Framework for analyzing and assessing the system of governance and the level of agrarian sustainability in Bulgaria and China

Bachev, Hrabrin and Ivanov, Bodjidar and Toteva, Desislava and Sokolova, Emilia

Institute of Agricultural Economics, Sofia

1 April 2017

Framework for analyzing and assessing the system of governance and the level of agrarian sustainability in Bulgaria and China

Bachev H., B.Ivanov, D.Toteva, E.Sokolova

Introduction

This framework is a part of a bilateral research cooperation project between Bulgaria and China on „Governing and Assessment of Agrarian Sustainability - Experiences, Challenges, and Lessons from Bulgaria and China“ funded by the Bulgarian Science Fund and the Ministry of Science and Technology of the People's Republic of China (http://bg-china.alle.bg/).

This framework is being used for analyzing the system of governance and the level of agrarian sustainability in Bulgaria and China, and comparative analysis between two countries.

First, major definitions are presented. After that a Framework for analyzing the system of governance of agrarian sustainability is outlined. Finally, a Framework for assessing sustainability levels of agriculture is presented. Theoretical and mythological approaches are previously presented by another publication (Bachev, Ivanov, Toteva, Sokolova).

I. Definitions

Agriculture is a major sector of economy and social life associated with *cultivation of animals, plants and fungi for food, fiber, biofuel, medicinal and other products and services* used to sustain and enhance human life. It is a major user of *natural resources* such as lands, waters, etc., material, biological, financial and intellectual capitals; provides provision, income and employment for a good part of population; and has significant impact on overall socio-economic development and natural environment.

Agrarian sustainability characterizes the *ability of agriculture to maintain its economic, ecological and social functions in a long-term.*

The **time horizon** for agrarian sustainability governance and assessment implied in this project is **7-10 years** coinciding with the programing period or the period of retirement of significant portion of farm managers in both countries.

Agrarian sustainability has **three Aspects**, which are *equally important* and have to be always accounted for. Agriculture is sustainable if it is:

- *economically viable and efficient* – i.e. provide enough employment and income for farms and farm households, good or high productivity of utilization of natural, personal, material, and financial resources, economic efficiency and competitiveness, and financial stability of activity;
- *socially responsible* regarding farmers, workers, other agents, communities, consumers and society - i.e. contribute to amelioration of welfare and living standards of farmers and farm households, conservation of agrarian resources and traditions, and sustainable development of rural communities and society;

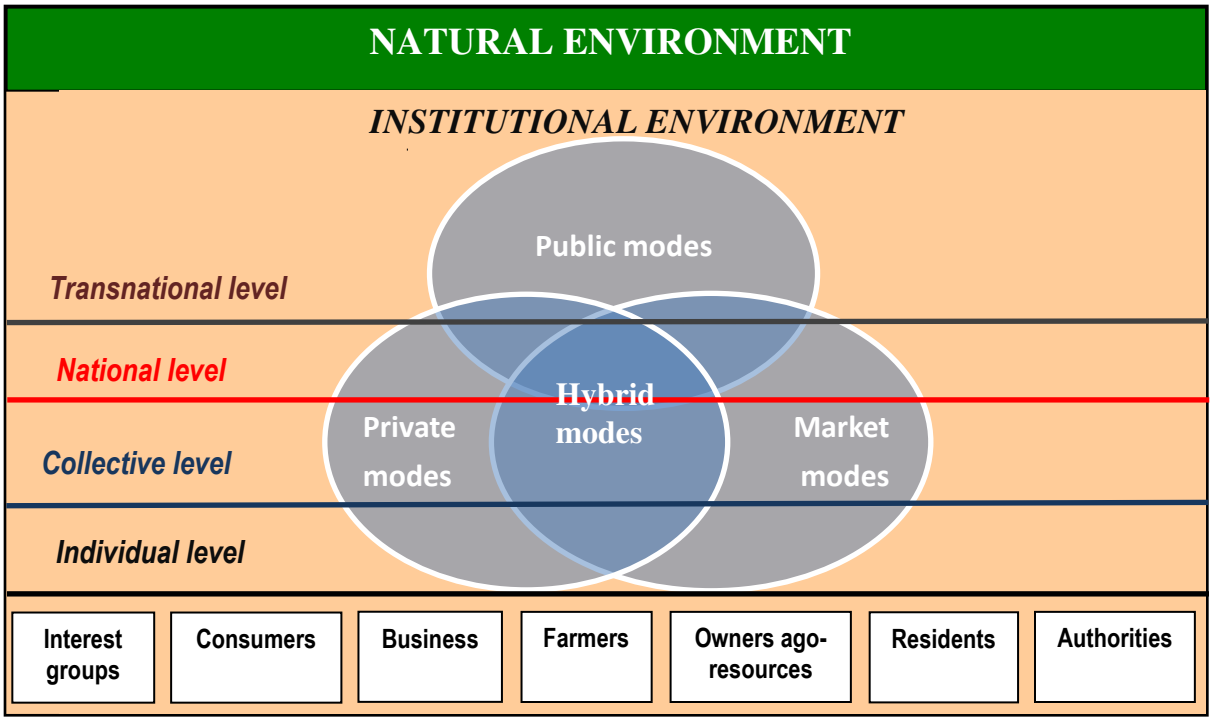
- *ecologically sustainable* – i.e. activity is associated with conservation, recovery and improvement of components of natural environment (landscape, lands, waters, biodiversity, atmosphere, climate, etc.), respecting "rights" of farm and wild animals ("animal welfare"), etc.

Maintaining social, economic and ecological functions of agriculture requires an effective *social order* – "good governance". The **system of governance** consists of all *variety of governing mechanisms and forms regulating, coordinating, stimulating, and controlling behavior, actions and relations of diverse agents (farm managers, owners of agrarian resources, agricultural labor, agri-business, interests groups, consumers, state and local authorities, etc.) at different levels* (Figure 1).

The system of governance of agrarian sustainability includes a number of **distinct mechanisms and modes**, which manage behavior and actions of individual agents, and eventually (pre)determine the level of agrarian sustainability:

First, *institutional environment* ("rules of the game") - that is the *distribution of rights and obligations* between individuals, groups, and generations, and the *system(s) of enforcement* of these rights and rules. The spectrum of rights comprises material assets, natural resources, intangibles, activities, working conditions and remuneration, social protection, clean environment, food and environmental security, intra- and inter-generational justice, etc. The enforcement of rights and rules is carried out by the state, community pressure, trust, reputation, private modes, or self-enforced by the agents. A part of rights and obligations is constituted by *formal laws, official regulations, standards, court decisions,* etc. In addition, there are important *informal rights and rules* determined and enforced by tradition, culture, religion, ideology, ethical and moral norms, etc.

Figure 1. Modes and levels of governance of agrarian sustainability



Second, *market modes* ("invisible hand of market") – those are various *decentralized initiatives* of individual agents governed by the free *market price movements and market competition* – e.g. spotlight exchange of resources, products and services; classical, purchase, lease or sell contract; trade with high quality, organic etc. products and origins, ecosystem services, etc.

Third, *private modes* ("private or collective order") – diverse *private initiatives*, and *special contractual and organizational arrangements* such as long-term supply and marketing contracts, voluntary eco-actions, voluntary or obligatory codes of behavior, partnerships, cooperatives and associations, brads and trademarks, labels, etc.

Forth, *public modes* ("public order") – various forms of *public (community, government, international, etc.) interventions* in market and private sector such as public guidance, public regulation, public assistance, public taxation, public funding, public provision, property right modernization, etc.

Fifth, *hybrid forms* – some combination of above 3 modes like public-private partnership, etc.

In a long run the specific system of governance of agrarian sector (sustainability) *(pre)determines the type and character of social and economic development*. Depending on the efficiency of the system of governance, the individual farms, subsectors, regions and countries achieve quite dissimilar results in socio-economic development and environmental protection, and there are diverse levels and challenges in economic, social and ecological sustainability of farms, subsectors, regions and the national agriculture.

