Environmental management in agriculture - mechanisms, forms and efficiency

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ENVIRONMENTAL MANAGEMENT IN AGRICULTURE – MECHANISMS, FORMS AND EFFICIENCY

This book suggests a new holistic framework for assessment and improvement of environmental management in agriculture, and analyzes the evolution of the system of agro-eco-management in Bulgaria, and assesses the impacts and responses to the 2011 Great East-Japan earthquake and Fukushima nuclear disaster. It incorporates an interdisciplinary New Institutional Economics approach (combining Economics, Organization, Sociology, Law, Behavioral and Political Sciences), and presents a modern framework for analyzing and assessing the environmental management in agriculture. It presents evolution and assesses the efficiency of diverse management forms and strategies for environmental management in Bulgarian agriculture during the post-communist transformation and the European Union integration, and evaluates the impacts of the EU Common Agricultural Policy on environmental sustainability of farms of different juridical type, size, specialization and location. It identifies and assesses the forms, factors, efficiency and perspectives of environmental management in the "eco-active" farms of different type and location in Bulgaria. It evaluates the multiple impacts of the Great East Japan Earthquake and the Fukushima nuclear disaster on the Japanese agriculture, and presents the process of restoration and adaptation of the sector to consequences of that first in the world history triple environmental disaster. Book would be helpful for a wide range of readers (researchers, educators, students, experts, farmers, civil servants, policy makers, interest groups, non-governmental and international organizations) who are involved or want to understand the eco-managment in agriculture.

Contents

Introduction

A significant amount of natural resources (lands, waters, biodiversity, ecosystem services, etc.) are part of the agricultural systems. Modern agriculture significantly affects the state and the sustainable exploitation of natural resources being a major factor for environmental degradation (pollution, destruction, extortion) as well an important contributor for the conservation and improvement of natural environment. Consequently, the issues associated with the effective governance for sustainable exploitation and conservation of natural environment in agriculture are among the most topical in public, political, business and academic debates around the globe (Baba *et al.*; Bachev; COST; Dobbs and Pretty; Dugos and Dupaz; Defrancesco *et al;* EC; Farmer; Hagedorn; Hart and Latacz; McCanna *et al.*; Mitchell; Peerlingsa and Polman; Reed; Scozzari and Mansouri; UN).

Despite its importance, the research on governance mechanisms and strategies for environmental management in agriculture is at the beginning stage due to the “newness” of the problem, and the emerging new challenges and risks in recent years (inter-sectors competition for natural resources, global climate change, depletion of non-renewable environmental resources, environmental disinters, etc.), and the fundamental development of the economic theory in the last three decades, and the “lack” of long-term experiences and relevant data for the process and efficiency, etc.

Most studies are focused on the specific aspects of natural resource management (soils, waters, biodiversity, agro-ecosystems services, etc.) without studying their relations, complementarities and contradictions. What is more, they are typically restricted to a certain form of governance (eco-product, eco-contract, eco-cooperative, industry eco-initiative, public eco-program, etc.), or a specific type of farm (family, agri-firm, cooperative, etc.), or management level (farm, ecosystem, national, etc.), or a particular location

(region, ecosystem, etc.), or particular type of environmental problem (natural disaster, desertification, climate change, etc.). Usually they are concerned with the “pure” and formal management forms and mechanisms, while various (and often more efficient) informal and complex forms (integral, interlinked, multilateral, multilevel, etc.) are broadly ignored.

Besides, uni-sectoral analyses are typically used separating the governance of farming from the management of the overall households and rural activities. Moreover, “normative” (to some “ideal model’ or the “model in another country”) rather than a comparative institutional approach between feasible alternatives in the specific socio-economic and natural environment of a certain farm, region, sector, or country is employed. Likewise, the significant social costs associated with the governance, known as transaction costs, are not (or only partially) taken into consideration.

Furthermore, unidisciplinary approaches dominate, and the efforts of researchers in economics, organization, law, sociology, agronomy, ecology, technology, and behavioral and political sciences are rarely united to deal with that complex matter. Lastly, there are few studies on specific institutional, economic, ideological, cultural, natural, etc. factors responsible for the big variation among countries, regions, industries, and organizations of agricultural activity.

Consequently, the understanding on the institutional, behavioral, technological, ecological, international, etc. factors of the environmental management in agriculture is impeded. Neither the spectrum of feasible formal, informal, market, private, public, integral, multilateral, transnational, etc. modes of governance can be properly identified, nor their efficiency (potential and limits), complementarities, conflicts, and prospects of development correctly assessed. All these restrict the capability to assist the improvement of public policies, strategies, and modes of intervention, and to support individual, business and collective strategies and actions for effective natural conservation.

This book suggests a new holistic framework for assessment and improvement of environmental management in agriculture, and analyzes the evolution of the system of agro-eco-management in Bulgaria, and assesses the impacts and responses to the 2011 Great East-Japan earthquake and Fukushima nuclear disaster.

First, it incorporates an interdisciplinary New Institutional Economics approach (combining Economics, Organization, Sociology, Law, Behavioral and Political Sciences), and presents a modern framework for analyzing and assessing the environmental management in agriculture.

Second, it presents evolution and assesses the efficiency of diverse management forms and strategies for environmental management in Bulgarian agriculture during the post-communist transformation and the European Union (EU) integration, and evaluates the impacts of the EU Common Agricultural Policy (CAP) on environmental sustainability of farms of different juridical type, size, specialization and location.

Third, it identifies and assesses the forms, factors, efficiency and perspectives of environmental management in the “eco-active” farms of different type and location in Bulgaria.

Forth, it evaluates the multiple impacts of the Great East Japan Earthquake and the Fukushima nuclear disaster on the Japanese agriculture, and presents the process of restoration and adaptation of the sector to consequences of that first in the world history triple environmental disaster.

Finally, it suggests recommendations for improvement of public policies, strategies and modes of intervention for effective environmental protection and agrarian adaptation.

I am enormously thankful to LAP LAMBERT Academic Publishing for giving me the extraordinary opportunity to present my work on environmental management in agriculture to the larger world audience. I am also grateful to the Japan Foundation, which supported financially the study on impacts of the Great East Japan Earthquake on Japanese agriculture.

Part 1. Framework for analyzing environmental management in agriculture

Definition and scope of analysis

Unlike the literal meaning of these words the *environmental management* means the management of the activities and the behavior of individual agents for restoration, preservation and improvement of natural environment and its individual components (soils, waters, landscape, atmosphere, biodiversity, climate, eco-system services).

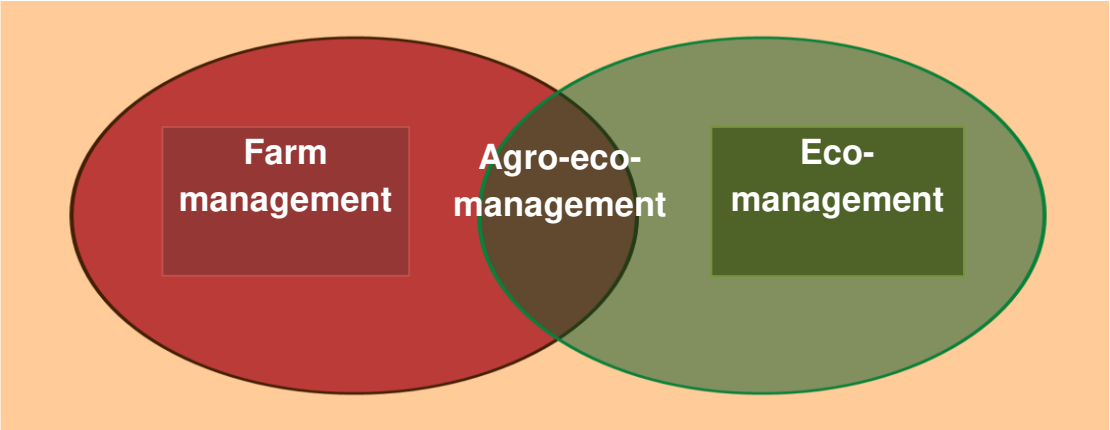
Restoration, maintaining and amelioration of the state of natural environment and its individual components requires an effective *social order* (governance) regulating behavior and relations of the various agents related to the natural environment - a system of motivation and coordination of (eco)actions which is to induce appropriate behavior[1] of individuals and coordinated actions at group, regional, national, and transnational levels [Bachev, 2010].

The environmental management in agriculture (or agro-eco-management) comprises the environmental management associated with the agricultural (food, fibber, bio-fuel, raw material, diverse eco-system and related services, etc.) production. It (is to) involves management of the activities, relations, and impacts of diverse *agrarian* (farm managers, resource owners, agricultural labor, etc.) and *non-agrarian* (upstream and down-stream businesses, consumers, residents, interest group, etc.) agents.

[1] "pro-environmental" actions, "anti-environmental" inactions.

A significant part of the agricultural production is managed and carried out by different type of farms[2] – individual, family, cooperative, corporative, public, hybrid, etc. Therefore, the agro-eco-management is to be studied as an integral part of the system of farm management (along with the management of production, labor, finance, innovation, inputs supply, marketing) and the system of eco-management in the society (Figure 1).

Figure 1. Scope of agro-eco-management



In some instances, the eco-activities constitute a relatively independent and/or a specialized part of the farming activity as in the case of environmentally friendly collection, storage and disposal of garbage, organic production, etc. However, very often the eco-management is an integral part of the farm and/or its individual functional areas (investment, labor, land management, crop production and protection, etc.).

That necessitates to evaluate the comparative and absolute potential (internal incentives, capability, costs, intentions) of different type of agricultural farms (subsistent, family, commissioned, cooperatives, corporation, public, etc.) for eco-friendly production and innovation,

[2] In modern agriculture there are more and more instances where agricultural production is entirely integrated by outside agent (a processor, retailer, restaurant chain, exporter, etc.) and carried as a part of a larger (industrial, internal input supply, etc.) activity and/or strategy. Here the “farmers” are turned into hired labor and take part in the “internal” division of labor of a major non-agricultural activity.

conservation and restoration of natural resources, long-term eco-investment, minimization of direct and indirect negative eco-effects, dealing with major eco-challenges, minimizing eco-costs and risks, effective adaptation, etc.

