricultural education/ qualification (0,2). Furthermore, some social indicators in this agro-ecosystem have unsustainability levels: payment of hired labour/average income in the region, manager's age, participation in education programs in the last 3 years, share of hired workers, members in trade unions, public positions of the farmer, manager or owner, participation in local initiatives.

The agro-ecosystem Western Rila mountain has satisfying ecological sustainability for: soil erosion (0,46), share of arable land in the total agricultural land (0,42), presence of protected species on the farm territory (0,33) and respecting the norms for animal welfare (0,33). The ecological sustainability of the ecosystem is unsatisfying for: compliance to norms of nitrate fertilization (0,25), number of cultural species (0,23), compliance to norms of potassium fertilization (0,08) and compliance to norms of phosphorus fertilization (0,08). This ecosystem is ecologically unsustainable in relation to the principles of organic production.

Finally, we compare the integral agrarian sustainability based on the assessment of sustainability of agro-ecosystems with the results of previous studies assessing agrarian sustainability with the aggregate sectoral (statistical, etc.) data in Bulgaria (Bachev et al., 2017).

According to the precious study based on aggregate data using the same methodological approach the integral sustainability index of the Bulgarian agriculture is 0,58 which correspond to a Good sustainability. That study has found out that the Economic sustainability of the Bulgarian agriculture is Good (index of sustainability 0,7), while the Social and the Environmental sustainability are also as Good but with a lower index (for both of them is 0,53) close to satisfactory level. Therefore, integral assessment results based on the micro agro-ecosystems (farm) data are similar with the results based on aggregated sectoral (statistical, etc.) data. It means that both approaches are reliable and could be simultaneously used for assessing agrarian sustainability at various level – sector, subsector, region, agro-ecosystem, and farm.

References:

1. Bachev, H. (2009): Governing of Agro-ecosystem Services. Modes, Efficiency, Perspectives, VDM Verlag Dr. Muller Aktiengesellscaft & Co. KG, Saarbrucken.
2. Bachev, H. (2010): Governance of Agrarian Sustainability, New York: Nova Science Publishers.
3. Bachev, H (2016): A Framework for Assessing Sustainability of Farming Enterprises Journal of Applied Economic Sciences, Spring Issue, Vol XI, 1(39), 24–43.
4. Bachev. H. (2016): Defining and Assessing the Governance of Agrarian Sustainability, Journal of Advanced Research in Law and Economics, Volume VII, Issue 4(18), 797–816.
5. Bachev, H. (2017): Sustainability Level of Bulgarian Farms, Bulgarian Journal of Agricultural Science, 23 (1), 1–13.
6. Bachev, H. (2017): Sustainability of Bulgarian Farming Enterprises during EU CAP Implementation, Journal of Applied Economic Sciences, 2(48), 422-451.
7. Bachev, H. (2018): The Sustainability of Farming Enterprises in Bulgaria, Cambridge Scholars Publishing.
8. Bachev, H. (2018): Institutional Environment and Climate Change Impacts on Sustainability of Bulgarian Agriculture, Bulgarian Journal of Agricultural Science, 24 (4), 523–536.
9. Bachev, H., B. Ivanov, D. Toteva, E. Sokolova (2016): Agrarian Sustainability and its Governance – Understanding, Evaluation, Improvement, Journal of Environmental Management and Tourism, Vol. 7, issue 4 (16), 639–663.
10. Bachev, H., B. Ivanov, D. Toteva and E. Sokolova (2017): Agrarian sustainability in Bulgaria – economic, social and ecological aspects, Bulgarian Journal of Agricultural Science, 23 (4), 519–525.
11. Bachev, H. and D. Terziev (2017): Environmental Sustainability of Agricultural Farms in Bulgaria, Journal of Environmental Management and Tourism, Vol. 8 No 5 (2017): JEMT Volume VIII Issue 5(21) Fall 2017, 968–994
12. Bachev, H., Terziev, D. (2018): A Study on Institutional, Market and Natural Environment Impact on Agrarian Sustainability in Bulgaria, Journal of Environmental Management and Tourism, Volume IX, Issue 3 (27), 452–478.
13. Bachev, H., Terziev, D. (2018). A Study on Agrarian Sustainability Impact of Governance Modes in Bulgaria. Journal of Applied Economic Sciences, Volume XIII, Spring, 1(55): 227–257.
14. Belcher, K. (1999): Agroecosystem sustainability: an integrated modelling approach, PhD Thesis, HARVEST, University of Saskatchewan.
15. Bohlen, P. and G. House (2009): Sustainable Agroecosystem Management: Integrating Ecology, Economics, and Society, CRC Press.
16. De Oliveira A. (editor) (2018): Sustainability of Agroecosystems, IntechOpen, DOI: 10.5772/intechopen.70964
17. FAO (2013): SAFA. Sustainability Assessment of Food and Agriculture systems indicators, FAO.
18. Fuentes M. (2004): Farms Management Indicators Related to the Policy Dimension in the European Union, OECD Expert Meeting on Farm Management Indicators and the Environment, 8–12 March 2004, New Zealand.
19. Ikerd J. (2015): On Defining Sustainable Agriculture, SARE.
20. http://www.sustainable-ag.ncsu.edu/onsustaibableag.htm
21. Hanna S., I. Osborne-Lee, G. Cesaretti, R.Magdy, T.Khalile (2016): Ecological Agro-ecosystem Sustainable Development in Relationship to Other Sectors in the Economic System, and Human Ecological Footprint and Imprint,Agriculture and Agricultural Science Procedia, Vol. 8, 17–30.
22. Hayati D.Z. Ranjbar, and E. Karami (2010): Measuring Agricultural Sustainability, in E. Lichtfouse (ed.), Biodiversity, Biofuels, Agroforestry and Conservation Agriculture, 73, Sustainable Agriculture Reviews 5, Springer Science+Business Media B.V., 73-100.
23. Ivanov, B., T. Radev, D. Vachevska, P. Borisov (2009): Agricultural Sustainability – ASVIWI. Avangard Prima, Sofia.
24. Lopez-Ridauira S., Masera O., Astier M. (2002): Evaluating the sustainability of complex socio-environmental systems. The MESMIS framework. Ecological indicators 2: 135–148.
25. Millennium Ecosystem Assessment (MEA) (2005): Ecosystems and Human Well-being: Synthesis. Washington, DC: Island Press.
26. Oelbermann M. (editor) (2014): Sustainable agroecosystems in climate change mitigation, Wageningen Academic Publishers, doi.org/10.3920/978-90-8686-788-2
27. Rezear K., A. Osmani; P. Borisov, D. Skunca (2018): Beyond the Metropolis: Farmers' empowering as a challenge of Peri-urban areas, European Journal of Economics and Management Sciences, Vol 3,
28. Ramírez-Carrillo E., O. López-Corona , J. Toledo-Roy, J. Lovett, F. León-González, L. Osorio-Olvera, J. Equihua, E. Robredo, A. Frank, R. Dirzo, V. Pérez-Cirera (2018): Assessing sustainability in North America's ecosystems using criticality and information theory, PLOS, Published: July 16
29. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200382
30. Sauvenier X., J. Valekx, N. Van Cauwenbergh, E. Wauters, H.Bachev. K.Biala, C. Bielders, V. Brouckaert, V. Garcia-Cidad, S. Goyens, M.Hermy, E. Mathijs, B.Muys, M.Vanclooster. and A.Peeters (2005): Framework for Assessing Sustainability Levels in Belgium Agricultural Systems – SAFE, Belgium Science Policy, Brussels.
31. Sidle R., W. Benson, J. Carriger, and T. Kamaic (2013): Broader perspective on ecosystem sustainability: Consequences for decision making, Proc Natl Acad Sci USA., 110(23): 9201–9208.
32. Terziev D., D. Radeva, & Y. Kazakova (2018): A new look on agricultural sustainability and food safety: Economic viability, in H. BACHEV, S. CHE, S. YANCHEVA (Editors) Agrarian and Rural Revitalisation Issues in China and Bulgaria, KSP Books, 231–242.
33. Todorova K. and R.Treziyska (2018): Agricultural sustainability through provision of agri-environment public goods: The role of farmers as decision-makers, in H. BACHEV, S. CHE, S. YANCHEVA (Editors) Agrarian and Rural Revitalisation Issues in China and Bulgaria, KSP Books, 253–267.
34. VanLoon, G., Patil, S., and Hugar, L. (2005): Agricultural Sustainability: Strategies for Assessment. London: SAGE Publications.
35. Zvyatkova D. and A. Sarov (2018): Process of Transfer of Family Farms for Sustainability of Agricultural Cooperatives, in "Role of Family Business for Sustainable Rural Development, Agrarian University, 61 (2), 125–134.