II. Analyzing the system of governance of agrarian sustainability

Identification of dominant mechanisms and forms of governance

Governance "needs" are associated with the necessity for building adequate mechanisms and forms for stimulating, coordinating, directing, and harmonizing behavior and actions of involved (interested) agents, for maintaining economic, social, and ecological functions of agriculture, and reviling problems and risks associated with agrarian sustainability and its individual aspects. *It is to be analyzed to what extent managerial needs associated with major aspects of agrarian sustainability are "satisfied" by the existing system of governance.*

Specific forms of governance of agrarian sustainability, which are used in the conditions of a particular farm, ecosystem, region, subsector, or agriculture is to be identified and evaluated. Analysis is to embrace the entire system of governance of agrarian sustainability, and characterize formal and informal institutions, market, private, collective and public forms of governance.

The entire spectrum of *"de-facto"* (rather than "de-jure") rights on material and ideal assets (material and intellectual agrarian and eco-products), natural resources, certain activities, clean nature, food and eco-security, intra- and inter-generational justice, etc., which are related to agrarian sustainability, are to be scrutinized. Furthermore, efficiency of the *enforcement system* of rights and rules by the state, community pressure, trust, reputation, private and collective modes, and by agents themselves is to be analyzed.

Assessment is to be made on which extent the *institutional environment* creates incentives, restrictions and costs for individual agents and society for achieving agrarian sustainability and its

economic, social and ecological dimensions, intensifying exchange and cooperation between agrarian agents, increasing productivity of resource utilization, inducing private and collective initiatives and investments, developing new rights, decreasing divergence between social groups and regions, responding to socio-economic and ecological challenges, conflicts and risks, etc.

Next, various *market forms* of governance of agrarian activity are to be specified, and the extent in which "free" market contributes to coordination (direction, correction) and stimulation of agrarian activity and exchange, and effective allocation and utilization of agrarian (material, finance, intellectual, natural, etc.) resources analyzed. Market governance is effective for an immense portion of activity and transactions in agrarian sector, since it is characterized with many participants, standard products, "free" competition and price formation, high frequency of transactions and low assets specificity. Simultaneously there are numerous *"failures" of market* in governing of critical for agriculture activities such as innovations, long-term investments, infrastructural development, environmental protection, etc. It has to be identified all cases of "market failure" leading to lack or insufficient individual incentives, impossibility for a choice or unwanted exchange, and deficiency for effective maintenance of economic, social and ecological functions of agriculture.

After that it is to be analyzed how and with what forms individual agents take advantage of economic, market, institutional, etc. opportunities, and overcome existing restrictions and risks through choice or design of new (mutually) beneficial *private or collective modes* (rules, organizations) for governing their activity and relationships. Agrarian sector is rich of diverse private organizations of different type based on contract agreements, quasi or complete (horizontal, vertical) integration in land, labor, finance, inputs supply, marketing of products, etc.

Rational (private) agents usually use and/or design such forms for governing of diverse activities and relations, which are the most efficient for the specific institutional, economic and natural environment, and which maximize their overall benefits (production, ecological, financial, transaction, social) and minimize their overall (production, transaction, etc.) costs. However, outcome of private optimization of management and activity not always is the most efficient allocation of resources in society and maximum possible sustainability. There are many instances for *private sector "failure"* in governing of socially desirable agrarian (economic, social, ecological) activity, which are to be identified and analyzed.

After that, analysis is to be made on diverse forms of *public "involvement"* in agrarian governance through provision of information and training for private agents, stimulation and (co)funding of their voluntary actions, imposition of obligatory order and sanctions for non-compliance, direct organization of activities (e.g. state enterprise, scientific research, monitoring, etc.). That analysis also has to assess specific (economic, social, ecological) benefits and the overall costs for individual agents and society related to particular public intervention. There are also cases for *public "failure"* (inactions, wrong interventions, over-regulations, mismanagement, corruption) leading to significant problems for sustainable agrarian development, which are to be identified and analyzed.

A great portion of employed agro-management modes are *integral*, and affect more than one aspects of agrarian sustainability. Besides, improvement of one aspect (e.g. economic) through a particular form often is associated with negative effects for other aspect, component or element (e.g. social, ecological). Thus, it is also to be taken into account *the overall efficiency of a particular*

form, particular "package" of instruments, or the system of governance as a whole. All existing and other practically feasible forms for agro-management are to be identified, analyzed and assessed as well as *complementarities* (mutual or multiplication effects) and *contradictions* between them specified.

Analysis and assessment of the system of governance of agrarian sustainability is a complex, multi-facet, and interdisciplinary process, requiring profound knowledge of advantages and disadvantages of diverse governance modes, and in-details characterization of their efficiency (benefits, costs, effects) in the specific conditions of each agrarian agent, holding, type of farms, ecosystem, subsector, region, country. Here quantitative indicators are often less applicable, and frequently *qualitative analysis* is to be widely applied.

Table 1 summarizes major forms for governing of agrarian sustainability in Bulgaria during post 1989 transition and European integration.

Table 1. Evolution of the system of governance of agrarian sustainability in Bulgaria

Institutions	Private modes	Market Modes	Public modes
Transition period (1989-2000г.)			
Not well defined eco-rights and rights on resource rights, bad enforcement; Lack of concept for sustainability	Provisional lease in contracts for farmland, natural resources and material assets; Unregistered farms; Firms; Cooperative farms; Consumers cooperatives; Interlinked and barter trade; Credit cooperatives	Spotlight trade with free-market prices; Direct marketing; Trade on wholesale and terminal markets; Commodity exchange trade; Trade with informal brands, origins, and ecosystem services; Free (monopoly) agricultural water pricing; Clientalisation	State and cooperative farms; Organization under privatization, liquidation and reorganization; State regulation of wholesale and retail prices; Export licenses and quotas; Import tariffs and duties; State crediting of working capital for grain producers; System of agro-market information; Outdated system of social, economic, and eco-regulations, monitoring and information; Foreign and international programs and assistance projects; State reserve
Pre-accession to European Union (2001-2006г.)			
Better defined and badly enforced rights on agrarian and eco-resources, and contracts; Harmonization with EU legislation and standards	Unregistered farms; Firms; Cooperative farms; Specialized and multipurpose cooperatives; Long-term contracts for marketing against innovation, credit, inputs etc. supply; Water User Associations;	Direct marketing; Wholesale, terminal and exchange markets trades; Trade with formal brands, origins, organic products, and ecosystem services; Free (monopoly) agricultural water	Product subsidies; Preferential credit for investment projects; Preferential short-term crediting; Special Accession Program for Agrarian and Rural Development; Regional programs for agrarian development; Cross-compliance requirement; Quality and eco-regulations, standards, and control agencies; Regulations for organic farming;

	Vertically integrated modes; Professional associations; Water Users Associations; Credit Cooperatives	pricing	Agricultural Advisory Service; Harmonization of standards for quality, safety, ecology etc. with EU; Foreign and international programs and assistance projects; State companies for research, maintenance of eco-systems, etc.; State reserve
EU membership (Since January 1, 2007)			
Well-defined rights and rules, and better enforcement; EU Community Acquis; Collective institutions; Monitoring and sanctions from EU	Unregistered farms; Firms; Cooperative farms; Specialized and multipurpose cooperatives; Long-term inputs supply and marketing contracts; NGOs; Industrial Codes of behavior; Diversification into processing, services and marketing; Credit cooperatives; Water User Associations; Professional producers organizations; Vertically integrated modes; Eco-associations, Eco and other labels; Protected origins and brands	Direct marketing; Wholesale, terminal and exchange markets trades; Trade with formal brands, origins, organic products, and ecosystem services; E-commerce with agrarian products; Free (monopoly) agricultural water pricing; Insurance against natural disasters	Implementation of EU regulations and standards; EU Operational Programs; National programs for eco-management (lands, waters, waste, emissions, etc.); National Program for Agrarian and Rural Development; Direct EU payments; National tops-ups; Export subsidies; Milk quotas; Advisory Service; Regional programs for agrarian development; System of social, economic and eco-monitoring, analysis and control; Protected zones (NATURA); Compensations for natural disasters; Mandatory training for farmers; Income and garbage taxation; Support to trans-border initiatives; Social security and assistance system; State companies for research, maintenance of eco-systems, etc.