Such an analysis is more complex for the farms with complex internal structure (multimember partnerships, agricultural cooperatives, agrarian corporations, public farms), which are characterized with the division of the ownership from the management, and the multiple owners and hired labor with diverse interests and eco-culture.

For the upper(farm) levels of management the eco-management 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 (programs for agro-ecology, mandatory eco-standards, etc.).

The entire “system” of agro-eco-management is to be analyzed including: various agents participating in the agro-eco-management; and diverse mechanisms and forms governing the behaviors and relationships of these agents.

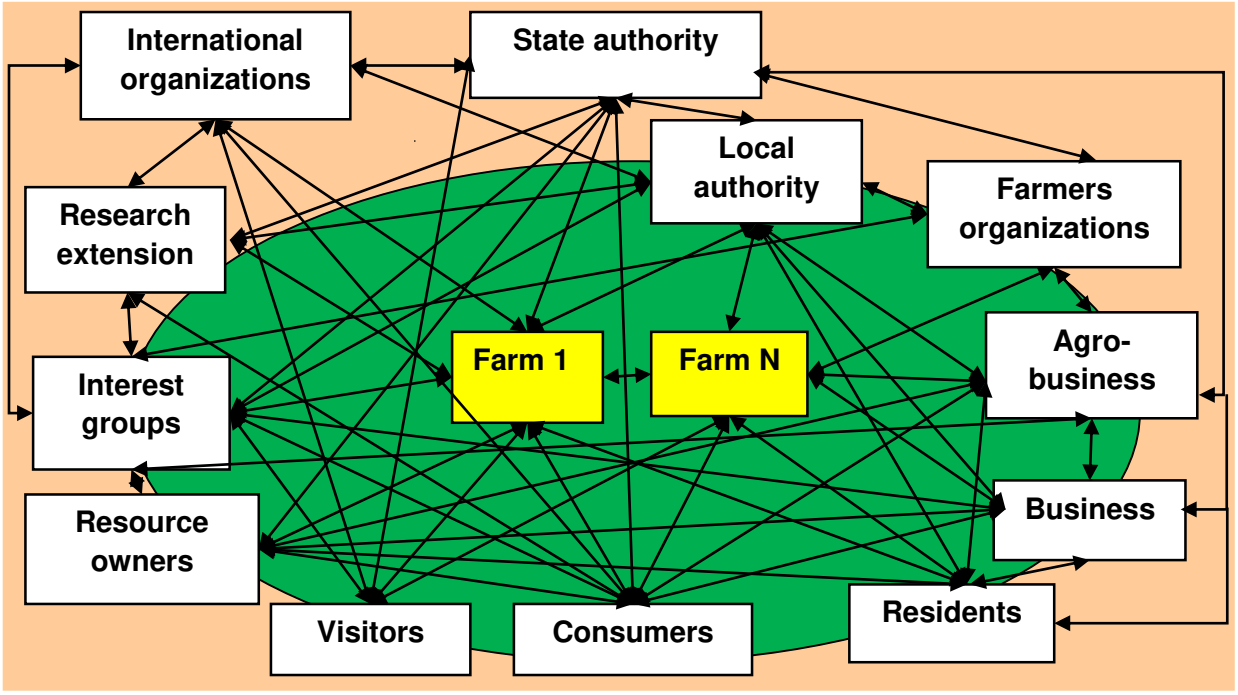
Agents, strategies, and needs of agro-eco-management

The environmental protection, restoration and improvement requires an effective private, collective and public order, which is to govern individual (agrarian) agents behavior and their relations with other agrarian agents (farm managers, resource owners, hired labor) and non-agrarian agents (agrarian and related business, residents of rural areas, consumers of farm products and services, interest groups, state and local authorities, international organizations, etc.).

Therefore, a critical moment of the analysis of the agro-eco-management is to identify the personality of agents of agro-eco-management and the specific character of their relations, interests, objectives, power positions, dependence, effects, and conflicts.

For instance, Figure 2 presents agents and relations in the agro-eco-management at the ecosystem level (Figure 2).

Figure 2. Agents of agro-eco-management at ecosystem level

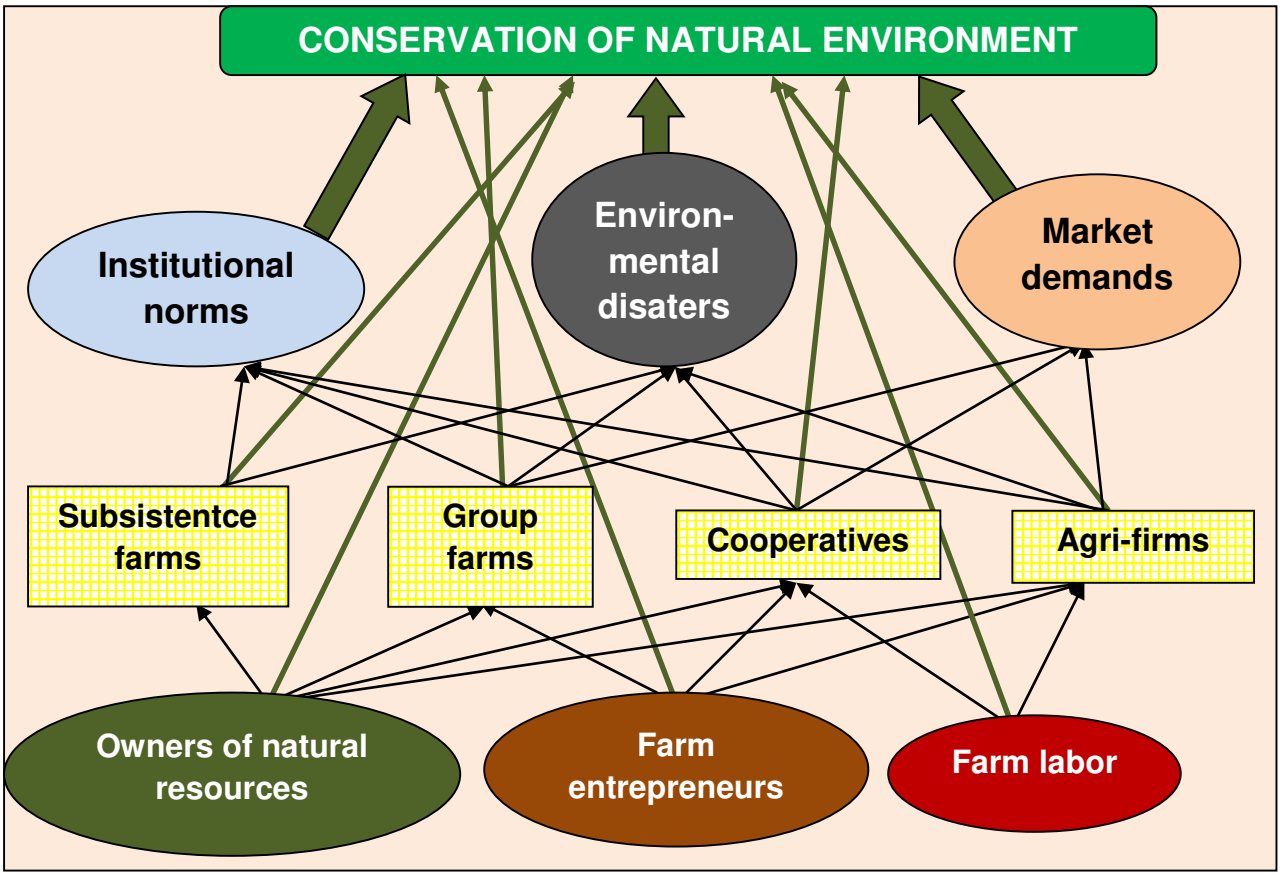


Individual agrarian agents (farmland owners, farm entrepreneurs, farm labor, etc.) may have quite diverse interests and strategies in terms of environmental protection, restoration and improvement (Figure 3). All these interests and strategies are to be carefully analyzed and identified.

According to their ideologies and environmental ethics, the awareness of environmental risks and problems, the managerial and technical ability, the financial capability, some individual agents may have direct natural resources conservation goals. Accordingly these “green” individuals will pursue natural resources conservation strategy in their everyday life and activity. For instance, for the natural resource owners the sustainable exploitation (conservation) of owned assets is often a primary concern and often it determines the type of farms they set up, and other ventures they participate (e.g. group or cooperative farms), or lease out contracts they sign. Similarly, a pro-environment farm entrepreneur establishes green (individual,

cooperative, firm) farming structure following own or collective voluntary eco-code of behavior. Finally, farm labor may seek employment in a green cooperative or companies with eco-social responsibility.

Figure 3. Environmental management strategies in agriculture



Furthermore, in recent years there have been developed a great number of farms and farming enterprises with a primary or a major mission the environmental conservation and improvement. For instance, in many EU countries the environmental cooperatives have been very popular, there are numerous green agri-firms, etc.

Nevertheless, most farm structures in the modern world have other goals and pursue other (than natural environment conservation) strategies – e.g. the agri-firms are “profit-oriented” and their primary strategy is to maximize profits for shareholders; the cooperatives are “member-oriented” and carry out strategy to increase benefits for members, etc.

However, there have been increasing consumer demands for the environmental conservation, and for the related organic, eco- and specific products from agriculture. Consequently, many market-oriented farms change their behavior in order to meet this growing market demand while keeping traditional (profit-making) strategy.

Furthermore, in modern societies there are a great number of formal and informal norms and restrictions related to the exploitation of natural resources. For instance, in the EU there is a huge body of environmental legislation and various environmental conservation programs. These institutional rules impose individual agents and farming structures mandatory norms and/or offer incentive to join voluntary schemes aiming at limiting environmental pressure, securing sustainable exploitation of natural resources, preservation of biodiversity, reducing pollution and emission of harmful substances, etc. This new public order modifies the individual strategies and behavior, and eventually leads toward conservation of natural environment.

Finally, there are numerous natural (floods, droughts, mudslides, tsunami, earthquakes, etc.) and man-made (industrial, pollution, etc.) environmental disasters which all require some actions of affected and interested agents – environmental restoration, adaptation, improvement.