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ЕКОСИСТЕМНИЙ ПІДХІД ДО ОЦІНКИ АГРАРНОЇ СТАЛОСТІ В БОЛГАРІЇ

Екосистемний підхід усе більше залучається до управління та оцінки рівнів сталості загалом, і в сільському господарстві зокрема. Незважаючи на значний прогрес у теорії та практиці цієї нової галузі, досі немає консенсусу щодо того, як оцінити сталість агроекосистем, зважаючи на різноманітні розуміння, підходи, методи, використані дані тощо. У Болгарії практично немає ґрунтовних досліджень рівня сталості різних агроекосистем. У даній статті оцінюється рівень сталості агроекосистем різного типу в Болгарії. Запропоновано цілісну ієрархічну структуру, включаючи 17 принципів, 35 критеріїв, 46 показників та контрольних значень, для оцінки інтегральної, економічної, соціальної та екологічної сталості агроекосистем. Оцінюється загальна сталость і її аспекти щодо великих (агро) екосистем в чотирьох географічних регіонах, а також в конкретних основних і специфічних типах агроекосистем країни. Оцінка заснована на інформації з перших рук, зібраної в ході докладних інтерв'ю з керівниками "типових"ферм відповідних екосистем. Дослідження показало, що існує значна диференціація рівня інтегральної сталості в сільськогосподарських екосистемах різних типів. Існують також істотні відмінності в рівнях економічної, соціальної та екологічної сталості агроекосистем різного типу, а також критичні показники, що підвищують або стримують загальну і особливу сталість окремих агроекосистем. Результати інтегрального рівня аграрної стійкості, засновані на даних мікроагроекосистем (ферм), подібні до попередньої оцінки на основі сукупних галузевих (статистичних та інших) даних. Беручи до уваги важливість цілісних оцінок такого роду для покращення аграрної сталості, управління фермерськими господарствами та аграрної політики, вони повинні використовуватися у повному обсязі, а їх точність та репрезентивність має бути покращана.

Ключові слова: агроекосистема, сталість, оцінка, економічна, соціальна, екологічна, Болгарія.

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ЭКОСИСТЕМНЫЙ ПОДХОД К ОЦЕНКЕ АГРАРНОЙ УСТОЙЧИВОСТИ В БОЛГАРИИ

Экосистемный подход все больше вовлекается в управления и оценивание уровней устойчивости в целом и в сельском хозяйстве в частности. Несмотря на значительный прогресс в теории и практике этой новой области, до сих пор нет консенсуса относительно того, как оценить устойчивость агро-экосистем, несмотря на различные понимания, подходы, методы, использованные данные и тому подобное. В Болгарии практически нет фундаментальных исследований уровня устойчивости различных агроэкосистем. В данной статье оценивается уровень устойчивости агро-экосистем различного типа в Болгарии. Предложена целостная иерархическая структура, включая 17 принципов, 35 критериев, 46 показателей и контрольных значений для оценки интегральной, экономической, социальной и экологической устойчивости агро-экосистем. Оценивается общая устойчивость и ее аспекты относительно крупных (агро) экосистем в четырех географических регионах, а также в конкретных основных и специфических типах агро-экосистем страны. Оценка основана на информации из первых рук, собранной в ходе подробных интервью с руководителями "типичных"ферм соответствующих экосистем. Исследование показало, что существует значительная дифференциация уровня интегральной устойчивости в сельскохозяйственных экосистемах различных типов. Существуют также существенные различия в уровнях экономической, социальной и экологической устойчивости агроэкосистем разного типа, а также критические показатели, повышающие или сдерживают общую и особенную устойчивость отдельных агроэкосистем. Результаты интегрального уровня аграрной устойчивости, основанные на данных микроагроекосистем (ферм), подобные предварительной оценки на основе совокупных отраслевых (статистических и других) данных. Принимая во внимание важность целостных оценок такого рода для улучшения аграрной устойчивости, управления фермерскими хозяйствами и аграрной политики, они должны использоваться в полном объеме, а их точность и репрезентивность должны быть улучшены.

Ключевые слова: агроэкосистема, устойчивость, оценка, экономическая, социальная, экологическая, Болгария.

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TAX ARBITRATION THROUGH OFFSHORE CENTRES AND TAX HAVENS

The aim of the study is to capture the most relevant aspects regarding the functioning of offshore centres and tax havens, focusing in particular on the most important conceptual and instrumental clarifications. There are several angles to approach the phenomenon of tax evasion that are pointed out in this article, alongside a comparison of various analytical perspectives and, based on these, a number of judgments regarding their (in)opportunity are issued. In order to make a consistent description of the tax havens, it is necessary to clarify the fundamentals, the specific determinants and the factors without which these structures could not exist in the first place, the main hypothesis being that the boundary between tax arbitration and tax evasion is highly ambiguous and this is the major rationale why polemics on this topic arise. The goal is to present as objectively as possible these offshore centres and tax havens activities, which are paramount financial centres, irrespective of the criticism made by those who deem them unfair, immoral or even evil, as well as dangerous. This article focuses on tax planning and tax arbitration practices (e.g., "treaty shopping"), concluding with a collection of rationales for a balanced view on fiscal competition.

Key words: cross-border transaction, capital mobility, offshore financial centres, tax havens, tax planning, fiscal competition

Introduction. Globalization has produced fundamental changes, blurring the traditional role of borders and trading barriers and creating an international economic system that accommodates some of the national operating mechanisms. [1]. This process of deepening economic interdependence has created a new international order, opened new opportunities for actors involved in cross-border transactions, and has transformed the main facets of the economic life. In the transition from traditional cross-border flows to global economic governance, the international economy has experienced impressive rates of growth, but has also faced ever-increasing obstacles that have stifled its momentum. Increasing the level of interconnection at international level has encouraged not only the mobility of