Elements and levels of analysis

Analysis of the system and forms of governance is to be done for agrarian sustainability *as a whole*, and for *each of its major Aspects* – economic, social, and ecological.

For every Aspect the analysis further deepens for major elements like *principles and components* of agrarian sustainability which are characterized with significant specificity in terms of governance needs, forms, factors, and efficiency. For instance, the components of governance of ecological sustainability are: (effective) management of soils, waters, atmosphere, biodiversity, landscape, climate, etc.; of economic sustainability: management of production efficiency, adaptability, financial stability, etc. of farms and the sector; of social sustainability: amelioration of welfare of farmers, wellbeing of rural communities, participation in public governance, etc.

Some of the specific forms of governance are relevant only for one aspect of agrarian sustainability, while others are integral and concern two or all of them. A particular mode is to be assessed independently only if it affects significantly social, economic, and/or ecological sustainability. In case that *two or more forms of governance are complementary and impact sustainability jointly, they have to be evaluated together as a "package".*

According to the specific objective, the analysis of the system of governance of agrarian sustainability could (is to) be made at *four different levels* (Figure 1):

- *individual level* - individual agrarian agents: owners of agrarian resources, farmers, hired labor, final consumers, regional and state administration, etc.;
- *collective level* – complex farms (cooperative, partnership, corporation, public), specific organizations (for inputs supply, marketing, innovation, environmental protection, etc.); particular ecosystem or region, etc.;
- *national level* – certain subsector of agriculture, agriculture as a whole;
- *trans-national level* – in regional, European, Asian, or global scale.

For each managerial level the relevant forms and mechanisms of governance of agrarian sustainability are to be identified and analyzed.

As a rule, the effects and costs at a particular level and upper management levels are not simple sums of those of composite elements or lower levels of management. It is to be taken into consideration the *necessity for "collective actions" for achieving a minimal economic, social, ecological and technological size for a positive effect, mutual and multiplication effects and spillovers, contradictory effects and costs, and externalities in different subjects and management levels, in space and time horizon.*

Agricultural farms are the main element of the system of agrarian governance. That necessitates to evaluate the comparative and absolute potential (internal incentives, capability, costs, intentions) of different type of farms (subsistent, semi-market, family, commissioned, cooperatives, corporation, public, hybrid) for: sustainable agriculture and innovation, conservation and restoration of natural resources, long-term investment, minimization of direct and indirect negative effects, dealing with existing challenges, minimizing related costs and risks, effective adaptation, etc. Such an analysis is more complex for farms with complex internal structure (multimember partnerships, agricultural cooperatives, agri-corporations, public farms), which are characterized with division of ownership from management, and multiple owners and hired labor with diverse interests, personal preferences, capability, etc.

For *upper(farm) levels* of management the governance of agrarian sustainability is either integrated in the main mechanisms of influence (e.g. requirement for "eco-compliance", "good agricultural practices, etc.) or it is a specialized structure (e.g. state programs for income support, agro-ecology, mandatory standards for product quality and safety, working conditions, environmental protection, animal welfare, etc.).

Factors of the governance of agrarian sustainability

Evolution of the system of governance of agrarian sustainability and the choice of one or another form by agents depend on diverse *economic, political, institutional, behavioral, technological, international, natural, etc. factors*.

The type and the evolution of forms of agro-management strongly greatly depends on the *personal characteristics* of farmers and other participants – personal preferences, experiences, knowledge, capability, ideology, etc.

Another important factor is *science and technological advancement*, which determines the extent of knowledge of factors and consequences of sustainable development, gives further information on socio-economic and ecological problems and risks (extent of degradation and pollution of natural environment, specific impact of different farms and technologies), and provides opportunities for effective management (improvement, adaptation) of diverse aspects of agrarian sustainability.

The choice of governance form also depends on *market and social demand* (public pressure) for sustainable exploitation of natural resources and balanced agrarian development. Character of that demand depends of general socio-economic development, priority (social, economic, ecological) challenges at the current stage of development, opportunities for profiting and investment, and the overall evolution of institutional environment (rules, standards, public support, etc.).

Another important factor determining the system of governance are *public (national, regional, European Union) policies* as well as implementation of *international conventions and agreements* (WTO, Global Convention of Climate Change, etc.) related to different aspects of agrarian sustainability.

Finally, the system of governance of sustainability is affected by the "*natural" evolution of natural environment* (e.g. global warming, extreme climate, drought, flooding, etc.), which imposes forms facilitating confrontation to negative trends and/or adaptation to natural changes.

In many cases, it is impossible to "influence" economic, social or natural environment through (agro)management, and the *effective adaptation* is the only possible strategy for overcoming the socio-economic and ecological consequences for agriculture. Therefore, the potential of farms and the agrarian sector for adaptation to constantly evolving market, institutional and natural environment is *one of the main factor and indicator for assessment of agrarian sustainability*.

At all analytical levels diverse "external" and "internal" factors of governance of agrarian sustainability are to be identified, and their importance and compatibility at the contemporary stage of development of agriculture, its subsectors, different regions, type of agri-ecosystems, farms, etc. estimated in order to assess adequately efficiency of the system of agro-management and agrarian adaptation.

It is to be taken into consideration that the state and changes in the socio-economic shape of agriculture, rural areas and natural environment are consequences not only of the system of governance in a particular farms, region, subsector, or country, but other factors as well – e.g. overall demographic evolution (aging of population, depopulation of regions), impact of other industries in the country and internationally (competition, financial crisis, contribution to global warming), natural cycles in the evolution of environment, etc. Consequently, the real improvement

or deterioration of the governance of agrarian sustainability in a particular farm, region, subsector, or country could be associated with a lack or controversial change in the level of agrarian sustainability at relevant levels and as a whole. Thus, impacts of all these "external" factors are to be specified and analyzed.

Efficiency of the governance of agrarian sustainability

Efficiency of the system of governance of agrarian sustainability represents the *specific effectiveness* in the specific socio-economic and natural environment of particular farms, eco-system, region, country in relations to *the extent of realization of practically* (technologically, agronomically, socially, politically, economically, financially) *possible level of social, economic, and ecological sustainability of agriculture, and minimization of the overall costs of governance*.

Assessment is to be made on the *overall efficiency* and the *partial efficiency* as the first one includes the system of governance as a whole, while the latter is for the main components (instruments) of governance of social, economic and ecological sustainability.

According to the objectives and period of analysis, and available information, the assessment of efficiency of the system of governance (or some of its element) is for the *potential efficiency* or *actual efficiency*. The former indicate the potential of the system or individual mode to change *behavior, action or contribution* of diverse agents for achieving agrarian sustainability, while the later shows the *ultimate result* (effect, impact, costs) in relation to agrarian sustainability.

Efficiency of the specific system of governance of agrarian sustainability eventually finds expression in certain level and dynamics of social, economic, ecological and integral sustainability of agriculture. Accordingly a *high or increasing agrarian sustainability means a high efficiency of the system of governance,* and vice versa.

Agrarian sustainability and its individual aspects have *many dimensions*. In order to evaluate the efficiency level of the governance it is necessary to work out an adequate system for assessing the economic, social and ecological aspects of agrarian sustainability, and the *integral* sustainability. Such system is presented in the III section of this document.