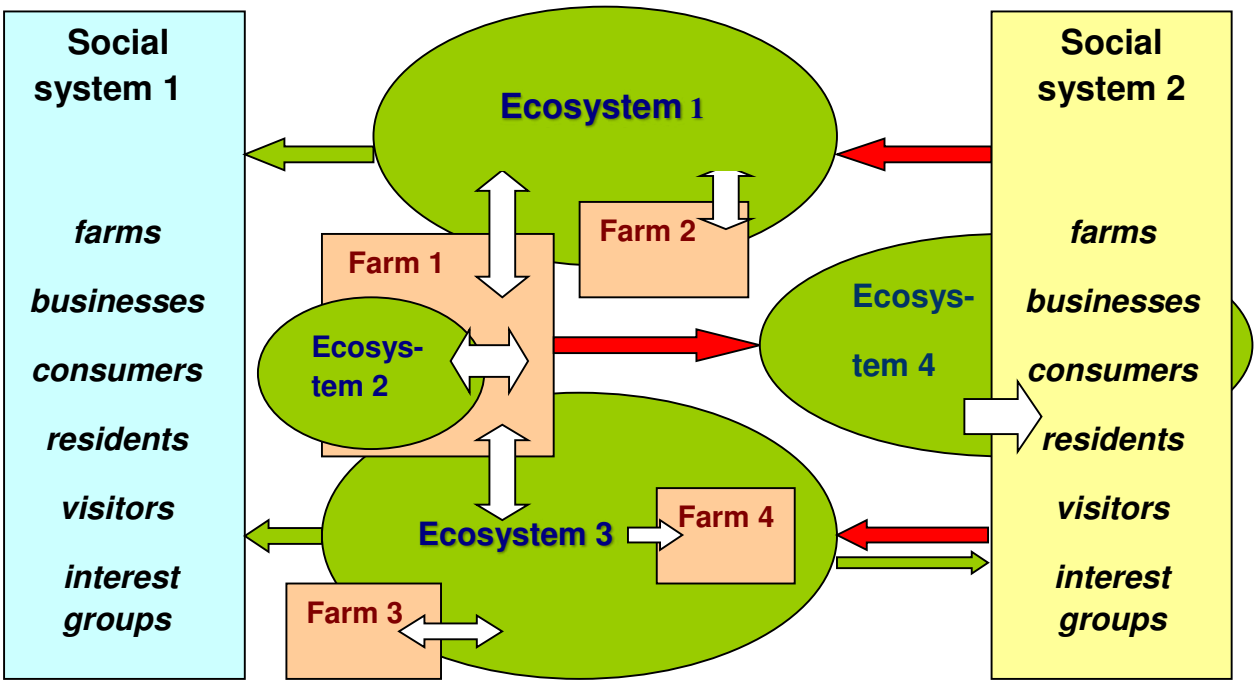
Thus achieving the effective natural environment conservation in agriculture will always be result of implementing of *multiple* voluntary or induced by market, community, public policies etc. individuals, farms, businesses, consumers, and public strategies.

The next step in the analysis is to define the “needs” for eco-management. They are associated with the necessity for building mechanisms for reviling the eco-problems and risks, stimulation of appropriate eco-behavior and cooperation, exchange of information, conflict resolution, payback and minimizing eco-costs, etc. of participating agents.

According to (awareness, symmetry, strength, harmonization costs of) the interests of agents associated with the natural environment there are different needs for management of actions.

Figure 4 illustrates diverse managerial needs with an example with the agro-ecosystem services (Figure 4).

Figure 4. Management needs for effective supply of agro-ecosystem services



Here the Farm 1 has to manage its *efforts* and *relations* with the Farm 2 since both receive services from the Ecosystem 1 and affect (positively or negatively) the service supply of that ecosystem.

Besides, both farms are to manage their relations with the consumers of services from the Ecosystem 1 (agents in Social system 1) to meet the *total demand* and *compensate costs* for the maintaining ecosystem services to that direction. In addition, the Farms 1 and 2 have to coordinate efforts with the agents in the Social system 1 to *mitigate conflicts* with the agents in the Social system 2 (affecting negatively services of the Ecosystem 1).

Furthermore, the Farm 1 is to manage its relations with the Farm 3 for the effective service supply from the Ecosystem 3, and manage its interaction with the Ecosystem 2. Moreover, the Farms 1 and 3 have to manage their relations with the Farms 4 and the agents from the Social system 1 (consumers of the services of the Ecosystem 3) and the Social system 2 (consumers and destructors of the Ecosystem 3 services).

Finally, the Farm 1 affecting adversely the Ecosystem 4 services is to manage relations with the agents in the Social system 2 (consumers of the Ecosystem 4 services) to reconcile conflicts and secure effective flow of the ecosystem services.

Therefore, the Farm 1 is to be involved in *seven* systems of governance in order to assure an effective supply of the services from the ecosystems of which it belongs or affects.

Next, it is to be analyzed the extent in which the management needs for the environmental management in agriculture is "satisfied" from the existing governance forms and mechanisms.

In certain cases, the eco-management in agriculture is entirely archived through the individual actions of autonomous agents (farms) within the Sector "Agriculture". For instance, a good care and sustainable use of privately owned agricultural lands and water sources are typical in a family farm since they are integral part of the strategy for sustainable development of that family enterprise. Similarly, many group farms have a primary goal for sustainable development or are set up as green farms. Even when the individual strategies of farm's components (e.g. a hired labor, a family or a group member) do not coincide with the overall farm strategy, the effective management (the "internal order") is able to achieve the goals for farm's sustainable growth.

However, the effective management of agro-eco-activity often requires complex and polyvalent forms, which have to be identified and analyzed. For instance, the inclusion of a farmer in the "organic products" chain coordinates

well relations between the producers and the final consumers. Nevertheless, the positive eco-effect could be minor, if simultaneously a form for the coordination of relations (collective action) with other farmers in a particular region or eco-system is not established to achieve the minimum (optimal) required scale for positive eco-impact.

The effective environmental management often necessitates concerted (collective) actions and eco-strategies of a number of farms as it is in the case of sustainable use of a common pasture and limited water supply, protection of local biodiversity, effective provision of agro-ecosystem services, etc.

Furthermore, modern farming activity is often profit-oriented and frequently associated with significant positive and/or negative externalities. Implementation of individual strategies of different farmers not always leads to overall conservation of natural resources. That requires a “common” strategy and managing relations (cooperation, reconciling conflicts, recovery of costs) between different farms, and increasingly between the farmers and non-farmers.

For example, the adverse effects of agricultural activities on water and air quality are often felt by the residents and businesses in neighborhood and/or more remote regions. Similarly, the agricultural contribution to the ecosystem services benefits a large number of residents, visitors, consumers, businesses, and interest groups requiring certain collective actions for a sustainable supply. In all these instances, the environmental management goes beyond the simple (technical, agronomic, ecological) “relations with the nature” and embraces the governance of relations and collective actions of agents with diverse interests, power positions, awareness, capabilities etc. in large geographical, sectoral, and temporal scales [Bachev 2011a].

What is more, modern environmental management is associated with growing needs for the “additional” actions (monitoring, coordination, investments, etc.) and integral management of natural resources and eco-risks at national and progressively at transnational scale. The later include the

water and garbage management, biodiversity conservation, climate change, etc. issues demanding effective regional, nationwide, international, and global governance.

For instance, the effective management of the biodiversity “component” of the natural environment includes multilevel (individual, sectoral, national, EU, worldwide) and multilateral initiatives of numerous farmers, businesses, consumers, residents, interests groups, etc. The same is true for the waters, lands, air, ecosystem services, etc. management.

Thus the effective conservation of natural environment will be achieved by coordinated collective actions and implementation of *multisectoral* and *multilevel* strategies of individual, family, partnership, private juridical, public juridical, state, etc. agents with diverse immediate goals, positions, capability and interests.

Forms and mechanisms of agro-eco-management

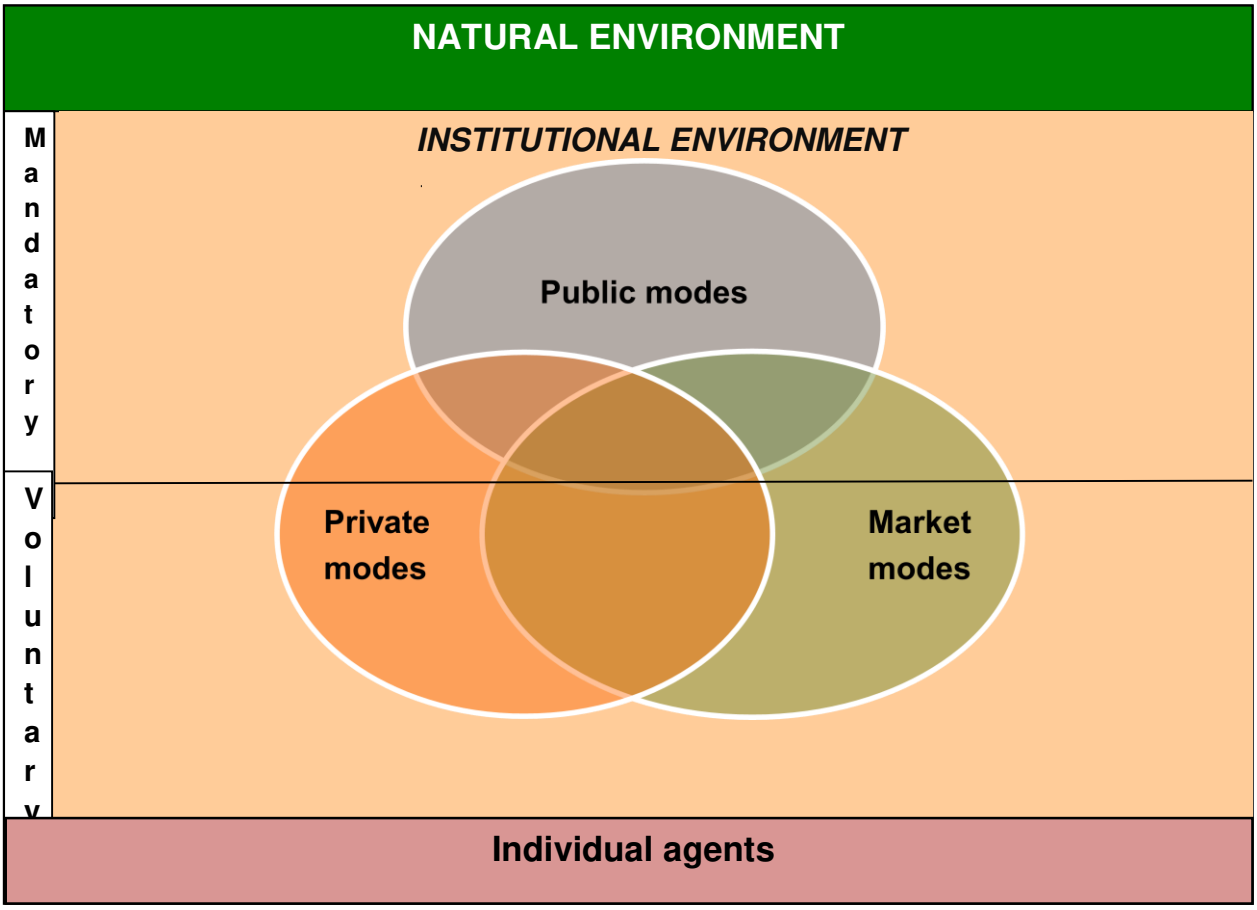
The individuals behavior (actions, restriction of actions) are affected and governed by a number of distinct modes and mechanisms of management which include (Figure 5):

First, the *institutional environment* (or the “rules of the game”) - that is the distribution of rights between individuals, groups, and generations, and the system(s) of enforcement of these rights and rules [Furuboth and Richter; North].