In each specific moment or a shorter-period of analysis adequate data not always could be found and/or direct links between the system of governance (and its individual forms) and agrarian sustainability determined. Therefore in management practice and design often it is necessary to assess governance system through *potential efficiency*, which allows timely assessment of its level, detecting low "efficiency" and possibility for augmentation, and undertaking measures for improving the existing governing system.

For the potential efficiency a system of appropriate indicators for assessing the potential of individual modes for economically viable, socially responsible, and ecologically sustainable agricultural *activity* (actions, contribution to) is to be used. Table 2 presents incomplete list of indicators for activity, which could be used for assessing potential efficiency of governing forms of economic, social and ecological sustainability.

Table 2. Indicators for assessing potential efficiency of governance forms of agrarian sustainability

Economic Sustainability	Social Sustainability	Ecological sustainability
Share of marketed output; Innovation activity; Extent of implementation of required agro-technique operations; Share of private investment; Participation in public support programs; Amount of public subsidies; Amount of direct foreign investment; Implementation of systems for quality control; Long-term inputs supply contract; Long-term contract for marketing of output and services; Membership in farm organization; Training of personnel; Number of protected origins, brand names, etc.	Social initiatives of farms and agrarian organizations; Extent of implementation of working condition standards; Extent of diversification of activity; Share of women managers of farms; Number of hired labor; Number of collective initiatives; Membership in community and interests groups organizations; Dynamics of labor remuneration; Extent of social assurance; Amount of costs for social actions and development	Implementation of efficient crop rotation; Implementation of Good Agricultural Practices; Introduction of professional codes of eco-behavior and eco-standards; Transition to eco or organic production; Introduced eco-products and services; Amount of costs for environmental protection; Amount and coverage of signed public eco-contracts; Membership in eco-cooperatives and associations; Number and coverage of green and agro-ecological payments; Amount and share of uncultivated farmland; Number of type of animals per unit farmland; Amount of chemicals for crop protection total and per unit of utilized farmland

Absolute and *comparative efficiency* of the governance of agrarian sustainability is to be distinguished. The former represents effectiveness in relation to the state before introduction of a particular form (instruments of governance) or the improvement of entire system. *If sustainability as a result of the new system of governance is improving or its further deterioration is prevented, then the form is (more) efficient,* and vice versa.

Comparative efficiency shows effectiveness (effects, costs) of a particular form or the system of governance in relation to another *alternative form* (system). It is to be assessed if it is at all practically possible an alternative system of management, which is able to increase the level of agrarian sustainability or achieve certain level with less total (private and public) costs. That approach is also used for *comparison of two or more feasible forms in order to select the most efficient one(s).* At management decision stage, the analysis of comparative efficiency are means for selecting the most-efficient option for management of agrarian sustainability (behavior, investment, cooperation, benefits) between institutionally, financially, and technologically possible alternative forms. Therefore, they are tools for increasing the absolute efficiency of the governance.

When the effects, costs and efficiency of individual components of the governance are evaluated it is to be taken into account their *different temporal scale, joitness, complementarity,*

controversies, temporal and social apartness, and potential for development in the conditions of constantly changing socio-economic and natural environment.

Assessment of the *costs of governance* is to include:

- pure *"production" costs and investment*, which are associated with the technology of agrarian production, social development and natural conservation;

and

- *transaction costs*, which are associated with the governance of relations with other agents – e.g. costs of finding labor, partner for cooperation or trade, acquiring information, negotiation, organizational development, registration and protection of rights and products, controlling opportunism, conflicts resolution, adaptation to market and institutional environment, etc.

Assessment of the *public forms* is to include the overall (public *and* private) costs, which usually comprise: direct program costs of tax payers and/or assistance agency (for program management, funding of private and collective activity, control, reporting, disputing implementation), transacting costs (for coordination, stimulation, control of opportunisms and mismanagement) of bureaucracy, private and collective costs for individuals' participation in public modes (for adaptation, information, negotiation, paper works, payments of fees, bribes), costs for community control over and reorganization (modernization, liquidation) of public forms, and (opportunity) "costs" of public inaction (negative effects on economy, human and animal health, lost biodiversity, etc.).

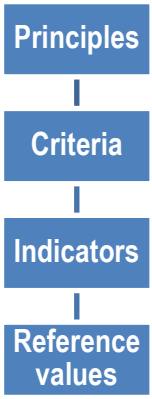
III. Assessing sustainability levels of agriculture

Hierarchical system of Principles, Criteria, Indicators and Reference values

Depending of the goal of analysis, available data, etc., the level of agrarian sustainability is evaluated at *national, regional, sectoral, eco-system, and farm* levels.

For assessing sustainability levels of agriculture at different levels and its economic, social and ecological aspects, a hierarchical system of well determined and selected *principles, criteria, indicators and reference values* is used (Figure 2).

Figure 2. Hierarchical levels of the system for assessing agrarian sustainability



Source: *Sauvenier et al. (2005): Framework for Assessing Sustainability Levels in Belgium Agricultural Systems – SAFE, Belgium Science Policy, Brussels*

Principles are the highest hierarchical level associated with the multiple functions of agriculture. They are universal and represent the *states of the sustainability, which are to be maintained or achieved* in the three main Aspects - economic, social and ecological.

For instance, for the assessment of **"Economic sustainability"** of Bulgarian and Chinese agriculture **four** Principles are specified - "Financial stability", "Economic efficiency", "Competitiveness", and "Adaptability to economic environment"; for the **"Social sustainability"** Principles are **five** – "Welfare of employed in agriculture", "Preservation of farming", "Gender equality", "Social capital", and "Adaptability to social environment"; and for the "**Ecological sustainability" seven** Principles – "Lands quality", "Waters quality", "Efficient energy use", "Biodiversity", "Animal welfare", and "Adaptability to natural environment" (Table 3).

Table 3. Principles, Criteria, Indicators and Reference values for assessing agrarian sustainability in Bulgaria and China

Principles	Criteria	Indicators		Description	Reference Values	
		Sector	Farm		Sector	Farm
Economic aspect						
Financial stability	Reducing dependence on subcidies	Share of direct payments in Net Income	Share of direct payments in Gross Value Added	Share of direct payments in GVA of a sector; Share of direct payments in Net Income of farms	Experts estimate/ Trend <20% - GS >50% - NS	Experts estimate/ Trend <20% - GS >50% - NS
	Sufficient liquidity	Ratio of overall liquidity	Ratio of overall liquidity	Final stocks to intermediate consumption; Ratio short-term assets to short-term obligations	Experts estimate/ Trend >20% - GS <5% - NS	Experts estimate/ Trend >20% - GS <5% - NS
			Ratio of quick liquidity	Short-term receivables + profit to short-term obligations	Experts estimate/ Trend <0,1 - NS >0,8 - HS	Experts estimate/ Trend <0,1 - NS >0,8 - HS
	Minimizing dependence on external capital	Ratio of assets growth to interest paid	Share of owned in total capital	Gross formation to interests paid; Share of owned in total capital	Experts estimate/ Trend <0,2 - NS >1 – HS	Experts estimate/ Average for the sector <10% - GS >90% – HS
Economic effectiveness	Positive or high profitability	Cost - effectiveness	Cost - effectiveness	Net entrepreneurial income to intermediate consumption; Profit to production costs	Experts estimate/ Trend 10% - GS < -10 - NS	Experts estimate/ Average for the sector 10% - GS < -10 - NS
		Profitability of capital	Profitability of capital	Entrepreneurial income to total assets; Profit to invested capital	Experts estimate/ Trend >5% - GS <-5% - NS	Experts estimate/ Average for the sector >5% - GS <-5% - NS
	Maximize or increase labour productivity	Labour productivity	Labour productivity	Gross product/Annual Work Unit	Experts estimate/ Trend >8000 lv - GS <1000 lv - NS	Experts estimate/ Average for the sector >8000 lv - GS <1000 lv - NS