The entire spectrum of rights is to be analyzed embracing material assets, natural resources, intangibles, certain activities, clean environment, food security, intra- and inter-generational justice, etc. A part of the rights and rules is constituted by the formal laws, regulations, standards, court decisions, etc. In addition, there are important informal rules and rights determined by the tradition, culture, religion, ideology, ethical and moral norms, which is to be

clarified. For instance, the "satoyama" ideology[3] is deeply routed in the Japanese agriculture for many centuries now.

Figure 5. Modes of environmental management in agriculture



Furthermore, an analysis is to be made on the system of enforcement of the rights and rules done by the state, community pressure, trust, reputation, private modes, and self-enforcement by agents.

After that, an assessment is to be made on which extent the institutional environment creates incentives, restrictions and costs for maintaining and improving the natural environment, intensifying eco-exchange and cooperation, increasing eco-productivity, inducing private and collective eco-initiatives, developing new eco- and related rights, decreasing eco-divergence

[3] Meaning "to live in harmony with the nature".

between social groups and regions, responding to ecological and other challenges, etc.

Furthermore, the driving forces and the prospects of institutional "development" are to be specified. The modernization of the institutional environment is initiated by the public (state, community) authority, international actions (agreements, assistance, pressure, etc.), and the private and collective actions of individuals. It is associated with the modernization and/or redistribution of the existing rights; and the evolution of new rights and the emergence of novel (private, public, hybrid) institutions for their enforcement.

In modern society a great deal of the individuals' activities and relations are regulated and sanctioned by some (general, specific) formal and informal institutions. However, there is no perfect system of preset "outside rules" that can manage effectively the entire eco-activity of individuals in all possible (and quite specific) circumstances of their life and relations associated with the natural environment.

Second, the *market modes* (the "invisible hand of market") – those are various decentralized initiatives governed by the free market price movements and the market competition – e.g. spotlight exchanges, classical contracts, production and trade of organic products and origins, etc.

It is to be analyzed the extent in which the "free" market contributes to coordination (direction, correction) and stimulation of the eco-activities and eco-exchanges, and the effective allocation of environmental resources. The individual agents use (adapt to) markets profiting from the specialization and the mutually beneficial exchange (trade) while their voluntary decentralized actions govern the overall distribution of efforts and resources between activities, sectors, regions, eco-systems, countries, etc.

Nevertheless, there are many instances of lack of individual incentives, choices and/or unwanted exchanges related to natural environment conservation - e.g. "missing" markets, monopoly and power relations, positive

or negative externalities, etc. Consequently, the free market “fails” to manage effectively the entire eco-activity, eco-exchanges, and eco-investments of individuals. Therefore, the cases of “failure” of market are to be determined, which lead to lack or insufficient individual incentives and choice and/or unwanted exchange associated with the environmental protection.

Third, the *private and collective modes* (the “private or collective order”) – those are diverse private initiatives, and special contractual and organizational arrangements – e.g. voluntary eco-actions, codes of eco-behavior, eco-contracts, eco-cooperatives, etc.

It is to be determined the extent in which the individual agents can take advantage of the economic, market, institutional etc. opportunities and deal with the institutional and market deficiency by selecting or designing mutually beneficial private modes (rules) for governing their eco-behavior, relations and exchanges.

The private mode negotiates “own rules” or accepts (imposed) existing private or collective order, transfers existing rights or gives new rights to counterpart(s), and safeguards absolute and/or contracted rights of agents. In modern society a great part of the agrarian activity is managed by the voluntary initiatives, private negotiations, the “visible hand of the manager”, or collective decision-making. Nevertheless, there are many examples of private sector deficiency (“failures”) in governing of socially desirable activity such as environmental preservation, eco-system services, etc. The later cases have to be identified and analyzed.

Forth, the *public modes* (the “public order”) – these are various forms of public (community, government, international) intervention in the market and private sectors - e.g. public guidance, public regulation, public taxation, public assistance, public funding, public provision, property right modernization, etc.

Analyses is to be made on existing forms for public “involvement” in the agro-eco-management through provision of eco-information and eco-training for private agents, stimulation and (co)funding of their voluntary actions,

enforcement of the obligatory eco-order and sanctioning for non-compliance, direct organization of eco- and related activities (state eco-enterprise, scientific research, monitoring, etc.).

The role of public (local, national, transnational, etc.) governance has been increasing along with the intensification of activity and exchange, and the growing interdependence of socio-economic and environmental activities. In many cases, the effective management of individual behavior and/or the organization of certain activity through a market mechanism and/or a private negotiation would take a long period of time, be very costly, could not reach a socially desirable scale, or be impossible at all. Thus a centralized public intervention could achieve the willing state faster, cheaper or more efficiently.

Nonetheless, there are a great number of “bad” public involvements (inaction, wrong intervention, over-regulation, mismanagement, corruption, etc.) leading to significant problems of sustainable development around the globe [Bachev, 2010]. All these cases of public “failure” are to be identified and analyzed.

Fifth, the *hybrid forms* – some combination of the above three modes like public-private partnership, public licensing and inspection of private organic farms, etc.

All existing and other practically feasible (potential) forms for agro-eco-management is to be identified, analyzed and assessed as well as their complementarities (mutual or multiplication effect) and contradictions between individual forms and mechanisms of agro-eco-management specified. For instance, often the private (eco)initiatives of individual agents are in “conflict” with each other and/or the interests of third parties; usually, public, collective and private forms are mutually complementary, etc.

The efficiency of the individual management modes is quite different since they have unlike potential to: provide adequate eco-information, induce eco-friendly behavior, reconcile eco-conflicts and coordinate the eco-actions of different parties, impact environmental sustainability and mitigate eco-risks,

and minimize the overall environment management (conservation, third-party, transaction) costs, for agents with different preferences and capability, and in the specific (socio-economic, natural, etc.) conditions of each eco-system, community, industry, region, and country.

For instance, providing appropriate eco-information (by a state agency, NGO, etc.) would be enough to induce voluntary actions by a “green” farmer, while the most commercial enterprises would need outside incentives (such as price premium, cash compensation, punishment, etc.); market prices would usually coordinate well relations between the water suppliers and the users, while the regulation of relations of water polluters and users would require a special private or public order; independent strategies and actions of farms would improve the state of local eco-systems, while dealing with most of the (regional, national, global) eco-challenges requires collective actions in large geographical and temporal scales, etc.

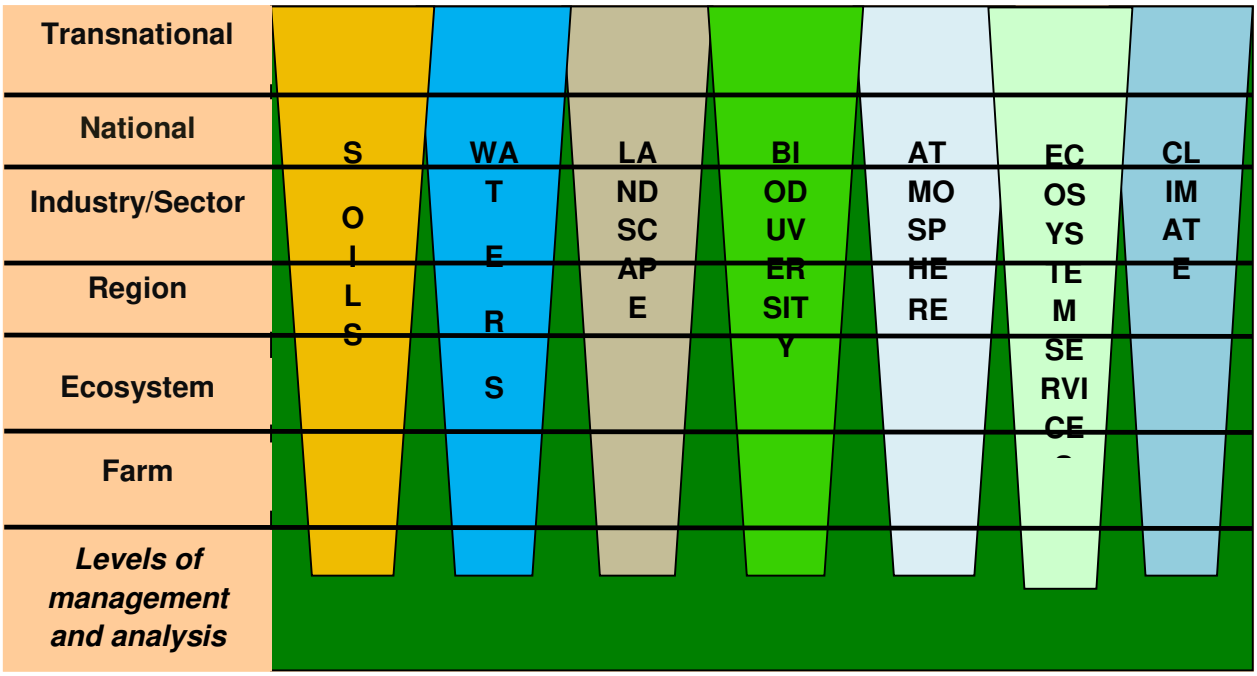
“Governance matters” and depending on the (efficiency of) system of management “put in place” the individual communities and societies achieve quite dissimilar results in the eco-conservation and improvement. Consequently, the extend of conservation of natural environment in agriculture (the type of exploitation of natural resources by agriculture and the agricultural impact on environment) would differ quite substantially in the different stages of development and among the diverse farming structures, eco-systems, regions, and countries.