	Maximize or increase land productivity	Productivity of land	Productivity of land	Gross crop output/ha	Experts estimate/ Trend >200 lv - GS <10 lv - NS	Experts estimate/ Average for the sector >200 lv - 0,6 <10 lv - 0
	Maximize or increase livestock productivity	Livestock productivity	Livestock productivity	Gross livestock output/livestock unit	Experts estimate/ Trend >700 lv - GS <50 lv - NS	Experts estimate/ Average for the sector >700 lv - GS <50 lv - NS
Competitiveness	Support or increase of marketed output	Share of marketed output	Share of marketed output	Share of marketed in gross output	Experts estimate/ Trend <5 – NS >90 - GS	Experts estimate/ Trend <5 – NS >90 - HS
	Support or increase of sales	Share of imported product in the total agriculturial productn	Sales growth in the last 3 years	Share of imported in total agricultural output	Experts estimate/ Trend >1 – GS <0,50 - NS	Experts estimate/ Trend >1 – GS <0,50 - NS
Adaptability to economic environment	Sufficient adaptability to market environment	Ratio of gross income to fixed costs	Ratio of gross income to fixed costs	Ratio of gross income to fixed costs	Experts estimate/ Trend >8 – GS <2 - NS	Experts estimate/ Trend >8 – GS <2 - NS
	High investment activity	Growth of long-term assets	Investment growth	Growth in funding for long term material assets in gross capital formation	Experts estimate/ Trend >0,1 - HS <0,01 - NS	Average for the sector/ Trend >0,1 - HS <0,01 - NS
Social aspect						
Welfare of employed in agriculture	Equality of income with other sectors	Ratio of agricultural income to the average income in the country	Ratio of farm income to the average income in the region	Ratio of factor income in the agriculture to average income in the economy; Ratio of net farm income to the average income in the region	Experts estimate/ Trend <50% – NS >100% - HS	Experts estimate/ Trend <25% – NS >100% - HS

	Fair distribution of income in agriculture	Variation of payment of hired labour to factor income	Ratio of payment of hired labour in the farm to average income in the region	Increase in salary of employed in agriculture for 3 years period; Ratio of payment of hired labour in agriculture to the same in the region	Experts estimate/ Trend >1 – HS <0,25 - NS	Average for the sector/ Trend <25% –NS >100% - HS
	Sufficient satisfaction from farm activity	Variation of employed in agriculture to the entire population	Degree of satisfaction from farm activity	Variation of employed in agriculture to the population in the country in last 3 years; Qualitative assessment of the level of satisfaction that farmers receive from agricultural activity	Trend >1 – HS <0,25 - NS	Farmers assessment 5 stage scale
	Satisfactory working conditions	Correspondence to official norms	Correspondence to official norms	Qualitative assessment of the degree of compliance with the official requirements for safe working conditions	Official norms 5 stage scale	Official norms 5 stage scale
Conservation of farming	Preservation of the number of family farms	Number of family farms	Existence of a heritor ready to take over of the farm	Share of family farms in all registered farms in the country; The existence of a family member ready to take over the farm	Experts estimate/ Trend >90% – HS <50% – US	Experts estimate/ Trend >1 – GS 0 – US
		Share of family labour to all employed	Number of family workers	Number of family members involved in farming activities	Experts estimate/ Trend >80% – HS <20% – US	Experts estimate/ Trend >3 – HS <1 – US
		Average age of managers	Age of the manager	Avarage age ot the managers; The age of the owner or the manager of the farm	Experts estimate/ Trend >65 – US <40 - HS	Farmers assessment/ Trend >65 – US <40 - HS
	Increasing the knowledge and skills	Share of trained farmers	Level of participation in the training programs	Number of trained by the farmers extension services	Experts estimate/ Trend 0 – NS 15% - HS	Experts estimate/ Trend 0 – NS 15% - HS
		Share of the managers with secondary and higher education	Level of education of the manager	Share of managers with high and secondary education in all managers	Experts estimate/ Trend >90% – HS <0% - NS	Experts estimate/ Trend >90% – HS <0% - NS

	Maintaining and increasing of agrarian education	Number of employed with special agricultural education	Number of employed with special agricultural education	Share of employees in agriculture with specialized education and/ or professional qualification in all employed	Experts estimate/ Trend >25% – GS <5% - NS	Experts estimate/ Trend >25% – GS <5% - NS
Gender equality	Equality in men-women relations	Share of female farm managers	Degree of participation of women in farm management	Share of women involved in the management function in total number of managers in farm	Half/Trend 50% - HS <15% - NS	Half/Trend 50% - HS <15% - NS
Social capital	Participation in professional associations and initiatives	Share of farmers which are members of professional associations	Number of participations in professional associations and initiatives	Share of farmers who are members of professional associations; Number of participations in professional associations and initiatives	Experts estimate/ Trend >50% – 0,6 <2% - 0	Experts estimate At least 1 member of the family or >5 – GS 0 - NS
		Share of hired labour members of labour unions	Level of hired labour membership in labour unions	Share of membership in labour unions of all employed in agriculture	Experts estimate/ Trend >50% – GS <2% - NS	Experts estimate/ Trend >50% – GS <2% - NS
	Participation in public management	Number of farmers having public positions	Public position	Number of farmers having public positions such as municipal councilor, mayor, parliament, etc.	Experts estimate/ Trend >3% – HS <0,5% – US	Experts estimate/ Trend >1 – HS 0 – US
	Contribution to the development of regions and communities	Share of farm population in general population	Participation in local initiatives	Share engaged in agricultural production in total population ot the country Participation in local initiatives	Experts estimate/ Trend >50% – HS >5 – US	Experts estimate/ Trend >5 participations – GS 0 participations - NS
Adaptability to the social environment	Sufficient ability to respond to the ceasing farming activity and the demographic crisis	Change in gross fixed capital formation to the change in the number of people employed in agriculture	Vacant job positions in the farms to the total number of employed.	Ratio of the change in gross fixed capital formation to the change in the number of employees; Share of vacant job positions in the farm	Experts estimate/ Trend >1,5 – HS <0,5 - NS	Experts estimate/ Trend <10% - HS 100% - US
Ecological aspect						

Air						
Air quality	Maintaining and improving air quality	Reduction of CO_2 emissions	Reduction of CO_2 emissions	Growth of carbon emissions for the past three years	Trend <- 2,2% – HS >0,5 - NS	Trend <- 2,2% – HS >0,5 - NS
Land						
Land quality	Minimizing soil losses	Soil erosion index	Soil erosion index	Share of farmland with strong water and wind erosion in the total agricultural areas	Scientific norm/ Trend 0 – HS 0,7 - US	Scientific norm/ Trend 0 – HS 0,7 - US
	Preservation and improvement of soil fertility	Amount of nitrogen fertilization	Amount of nitrogen fertilization	Amount of nitrogen fertilizers used per unit area	Scientific norm/ Trend 15 kg/dca – HS >30 kg/dca - NS	Scientific norm/ Average for the sector 15 kg/dca – HS >30 kg/dca - NS
		Amount of potassium fertilization	Amount of potassium fertilization	Amount of potassium fertilizers used per unit area	Scientific norm/ Trend 8 kg/dca – HS >20 kg/dca - NS	Scientific norm/ Average for the sector 8 kg/dca – HS >20 kg/dca - NS
		Amount of phosphorus fertilization	Amount of phosphorus fertilization	Amount of phosphorus fertilizers used per unit area	Scientific norm/ Trend 5 kg/dca – HS >15 kg/dca - NS	Scientific norm/ Average for the sector 5 kg/dca – HS >15 kg/dca - NS

	Maintaining a balanced land use structure	Share of arable land (without fallow) in total agricultural areas	Share of arable land (without fallow) in total agricultural areas	% of arable land (without fallow) in total agricultural areas	Scientific norm/ Trend <10% – HS >100% - NS	Scientific norm/ Average for the sector <- 10% – HS >100% - NS
	Preservation of landscape features	Amount of area covering the requirements for "green" direct payments through maintaining landscape elements	Amount of area covering the requirements for "green" direct payments through maintaining landscape elements	Share of areas that meet the requirements for maintaining landscape elements	Planed target/ Trend <0% – NS >5% - HS	Experts estimate/ Trend <0% – NS >5% - HS
Water						
Water quality	Maintaining and improving water quality	Index of groundwater pollution	Index of groundwater pollution	Share of ground waters strongly polluted with Nitrates	Scientific norm/ Trend <30 kg/dca – HS >150 kg/dca - NS	Scientific norm/ Average for the sector <30 kg/dca – HS >150 kg/dca - NS
Energy						
Effective energy consumption	Minimizing the use of conventional energy	Fuel consumption per unit area	Fuel consumption per unit area	Fuel consumption of the agricultural machinery and for production activities per unit area	Experts estimate/ Trend <0,5 l/dca – HS >3 l/dca - NS	Experts estimate/ Average for the sector <0,5 l/dca – HS >2,5 l/dca - NS

		Cost of conventional electric energy per unit of gross output	Cost of conventional electric energy per unit of gross output	Growth in electric energy consumption per unit of production for the last three years	Experts estimate/ Trend <3 lv/ kW/h – NS >8 lv/ kW/h – GS	Trend/ Average for the sector <3 lv/ kW/h – NS >8 lv/ kW/h – GS
Plants and animals						
Biodiversity	Maintaining or enhancing natural habitats	Change in the number of habitats	Change in the number of habitats	Number of habitats in the agricultural areas; Presence of protected habitats on the farm	Experts estimate/ Trend <0,5 – NS >1 – 0GS	Trend/ Average for the sector <0,5 – NS >1 – GS
		Share of agricultural land in NATURA 2000 and other protected areas	Share of agricultural land in NATURA 2000 and other protected areas	Share of agricultural lands within the scope of Natura 2000	Planed target/ Trend <0,7 – NS >1 – GS	Planed target Trend/ <0,7 – NS >1 – GS
	Preserving and improving the biodiversity	Number of cultivated indigenous plant species	Number of cultivated plant species	Number of species cultivated in the farms; Growth in the number of indigenous plant species cultivated by farmers	Experts estimate/ Trend <0,5 – NS >1 – GS	Trend/ Average for the sector <5 dca per species – HS >100 dca per species – US
Animal welfare	Compliance with the principles of animal welfare	Level of compliance with the principles of animal welfare	Level of compliance with the principles of animal welfare	Share of livestock in compliance with the animal welfare requirements; Share of farms in compliance with animal welfare requirements in all livestock farms.	Official norms 0 – NS 100% – HS	Official norms 0 – NS 100% – HS
Implementation of organic production	Increasing the organic production	Share of areas under conversion or certified for organic production	Share of areas under conversion or certified for organic	Share of areas certified for organic production or undergoing conversion	Planed target/ Trend <0,2% – NS >5% – HS	Experts estimate/ Trend <0,2% – NS >5% – HS

			production			
Adaptability						
Adaptability to the environment	Sufficient adaptability to climate change	Variation in the yield of main crops	Variation in the yield of main crops	Variation in crop yields in 5-year period	Experts estimate/ Trend <0,2 – HS >10 – NS	Average for the sector/ Trend <0,2 – HS >10 – NS
		Share of production losses in gross output in livestock sector	Death rate in livestock farms	Ratio of losses to gross output in livestock production; Share of dead animals during the year in the average number of livestock units in the farm during the year	Experts estimate/ Trend <0,01% – HS >1% – US	Average for the sector/ Trend <1% – HS >50% – NS

Criteria are more precise from the principles and easily linked with the sustainability Indicators. They represent a *resulting state of agriculture when the relevant Principle is realized*. For instance, for the Principle "Financial stability" **three** Criteria are identified: "Decreasing dependency from subsidies", "Adequate liquidity" and "Minimization of dependency from outside capital" (Table 3).

Indicators are *quantitative and qualitative variables* of different type (activity, input, effect, impact, etc.), *which can be assessed* in relation to a particular Criterion. For instance, for the Criteria "Decreasing dependency from subsidies" **one** Indicator "Share of direct subsidies in the Net Income" is selected.

The set of indicators is to provide a representative picture for agrarian sustainability in all its Aspects.

Two types (macro and micro) Indicators for assessing the level of agrarian sustainability can be used:

- *Sector level indicators* for agriculture as a whole, for a particular subsector, a specific region, large ecosystem, type of agrarian organizations etc., which are usual based on *aggregated* data from statistical, official report, survey and other sources;
- *Farm level indicators*, which are based on *first-hand* data collected from different type of farms and agrarian organizations. These micro indicators are to give credible insights for agrarian sustainability as a whole and can be analyzed or/and further aggregated for different management levels.

Reference values are the *desirable levels* (absolute, relative, qualitative, etc.) for each *Indicator,* which assist the assessment of the *state and levels of sustainability* as well as give *guidance* for achieving (maintaining, improving) agrarian sustainability. They are determined by the *science, experimentation, statistical, legislative, expert or other appropriate ways*.

As a Reference value it could be used:

- *specific rule or standard* – e.g. application of good agricultural and ecological practices; labor safety standards; standards for animal welfare, etc.
- *formal restriction* – e.g. norm for acceptable pollution of waters, soils and air; ecological limit for Nitrate pollution of lands and waters, etc.;
- *norm for comparison* – e.g. optimum rate for chemical fertilization, pesticides application, water irrigation; extent of conservation of biodiversity, traditions, etc.;
- *minimum or maximum requirement* - e.g. rate of profitability; extend of liability; hired labor compensation; etc.;
- *limits of variation* – e.g. number of livestock on a unit of pasture land; diversity of population of wild birds and animals, etc.;
- *average values* – e.g. age of farm managers; income level in the sector and entire economy; diversity of cultural plants, etc.;
- *trends* – e.g. share of marketed output; growth in productivity, long-term assets etc.; evolution of emissions of greenhouse gasses; level of diversity of insects and plants, etc.;
- *personal or collective preferences* - e.g. satisfaction from farming activity, preservation of traditions, varieties and technologies, etc.

Reference values have quite dissimilar characteristics depending on the Indicators' specific *unit/measure* (%, kg/ha, USD/AWU, utitless Index, qualitative state, etc.), *variations* (binary, multiple scales), *importance* for determine the overall sustainability level (threshold), etc.

The content and the importance of the specific Principles, Criteria, Indicators and Reference values are *formulated and selected* by the *leading experts* in the area. The system is to be *permanently updated* according to the development of science, measurement and monitoring methods, available information, industry standards, social norms, etc., and *adapted* to the *needs of evaluators* and *particularity of the assessed system* (subsector, region, etc.).

A list with the potential Principles, Criteria, Indicators and Reference values for the specific conditions of Bulgarian and Chinese agriculture was prepared by project teams, and based on consultations with the leading experts in the area, available academic publications, official documents, and practical experiences in both countries and around the globe.

The experts discussed, complemented and evaluated the importance of the Principles, Criteria, Indicators and Reference values for the contemporary conditions of the development of Bulgarian and Chinese agriculture. The most adequate ones have been selected using following criteria: *relevance to reflect sustainability aspects, discriminating power in time and space, analytical soundness, intelligibility and synonymity, measurability, governance and policy relevance, and practical applicability.* The goal was to select a balanced system with sufficient for each aspect of sustainability, but not to many indicators which would guarantee the efficiency of use.