Elements and levels of analysis

The analysis of the system and the forms of agro-eco-management is to be done for the system as a whole and/or for the individual components of the

natural environment – soils, waters, atmosphere, biodiversity, landscape, climate, eco-system services, etc. (Figure 6). In the later cases, the analysis of relatively independent *(sub)systems* of management is concerned - agricultural lands, agricultural waters, agricultural emissions, agrarian and related biodiversity, rural landscape, agricultural impact on climate, and agro-ecosystem services.

Figure 6. Components and levels of analysis of agro-eco-management



For each of the elements of the nature the analysis further deepens for sub-components as well. The later are characterized with significant specificity in terms of management forms, factors, and efficiency. For instance, as elements of the component “soils” could be included cultivated farmland, lands with permanent crops, permanent grasslands and pastures, etc.; for the component “waters” – surface waters, ground waters, waters for irrigation, drinking waters, etc.; for the component “biodiversity” – agro-biodiversity, natural biodiversity, etc.; for the component “atmosphere” and “climate” – greenhouse gas emissions, dust, odors, other pollutants, etc.

It is to bare in mind that a great part of the employed modes of agro-eco-management are integral, and affect two or more relatively independent elements or sub-components of the natural environment. Besides, the improvement of one aspect of the management through a particular form often is associated with the negative effects for other aspect, component or element. Therefore, in addition to the “private” efficiency always it is to be taken into account the overall efficiency (direct and indirect effects and costs) of a particular forms or the system of management as a whole.

According to the specific objective the analysis of the system of agro-eco-management is made at different management levels (Figure 6):

- *farm level* – individual farm, farms of a particular type (family, cooperative, crop, livestock, organic, semi-market, etc.);
- *eco-system* – individual eco-system (e.g. Danube river basin; Northern Rockies; Dobrudja plain) or type of agro-eco-system (plain, mountainous, semi-mountainous, riverside, coastal, etc.);
- *regional* – major administrative, economic or geographical regions of the country;
- *Industry (sector)* – major sectors and subsectors of agriculture – crop production, livestock production, grain production, horticulture, poultry, dairy cattle, etc.;
- *national* – Bulgaria, Missouri, Australia;
- *trans-national* – Western Balkans, European Union, global.

Specification of the individual elements of the system of agro-eco-management in each level is to be done carefully.

For instance, at the individual farm level most of the forms of public intervention (mandatory norms and standards, sanction mechanisms, etc.) play a role of “external” environment, while at the national and/or industry level they are internal mechanisms of management.

Similarly, some of the dominant forms and mechanisms of management at a national or sectoral level may not be relevant for the individual farm or

farms of a particular type. For instance, most of the (eco)instruments of the EU CAP do not impact at all the majority of Bulgarian farms due to the impossibility for participation in public programs (formal restrictions, high costs), low interests, enormous difficulties and costs for detection of non-compliances and for sanction by the authority, etc. [Bachev, 2010].

At certain level of analysis (e.g. eco-system, region) there may be no specific (formal) structure of management at all, and the agro-eco-management to be “carried out” by other (main) organizations (e.g. farms and farm organizations) and/or the general system of eco-management in the country.

As a rule, the eco-effects and the eco-costs at a particular level and upper management level are not simple sums of those of the composite elements or those at lower levels of management. Therefore, it is to be taken into consideration the necessity for “collective actions” for achieving a minimal 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.

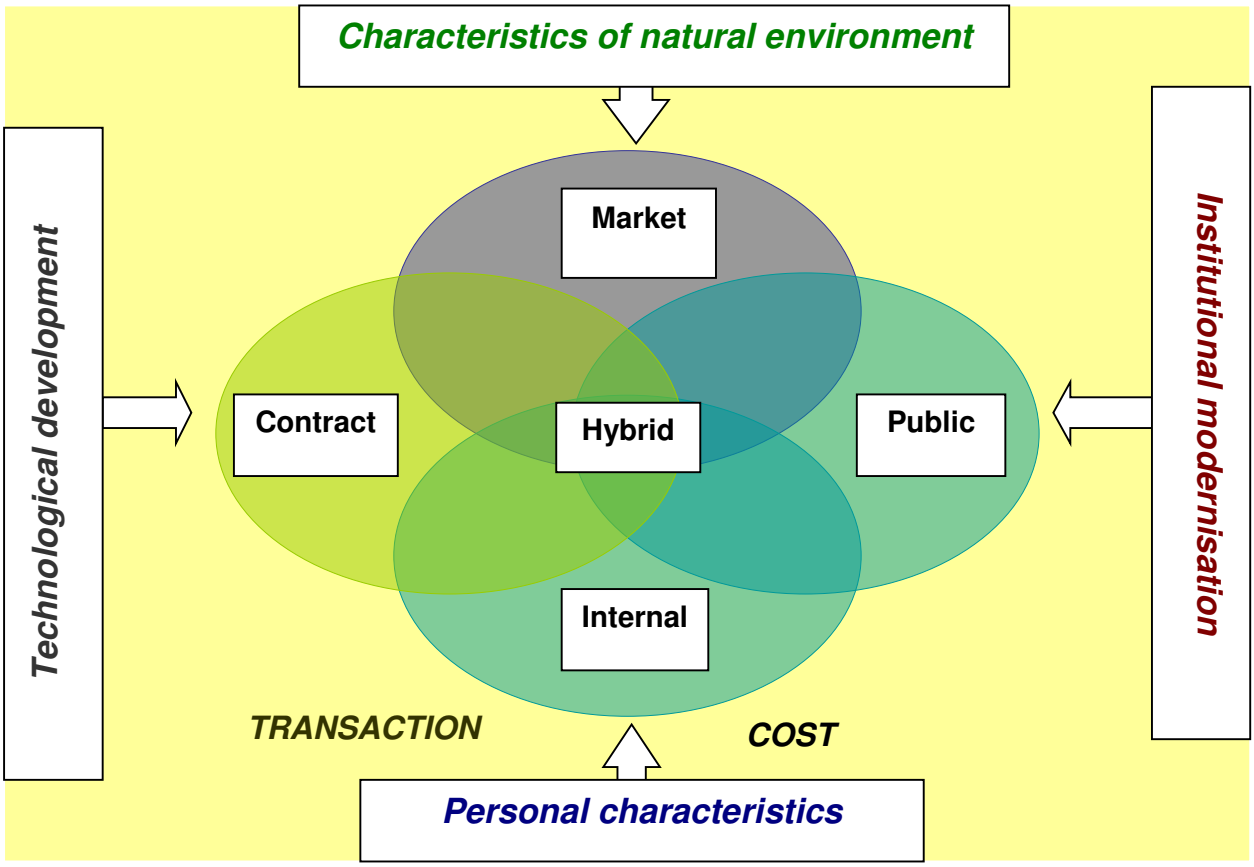
Needs and factors of agro-eco-management

The evolution of the system of agro-eco-management and the choice of one or another form of eco-management by agents depend on diverse natural, economic, political, institutional, behavioral, technological, international, etc. factors (Figure 7).

For instance, the type of the development of agro-eco-management strongly depends on the (eco)preferences and the experiences of farmers and other participants in the process, the extent of degradation and pollution of the natural environment, the social demands and the pressure for sustainable exploitation of natural resources, the economic development and capabilities

for eco-investments, the public policies and the implementation/enforcement of international (eco)conventions, the natural evolution of environment, etc.

Figure 7. Factors for managerial and strategy choices for agro-eco-management



Therefore, the specific factors for agro-eco-management is to be identified and their importance and compatibility at the each stage of agricultural development analyzed. The experience demonstrates that the natural environment is "valued" less and the good eco-management is not a priority, when there is no institutional stability (unspecified and/or not enforced agrarian, contractual and eco-rights, restructuring, unsustainable policies, etc.) and when the financial and economic situations of household, farms and the state deteriorate.

Likewise, the monitoring, enforcement and disputing of many of the terms of eco-contracts is extremely difficult (costly) or practically impossible, and

therefore supporting voluntary eco-initiatives of farmers is often more effective than the mandatory norms and “contracts”. Similarly, due to technological, ecological or socio-economic reasons some of the widely used forms could be impossible for the conditions of a particular subsector, region, eco-system or (type) farm.

Most environmental activity and exchange in agriculture could be managed through a great variety of *alternative* forms. For instance, a “supply of environmental preservation service” could be governed as: voluntary activity of a farmer; though private contracts of the farmer with interested or affected agents; though interlinked contract between the farmer and a supplier or processor; though cooperation (collective action) with other farmers and stakeholders; though (free) market or assisted by a third-party (certifying and controlling agent) trade with special (eco, protected origins, fair-trade, etc.) products; though a public contract specifying farmer’s obligations and compensation; though a public order (regulation, taxation, quota for use of resources/emissions, etc.); within a hierarchical public agency or by a hybrid form.

Commonly the natural and the institutional environment evolve very slowly over a long-term periods. Therefore, in the specific natural, socio-economic and institutional environment, the choice of the management mode would depend on a number of key factors including:

- the *personal characteristics of individual agents* – preferences, believes, ideology, knowledge, capability, training, managerial experience, risk-aversion, bounded rationality, tendency for opportunism, reputation, trust, power, etc. For instance, benefits for farmers from the eco-management could range from the monetary or non-monetary income; profit; indirect revenue; to pleasure of involvement in environment and biodiversity preservation activity.

- the *formal and informal institutions* - often the choice of management mode is (pre)determined by the institutional restrictions as some forms for carrying out farming, environmental, etc. activities could be socially

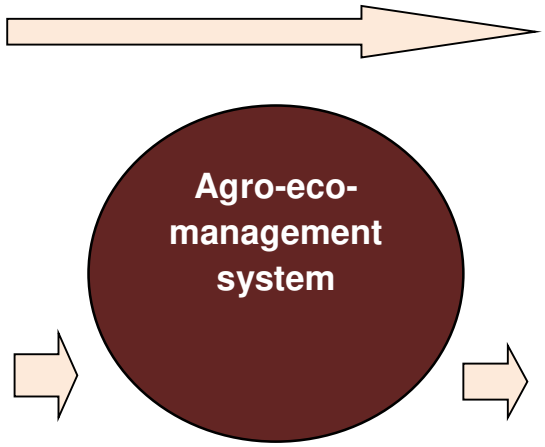
unacceptable or illegal. For instance, market trade of farmland, natural resources, and (some) eco-system services are not allowed in many countries.

Furthermore, the institutional environment considerably affects the level of management costs and thus the choice of one or another form of organization. For instance, in conditions of well-working public system of regulations (quality standards, guarantees) and laws and contract enforcement, a preference is given to spotlight and classical (standard) contracts. On the other hand, when rights on major agrarian and natural resources are not defined or not well defined, and the absolute and contracted right effectively enforced, then the high transaction costs could create difficulties (or block) effective eco-management - costly unsolvable disputes between polluting and affected agents, disregards of interests of certain groups or generations, etc. Consequently, the institutional structures for carrying out the agrarian and environmental activities become an important factor, which eventually determines the outcome of the system (the efficiency) and the type of development (the sustainability).

- the *natural and technological factors* - eco-management strongly depends on the type of the environmental challenge (spatial and temporal scale, risks, etc.) and the natural recourses endowment as well as on the development of farming, environmental, monitoring, information, etc. technologies. For instance, management of water resources depends on the advancement of water conservation, use, recycling and monitoring technologies, etc.

In a long-term the state of the natural environment and its individual components, and the associated risks, conflicts and costs, depends on the efficiency of the “established” system of eco-management in a particular society, community, sector, region, economic organization, etc. (Figure 8).

Figure 8. Factors and efficiency of agro-eco-management



However, in each specific moment or a shorter-period of analysis not always could be found adequate data and/or determine direct links between the system of agro-eco-management (and its individual forms) and the state of the natural environment. The later is caused by:

- the time period (delay) between the management actions ("improvement" of the system of management), and the changes in the eco-behavior of agents, and the positive, negative or neutral effects on the state of natural environment and its individual elements;
- the "impossibility" for adequate assessment of the natural environment and the associated risks and costs, due to the lack of "full" knowledge on the state and the processes of environmental change, the type of correlation with agrarian activities and the new (nano, genetically-modified, etc.) products and technologies, on future costs associated with the deterioration, restoration and conservation of natural environment, etc.;
- insufficient factual data for the extent of eco-degradation and pollution in agriculture due to lack of monitoring, precise measurements, and/or research studies in that area;

- “undervaluation” of the natural resources by individual agents, social groups and/or society as a whole and/or the “lack” of any system of agro-eco-management.

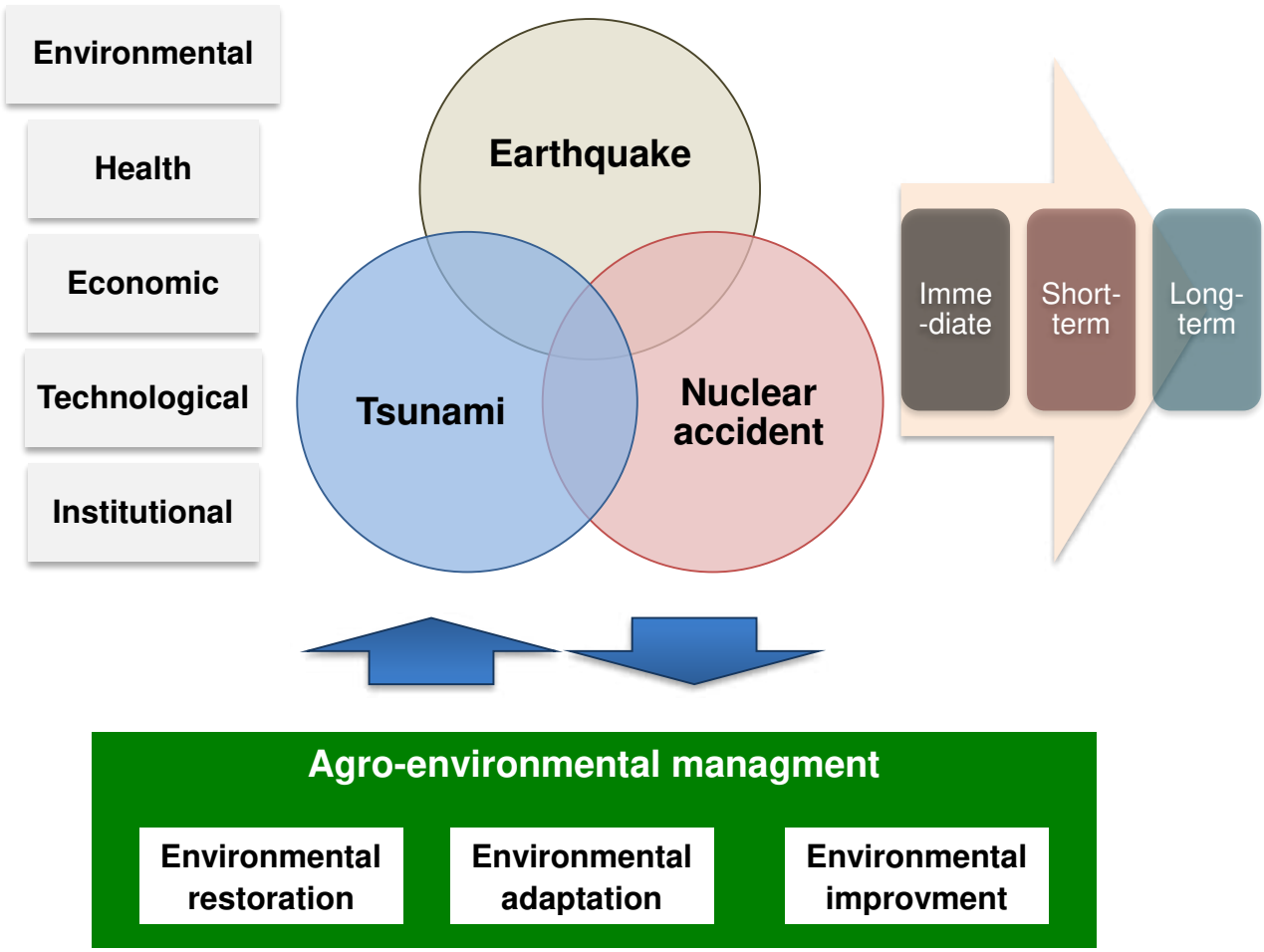
Also, it is to be taken into consideration that the state and the changes in the natural environment are consequences not only of the system of agro-eco-management in a particular farms, region, subsector, or country, but other factors as well such as: the impacts of other industries in the country and at international scale, the natural evolution of environment, etc. Consequently, the real improvement or deterioration of the eco-management in a particular farm, group of farms in a region, subsector, or in the country could result in a lack or controversial change in the quality of waters, soils, air, biodiversity and climate.

In many cases, it is impossible to “influence” the natural environment through (agro)eco-management at all, and the *effective adaptation* is the only possible strategy for overcoming the socio-economic consequences for the agriculture and other sectors of human activity [Bachev, 2013a].

For instance, the 2011 Great East-Japan Easrthquake and the subsequent trunami and Fukushima nuclear power plant accident have cased enourmouse environmental damages and changes impacting different aspects of humen life in Japan and beyond [Biodivercity Center of Japan; Britanica; Buesseler; IBRD; Vervaeck and Daniell; UNEP].

The individuals and households, farms and businesses, communities, farmlands, material, biological and intellectual properties, institutional and natural environment, etc. all they have been significanty affected by *one, two* or *three disasters* (earthquake, tsunami, nuclear accident) (Figure 9).

Figure 9. Impacts of 2011 triple disasters on Japanese agriculture



The environmental restoration (cleaning of debris, desalinization, recontamination, rebuilding farming activities and resources, etc.) has been a major strategy for post disaster recovery for many agents. Nevertheless, for many farmers the effective adaptation to the new natural and socio-economic environment has happened to be the only possible strategy – slow process of cleaning of farmlands, lack of infrastructure and financial resources, decreased demands for local products, etc.

Therefore, at all levels of analysis the diverse “external” and “internal” factors are to be identified and their importance estimated in order to assess adequately the efficiency of the system of agro-eco-management and the farm adaptation.

Understanding efficiency of agro-eco-management

The proper understanding the efficiency of agro-eco-management greatly depends on the understanding the role of transaction costs and the governance [Bachev, 2004, 2010, 2013b].

The problem of "social costs" does not exist in the conditions of *zero transaction costs*[4] and *well-defined private property rights* [Coase]. Then the state of maximum efficiency is always achieved independent of initial distribution of rights between individuals and the mode of governance. All information for the effective potential of activity and exchange (optimization of resources, meeting various demands, respecting assigned and transferred rights) would be *costlessly* available to everybody. Individuals would costlessly coordinate their activities; define, adapt and implement their strategies, define new rights, and protect their (absolute and contracted) rights[5], and trade owned resources (and rights over them) in mutual benefit with *the same* (*equal) efficiency* over the free market (adapting to price movements), and the private modes of different types (contracts, firms), and the collective decision making (cooperative, association), and in a nationwide hierarchy (a single private or state company). Then the ecological requirements for sustainability and the technological opportunities for economies of scale and scope (the maximum environmental conservation/enhancement and productivity of resources, "internalization of externalities") and the maximum welfare (consumption, conservation of natural resources) would be easily/costlestly achieved[6].

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[4] The costs for *governing* relations between individuals – for protection and exchange of individual rights.

[5] When transaction costs are zero then definition (redistribution) of *new rights* of individuals, interests groups, and society as well as effective enforcement of the new rights would be easily achieved.