The generic system of the Principles, Criteria, Sector and Farm Levels Indicators, and Reference values for assessing agrarian sustainability in Bulgaria and China is presented on Table 3. *The later suggests the specific Reference values for the Bulgarian conditions for High (HS) or Good Sustainability (GS) as well as for Unsatisfactory (US) or Non-sustainability (NS).* ***Chinese experts have to specify appropriate Reference values for the conditions of Chinese agriculture.***

Calculation, evaluation and presentation of assessments

According to the specificity of Bulgarian and Chinese agriculture, selected case study regions and/or subsectors, type of farming organizations etc. *certain Indicators can be modified, replaced or abandoned by the country's teams. The same applies for the Reference Values* employed in the sustainability assessment.

An *equal approach for collecting data and calculation* of Indicators is to be secured in order to guarantee an adequate assessment and comparison.

The same **moment of sustainability assessment** is to be used in both countries - *December 31, 2015***.** Some Indicators require **one year data** while others **three year data** for calculating average values or identify the trends – in the former case period January 1 – December 31, 2015 is to be used while in the later the period January 1, 2013 – December 31, 2015.

After the qualitative or quantitative value of every Indicator is determined, it is to be compared with the relevant Reference Value. *A level of a particular Indicator on, within or close to the Reference Value(s) means a good or high sustainability*, and vice versa.

The Experts determined different *qualitative states of sustainability* (*indicator's ranges for* ***high, good, satisfactory, unsatisfactory,*** *or* ***non-sustainability****) for diverse deviations of the Indicators values from the Reference values* for the conditions of Bulgarian and Chinese agriculture.

Some (mostly farm level) Indicators are *binary* representing a *distinct state* of (non)sustainability and having only **two** Reference values (*Sustainable, Unsustainable*) – e.g. "Preservation of local habitats", "Membership in professional organizations", "Compliance with animal welfare standards", etc.

Most of the Indicators could *vary in a certain range* and there are a number of Reference values for indicating diverse **levels of sustainability** - *High, Good, Satisfactory, Unsatisfactory* or state of *Unsustainability*. Specific *sustainability function* is quite different for each Indicator and has to be specified by the experts in the field.

Table 4 gives an example with assessment of sustainability level with four Indicators – "Profitability", "Nitrate application", "Satisfaction from farming activity", and "Membership in professional organizations" (Table 4).

Table 4. Scales for assessing sustainability levels for diverse values of Indicators "Profitability", "Nitrate application", "Satisfaction from farming activity", and "Membership in professional organizations"

Indicators	Levels of sustainability according to Indicator's value				
	High	**Good**	**Satisfactory**	**Unsatisfactory**	**Unsustainable**
Rate of profitability – *sectoral level*	Above 8%	5-8%	2-4%	0-1%	Negative
Rate of profitability – *farm level*	Above average for the sector/region	Average for the sector/region	Up to 10% below the average for the sector/region	10-20% below the average for the sector/region	More than 20% below the average for the sector/region
Nitrate application - *sectoral level*	100-140 kg/ha	85-100 kg/ha or 140-155 kg/ha	70-85 kg/ha or 155-165 kg/ha	50-70 kg/ha or 165-180 kg/ha	Under 50 kg/ha or above 180kg/ha
Nitrate application - *farm level*	Optimal for the farm	Average for the sector/region	Up to 10% below or above the average for the sector/region	10-20% below or above the average for the sector/region	More than 20% below or above the average for the sector/region
Satisfaction from farming activity – *sectoral* and *farm*	High	Good	Middle	Low	None

levels					
Membership in professional organizations *sectoral level*	Above 90%	50-90%	15-50%	Less than 15%	0%
Membership in professional organizations *farm level*	Yes	-	-	-	No

Suggested approach let us *determine* and analyze the *sustainability level* for each Indicator as well as undertake *measures for the improvement of sustainability for areas (Indicators) with inferior values.*

For instance, all Indicators for the sustainability in a particular (livestock) subsector may be good but for the compliance with the animal welfare norms unsatisfactory. Thus putting efforts (measures) to introduce and enforce the animal welfare standards in the livestock holdings would enhance the ecological and the overall sustainability in that subsector.

Accordingly, appropriate *governance form(s)/instrument(s)* are to be considered to enhance sustainability in that direction though: training of farmers on animal welfare standards, appropriate transition period for full compliance with animal welfare norms, public financial support, sharing positive experiences, better enforcement and sanctions for noncompliance, etc.

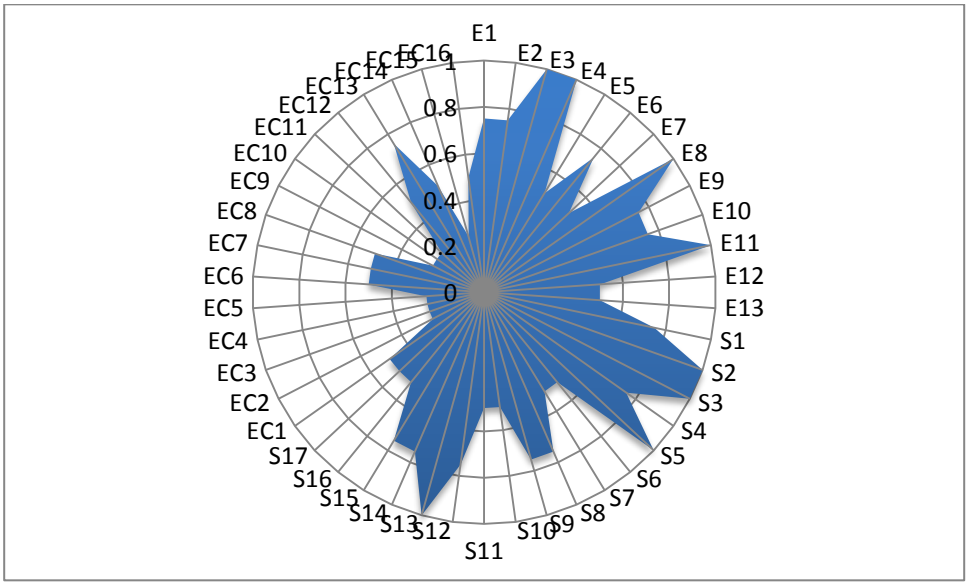
In order to present visually in a graphic form diverse aspects and dimensions of sustainability of a particular farm, and integrate different type of indicators for a particular Criterion, Principle and Aspect, the qualitative levels of each indicator are transformed into (unitless) *Index of Sustainability* (IS_i) using Table 6.

Table 6. Scale for transformation of qualitative levels into Index of Sustainability for a particular indicator

Levels of sustainability	Index of Sustainability (IS_i)
High	1
Good	0,75
Satisfactory	0,50
Unsatisfactory	0,25
Non-sustainable	0

Figure 2 presents a result of the assessment of the sustainability level in a *case study* region in Bulgaria (Figure 2). It is apparent that in order to increase the overall sustainability of regional agriculture it is to improve significantly the environmental protection activities. The later implies both a change in the strategy of farms as well as targeted support policy of the state for stimulation of the eco-activity (function) of agriculture.

Figure 2. Level of agrarian sustainability in a case study region in Bulgaria for all Indicators



Integral assessment

Very often individual Indicators for each Criterion and/or different Criteria, Principles and Aspects of sustainability are with unequal, and frequently with controversial levels. That significantly hardened the overall assessment and requires an *integration of Indicators*.

The experts decided that the **weight** (importance) *are **equal*** for each *Aspects of sustainability in the Integral Sustainability Index, and for each Principle in the Integral Index of a particular Aspect, and for each Criterion in the Integral Index of a particular Principle, and for each Indicator in the Integral Index of a particular Criterion.*

The Integral Index for a particular Criterion (IS_c), Principle (IS_p), Aspect of sustainability (IS_a) or Overall level (IS_o) is an *arithmetic average of relevant Indicators and Indices:*

$IS_c = \sum IS_i/n$ (n – number of Indicators)

$IS_p = \sum IS_c/n$ (n – number of Criteria)

$IS_a = \sum IS_p/n$ (n – number of Principles)

$ISo = \sum IS_a/3$

Integration: *Integral Index 1 or close to 1 means a high sustainability, Index around 0.75 means good sustainability, while Index 0 or close to 0 a state of non-sustainability.*

For interpretation of the integral assessments the **Table 7** could be used.

Table 7. Limits for grouping of integral assessments of agrarian sustainability

Integral Index of Sustainability ($ISI_{p,a,o}$)	Sustainability level
0,86 - 1	High
0,63 - 0,85	Good
0,36 - 0,62	Satisfactory
0,13 - 0,37	Unsatisfactory
0 - 0,12	Non-sustainable

Figure 3 represents the integral assessment of a *case study* region for all Aspects of sustainability. It is apparent that agriculture in the evaluated region is with a good overall sustainability, which is determined by the good economic and social sustainability. At the same time the evaluated region is with a satisfactory integral ecological sustainability, which requires taking measures for improvement of eco-performance of holdings and the sector.

Figure 3. Integral level of economic, social and ecological sustainability of agriculture in a case study region in Bulgaria

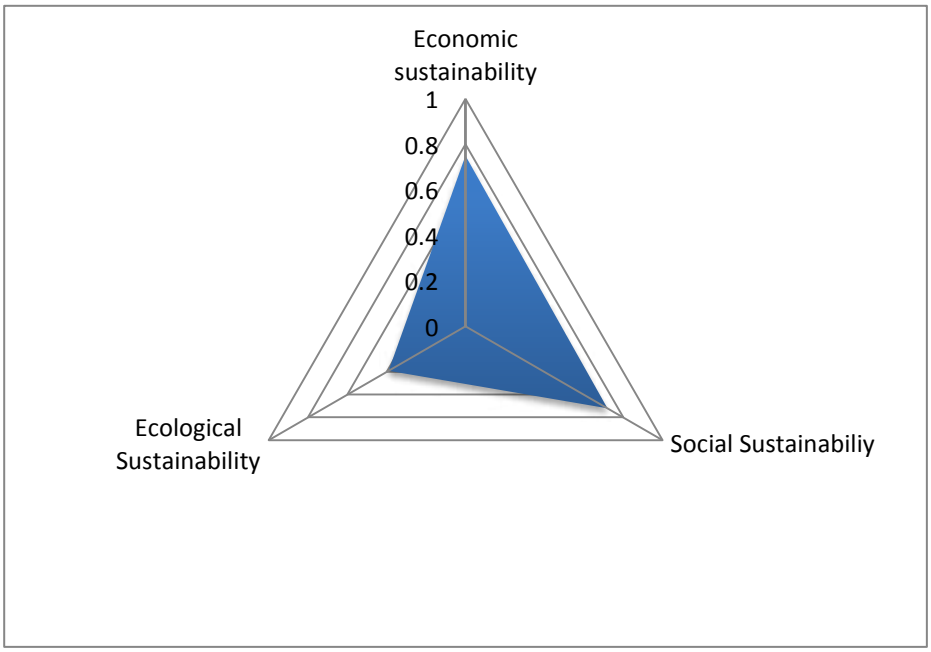
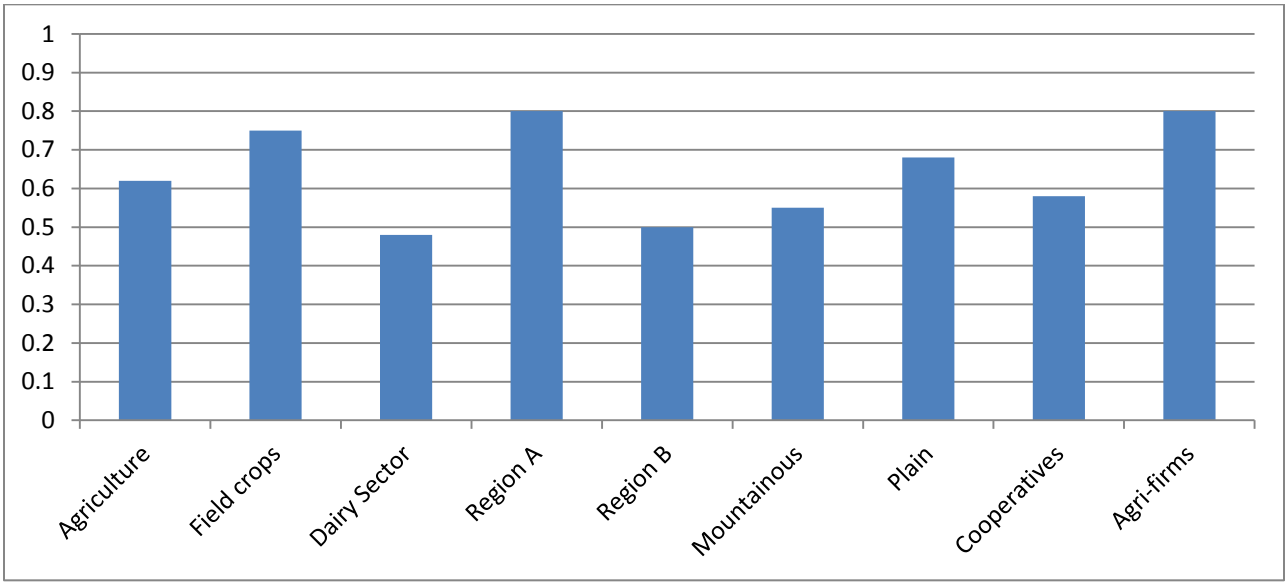


Figure 4 represents a *tentative* assessments of Integral Index of Sustainability in Bulgarian agriculture, two representative subsectors (Field crops and Dairy), two representative regions (A and B), two typical eco-systems (Mountainous and Plain), and two type of farming organizations (Cooperatives and Agri-firms) (Figure 4). It is obvious that in order to increase agrarian sustainability in the country it is to take measures to improve sustainability level of dairy sector, regions of type B and in mountainous areas, and cooperative farming, all which diminish the overall sustainability of national agriculture.

Figure 4. Integral Indexes of Sustainability for Bulgarian agriculture



It is well known that every integration of indicators of different type is associated with much *provisionality*, as it implies certain *"interchangeability"* of the individual dimensions of sustainability. In particular, it presumes, that a low level of sustainability or a state of non-sustainability for one (several) Indicator(s) could be "compensated" with a higher value of another (other) Indicator(s) without a change in the integral level. However, the later not always is true for certain Indicators for economic sustainability in a short-term, as well as in a longer-term for many of the indicators for social and ecological sustainability.

Therefore, *experts are to specify the Indicators for which unsatisfactory or non-sustainable level predetermines the overall (unsatisfactory or non-sustainable) level for relevant Criteria and Principle.* For instance, if profitability is 0 or negative the sector is not economically viable and thus with unsatisfactory economic sustainability of unsustainable economically.

The integration of Indicators does not diminish the analytical power since it makes it possible to compare sustainability of the diverse aspects of agrarian sustainability. Besides, since the assessment of the sustainability levels for the individual Indicators is a (pre)condition for the integration itself, the *primary information always is available and could be analyzed in details if that is necessary.*

Depending on the final users and the objectives of the analysis the extent of the integration of Indicators is to be differentiated. While farm managers, investors, researchers etc. prefer detailed information for each Indicator and Criterion at low (farm, eco-system, etc.) level, for decision-making at the higher (policy, administration) level are needed more aggregated (sectoral, sub-sectoral, regional, etc.) data for overall sustainability level and for major Aspects and Principles of sustainability.

Reference:

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.