[6] Presently there is a *principle agreement* ("social contract") for global sustainable development. Nevertheless, depending on the specific social preferences that "social consensus" not always is expressed in maximum environmental conservation and improvement. At certain stages of development the social priority

However, when transaction costs are significant, then costless contracting, exchange and protection of individual right is impossible. Therefore, the initial distribution of property rights between individuals and groups, and their good definition and enforcement are critical for the overall efficiency and sustainability. For instance, if the “right on clean and conserved natural environment” is not well-defined, that creates big difficulties for efficient eco-management – costly disputes between polluting and affected agents; not respecting interests of certain groups or generations, etc.

What is more, in the conditions of well-defined rights the eco-management is usually associated with significant transaction costs as well. For example, the agents have costs for identification and protection of various rights (unwanted take overs from others); studying out and complying with diverse institutional restrictions (norms, standards, rules, etc.); collecting needed technological, environmental, etc. information; finding best partners and prices; negotiating conditions of exchange; contract writing and registration; enforcing negotiated terms through monitoring, controlling, measuring and safeguarding; disputing through a court system or another way; adjusting or termination along with the evolving conditions of production and exchange, etc.

Therefore, in the “real world” with not completely defined and/or enforced rights, and the positive transaction costs, the *mode* of agro-eco-governance is crucial and eventually (pre)determines the extent of degradation, conservation and improvement of natural environment [Bachev 2010]. That is because the different modes have unequal efficiency (benefits, costs) for governing the same eco-activity in the specific socio-economic and natural environment.

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could be given to the economic growth at the “price” of certain degradation of natural resources - „over” pollution and emissions, unsustainable exploitation, partial or complete exhaustion (termination).

Moreover, often the high transaction costs deteriorate and even block organization of otherwise efficient (mutually-beneficial) for all participants' eco-activity and exchange.

It has to be distinguished the transaction from the proper conservation or "production" (agronomic, opportunity, etc.) environmental costs. In modern conditions the later are significant economic costs, which are to be recovered like other technological costs from the beneficiaries of conserved or improved natural environment. Often that is the farmer, who invests for maintaining productivity of the natural resources (soil fertility, water purity, ecosystem services, etc.), and recover these costs similarly to other investments thought flow of future benefits (productivity, profitability, market position, etc.). More frequently, these are other agents, who pay for used eco-services directly (buying eco-products and services) or indirectly (though collective organizations, taxes and fees, etc.).

The effective modes for agro-eco-management optimize the *total* (transaction *and* conservation costs) for agrarian activity – minimizing the transaction costs and allowing (otherwise mutual beneficial) eco-exchange to be carried out in a socially desirable scale, and allowing achievement of minimum/optimum environmental requirement, and/or exploration of pure technological economies of scale and scope of farm, environmental conservation, etc. activities.

In very rare cases, there is *only one* practically possible form for governing of natural resources, eco-activity and eco-exchange[7]. However, usually there are a number of *alternative* modes for governing of eco-conservation activity.

[7] For instance, in Japanese agriculture with small-scale paddy fields organization of water supply could not be carried out by individual farms (high mutual assets dependency, non separability of water use). Therefore, since ancient time organization of water supply is governed as public projects [Mori].

Different management modes are alternative but *not equally efficient* modes for the organization of eco-activities. Each form has distinct *advantages* and *disadvantages* to protect eco-rights and investment, coordinate and stimulate socially desirable eco-behavior and activities, explore economies of scale and scope, save production and transaction costs, etc.

For instance*, the free market* has a big coordination and incentive advantages ("invisible hand", "power of competition"), and provides "unlimited" opportunities to benefit from the specialization and exchange. However, market management could be associated with a high uncertainty, risk, and costs due to the lack of (asymmetry) of information, low "appropriability" of some rights ("public or collective goods" character), price instability, a great possibility for facing an opportunistic behavior, "missing market" situation, etc.

The special contract form ("private ordering") permits a better coordination and intensification of eco-activity, and safeguards agent's eco-rights and eco-investments. However, it may require large costs for specification (and writing) contract provisions, adjustments with constant changes in conditions, enforcement and disputing of negotiated terms, etc.

The internal organization allows a greater flexibility and control on activity (direct coordination, adaptation, enforcement, and dispute resolution by a "fiat"). However, the extension of internal mode beyond family and small-partnership boundaries (allowing achievement of "minimum" technological or ecological requirements; exploration of technological economies of scale and scope, etc.) may command significant costs for development (initiation, design, formal registration, restructuring) and for current management (collective decision making, control on coalition members opportunism, supervision and motivation of hired labor).

The separation of the ownership from the management (cooperative, corporation, public farm/firm) gives enormous opportunities for growth in productivity, and environmental and management efficiency – "internal"

division and specialization of labor; achieving ecosystem's requirements; exploration of economies of scale and scope; introduction of innovation; diversification; risk sharing; investing in product promotion, brand names, relations with customers, counterparts and authorities, etc. However, it could be connected with huge transaction costs for decreasing information asymmetry between management and shareholders, decision-making, controlling opportunism, adaptation, etc.

The cooperative and non-for profit form also suffers from a low capability for internal long-term investment due to the non-for-profit goals and the non-tradable character of shares (so called "horizon problem"). What is more, the evolution and maintenance of large collective organizations is usual associated with significant costs – for initiating, informing, "collective| decision-making and internal conflict resolution, controlling opportunism of (current and potential) members, modernization, restructuring, liquidation, etc.

Finally, *the pubic forms* also command high internal (internal administration and coordination) and outside (for other private and public agents) costs – for establishment, functioning, coordination, controlling, mismanagement, misuse by private and other agents, reorganization, and liquidation. What is more, unlike market and private modes, for public organizations there is no "automatic" mechanism (such as competition) for the selection of (in)effective forms. Here public "decision making" is necessary which is associated with huge costs and time, and often affected by the strong private interests (the power of lobbying groups, politicians and their associates, bureaucrats, employees in the public forms) rather than the efficiency.

Principally the „rational" agents tend to use and/or design such modes for governing their diverse activity and relations which are the *most efficient* in the specific institutional, economic and natural environment – forms *maximizing their overall* (production, ecological, financial, transaction, etc.)

benefits and *minimizing their overall* (production, environmental, transaction, etc.) costs [Bachev 2010].

However, a result of such *private strategies* and *optimization* of management/activity is not always the most socially effective distribution of resources and the socially desirable (maximum possible) conservation of natural environment. It is well known that the agricultural activity is often associated with significant undesirable negative environmental effects such as soils degradation, waters pollution, biodiversity termination, air pollution, considerable green-house gases emissions, etc.

Therefore, the system of agro-eco-management is *to be improved*, and that frequently necessitates a *public (state) involvement* in the agrarian and environmental management. Nevertheless, the public intervention in (eco)management is not always more effective, since *public failure* is practically possible. Around the globe there are many examples for inappropriate, over, under, delay, or too expensive public intervention at all levels. Often the public intervention either does not correct the market and private sector failures, or “correct| them with higher overall costs.

Thus the *criterion* for assessing the efficiency of agro-eco-management and strategies is to be *whether socially desirable and practically possible environmental goals are realized with the minimum possible overall costs* (direct, indirect, private, public, production, environmental, transaction, etc.). Accordingly, inefficiency is expressed either in *failure to achieve the feasible* (technically, politically, economically, etc.) *environmental goals* (conservation of natural resources, overcoming certain eco-problems, diminishing existing eco-risks, decreasing eco-losses, recovery and improvement of natural environment, etc.) or achieving of set up goals with *more costs comparing to another feasible form of management.*

Contemporary socio-economic, institutional and (more often) natural environment are changing very fast and often unpredictably[8]. Consequently, any strategy for the effective environmental management is to be an *adaptive strategy*.

Accordingly, dominating and other feasible (market, private, public, hybrid, etc.) forms are to be assessed in terms of their absolute and comparative *(adaptation) potential* to protect eco-rights and investments of agents, assure socially desirable level of environmental conservation (enhancement), minimize overall costs, coordinate and stimulate eco-activities, reconcile conflicts, and recover long-term costs for organizational development in the specific economic, institutional and natural environment.

(The most) effective forms for agro-eco-management

Usually "evolution" of the natural and the institutional environment is quite slow and in long periods of time. Therefore, to a great extent the efficiency of the system of agro-eco-management depends on the level of transaction costs.

The transaction costs have *behavioral origin*: namely individual's *bounded rationality* and *tendency for opportunism* [Williamson].

The agrarian agents do not possess full information about the system (eco-benefits and costs, effects on others, formal requirements, development trends, etc.) since collection and processing of such information would be either very expensive or impossible (multiple spillover effects and costs in a large geographical and temporal scale, future events, partners intention for cheating, etc.). In order to optimize the decision-making and the activity the

[8] There have been many financial, economic, food, environmental crisis in recent years inducing fundamental changes in economic structure and institutional rules at local, national, transnational and global scales.

agents have to spent costs for “increasing their imperfect rationality” – for monitoring, data collection, analysis, forecasting, training, consulting, etc.

Besides, the economic agents are given to *(pre-contractual, post-contractual, and non-contractual)* opportunism. Accordingly, if there is opportunity for some of the transacting sides to get non-punishably an extra benefit/rent from voluntary or unwanted exchange, he will likely take advantage of that.

Usually it is very costly or impossible to distinguish the opportunistic from non-opportunistic behavior because of the bounded rationality of agents. What is more, in the real life there is widespread non-contractual opportunism[9], namely unwanted “exchange” or stealing of rights from a private and/or public agents without any contracting process (because of the lack or asymmetry of information, capability for detection and protection, weak negotiating positions, etc.).

Therefore, individual agents have to protect their rights, investments and transactions from the hazard of opportunism through*: ex ante efforts* to find a reliable counterpart and to design efficient mode for partners credible commitments; *ex post investments* for overcoming (through monitoring, controlling, stimulating cooperation) of possible opportunism during the contract execution stage; and *permanent efforts/costs* for protection from unwanted non-contractual exchange though safeguarding, diversification, cooperation, court suits, etc.

The eco-opportunism is also widespread in agriculture. For instance, the farmer knows or eventually recognizes that his activity is harmful for the environment, but in order to save additional costs continues to execute risk operations when the negative effects are for other agents (the owners of natural resources, other farms, non-agrarian agents, society as a whole).

[9] Most economic analysis focused on pre-contractual ("adverse selection") and post-contractual ("moral hazard") opportunism. Widely distributed *non-contractual* opportunism is usually ignored.

Similarly, farmer sells conventional products as “organic” and profit price premium from the unaware buyers; or he joins the public agro-eco-programs to get subsidies, but does not comply with the “contracted” eco-obligations[10].

Part of the transaction costs for the eco-management could be determined relatively easily - e.g. costs for licensing, certifications, tests, purchase of information, hiring consultants, payments for guards and lawyers, bribes, etc.

However, the assessment of another (a significant) part of the transaction costs in eco-activity is often impossible or very expensive [Bachev, 2011a].

That is why the *Comparative Structural Analysis* is to be employed [Williamson]. This analysis would align eco-activities/transactions (which differ in their attributes) with the governance structures (which differ in their costs and competence) in discriminating (mainly transaction cost economizing) way.

Frequency, uncertainty, assets specificity, and appropriability are identified as *critical dimensions* of the eco-activity and transaction[11] - the factors responsible to the variation of transacting costs between alternative modes of management.

In the specific socio-economic and natural environment, depending to the *combination* of the critical factors of eco-activities and eco-transactions, there will be *different the most-effective forms* of their management (Figure 10).

Figure 10. Principle modes for environmental management in agriculture

	Critical dimensions of transactions
	Appropriability

[10] Not compliance with the terms of public eco-contracts by farmers is widespread even in some of the old member states of European Union.

[11] *Frequency, uncertainty”,* and *asset specificity* are identified as critical factors of transaction costs by Williamson [Williamson] while *appropriability* added by Bachev and Labonne [Bachev and Labonne].

Generic modes	*High*								*Low*
	Assets Specificity								
	Low				*High*				
	Uncertainty								
	Low		*High*		*Low*		*High*		
	Frequency								
	High	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	
Free market									
Special contract form									
Internal organization									
Third-party involvement									
Public intervention									

 - the most effective mode;  - necessity for a third party involvement

The eco-activity and transactions with good appropriability of rights, high certainty, and universal character of investments could be effectively managed by the free market through *spotlight* or *classical contracts*. For instance, there are widespread market modes for selling diverse ecosystem services and eco-products - eco-visits, organic, fair-trade, origins, self-production or self-pick up of yields from customer[12], eco-education, eco-tourism, eco-restaurants, etc.

The frequent transactions with high appropriability could be effectively managed through a *special contract*. For example, eco-contracts and cooperative agreements between farmers and interested businesses or communities are widely used including a payment for ecosystem services, and leading to production methods (enhanced pasture management, reduced use of agrochemicals, wetland preservation, etc.) protecting water from pollution, mitigating floods and wild fires, etc.

[12] These type of services are very popular for residents of big Japanese cities.

When the uncertainty is high and the assets dependency (specificity) is symmetrical the *relational ("neoclassical") contract* could be used. Since detailed terms of transacting and results are not known at outset (a high uncertainty), a framework (mutual expectations) rather than the specification of obligations of partners is practiced (opportunisms is (self)restricted due to the symmetrical dependency of investments of the partners). A *special contract* forms is also efficient for the rare transactions with a low uncertainty, high specificity and appropriability. The dependent investment could be successfully safeguarded through contract provisions since it is easy to define and enforce the relevant obligations of partners in all possible contingencies (no uncertainty exist).

The transactions and activity with a high frequency, big uncertainty, and great assets specificity have to be managed within *internal organization*. For instance, a good portion of the eco-investments are strongly specific to (certain land plots, eco-systems, etc.) a farm and they can be effectively implemented and "paid-back" within the borders of the particular farm.

The high *interdependency* (specificity) of the eco-investments with other farm's assets and activity is the reason that a great part of the agro-eco-management to be executed by the different type of farms – family, cooperative, agri-firms, public, hybrid, etc.

There are also cases when the farms and other agents are *specialized in eco-management* and entirely engaged in (aimed at) "keeping natural environment in a good condition" or "recovery or amelioration of natural environment". Here the agricultural activity either "does not exist" (e.g. prolonged follow up) or it is practiced as far as it is required by the purely agronomic, ecological and other (e.g. educational, rehabilitation, etc.) needs. According to the extent of appropriability of the results and the "universal" character of the investments, these type of farms could be market-oriented

(selling eco-services to landlords or other buyers), community[13] (funded by communities, interests groups) or public (e.g. for conservation of important eco-systems like national parks, natural phenomenon, etc.).

Very often the effective scale of the specific investment in agro-ecosystem services exceeds the borders of the traditional agrarian organizations (family farm, small partnership, etc.).

For instance, much of the eco-investments, which are done in one farm (protection of waters and air, biodiversity, etc.) benefit other farms or non-agrarian agents. Often, the dependency of eco-investments of a farm is *unilateral* from the agent benefiting from the positive result.

Besides, the positive impact of the eco-investment often depends on the minimum scale of activity and frequently requires collective action (co-investment). Consequently, the eco-activity/assets of many farms happen to be in a high *mutual-dependency* with the eco-activity/assets of other farms and/or non-agrarian agents in a *large spacial* and often *temporal scale*.

Thus, if the specific capital (knowledge, technology, equipment, funding, etc.) cannot be effectively organized within a single organization[14], then effective *external form(s)* is to be used – e.g. joint ownership, interlinks, cooperative, joint investment in labels and origins, lobbying for public intervention, etc.

For instance, the environmental cooperatives are very successful in some European countries (like, Finland, Germany, Holland, etc.) where there are strong incentives for cooperation due to the mutual-dependency of farms eco-activity, evolving "market" for eco-services, and widespread application of long-term public eco-contracts for eco-coalition. There is also rapid development of diverse associations of producers around the specific capital

[13] In response to the unprecedented decrease in number of farms in Japan a "third sector" has developed - in many places community farms are established aiming at conservation of natural environment rather than farming.

[14] coalition made, minimum scale of operations reached, economy of scale and scope explored.

invested in eco-products and services, trademarks, advertisement, marketing channels, etc.

Nevertheless, the costs for initiation and maintaining of the collective organization for overcoming the unilateral dependency are usually great (a big number of coalition, different interests of members, opportunism of “free-riding” type) and it is unsustainable or does not evolve at all. That strongly necessitates a *third-party involvement* (non-governmental or state organization) to make such organization possible or more efficient.

The transaction costs analysis let us identify the situations of *market* and *private sector failures*.

For instance, serious problems usually arise when the condition of assets specificity is combined with the high uncertainty and the low frequency, and when the appropriability is low. In all these cases, a *third part* (private agent, NGO, public authority, etc.) involvement in the transactions is necessary (through assistance, arbitration, regulation, funding, etc.) in order to make them more efficient or possible at all.

The emergence and the unprecedented development of special origins, organic farming and system of fair-trade, are all good examples in that respect. There is increasing consumer’s demand (price premium) for these products but their supply could not be met unless an effective *trilateral management* (including independent certification and control) is put in place.

The respect of others rights or granting out additional rights could be managed by *“good will”* or *charity actions*.

For instance, a great number of *voluntary* environmental initiatives (“codes of behavior”, etc.) have emerged driven by farmers’ preferences for eco-production, competition in industries, and responds to the public pressure for a sound environmental management.

However, the voluntary and charity initiatives could hardly satisfy the entire social demand especially if they require considerable costs. Besides, the environmental standards are usually “process-based”, and the

"environmental audit" is not conducted by independent party, which does not guarantee a "performance outcome" [15].

Most environmental management requires large organizations with diversified interests of agents (providers, consumers, destructors, interest groups, etc.). The emergence of special large-members organizations for dealing with the low appropriability is slow and expensive, and they are not sustainable in a long run ("free riding" problem). Therefore, there is a strong need for *a third-party public (Government, local authority, international assistance) intervention* to make such eco-activity possible or more effective [Bachev 2010].

For example, the supply of "environmental goods" by farmers could hardly be governed through private contracts with the individual consumers because of the low appropriability, high uncertainty, and rare character of transacting (high costs for negotiating, contracting, charging all potential consumers, disputing, etc.). At the same time, the supply of additional environmental protection service is very costly (in terms of production and organization costs) and would unlikely be carried out on a voluntary basis. Besides, the financial compensation of farmers by willing consumers through a pure market mode (eco-fee, eco-premium to price, etc.) is also ineffective due to the high information asymmetry, and the massive costs for enforcement, disputing and excluding of "dishonest" users, etc.

A third-party mode with a direct public involvement would make that type of transaction effective: on behalf of the consumers the State agency negotiates with the individual farmers a *public contract* for the "environment conservation service", coordinates activities of various agents, provides public

[15] The huge food safety and environmental pollution scandals in recent years prove that private schemes often fail (high information asymmetry and possibility for opportunism).

payments for compensation of farmers, and controls the implementation of negotiated terms[16].

Assessing and designing public modes for agro-eco-management

In modern agriculture there are a *great variety* in forms and efficiency of public intervention in agri-eco-management[17]. In assessment of the public modes for agro-eco-management it has to be taken into account the *overall* (public *and* private) costs for the implementation ***and*** transaction for achievement of the social eco-goals *in comparison with another practically possible form* of intervention.

The Discrete Structural Analysis is to be applied which would assist the assessment of the efficiency and the design of forms of public intervention. Depending on the *uncertainty, frequency*, and *necessity for specific investment* of public involvement different form of public intervention will be the most efficient (Figure 11).

Figure 11. Principle modes for public intervention in environmental management

Level of Uncertainty, Frequency, and Assets specificity					
Low	←----------			----------→	***High***
New property rights and enforcements	Public regulations	Public taxation	Public assistance	Public funding	Public provision

[16] *Public eco-contracts* are the most widely used instrument for improving agro-eco-activity in European Union. What is more, further "greening" of the Common Agricultural Policies and augmentation of "eco-subsidies" is planed from 2014 on.

[17] For instance, review of diverse modes of governance of agro-ecosystem services is made by Bachev [2011a].

Interventions with a low uncertainty and assets specificity would normally require a *smaller public organization* - more regulatory modes, improvement of the general laws and contract enforcement, etc.

When the uncertainty and assets specificity of transactions increases a *special contract mode* would be necessary – e.g. employment of public contracts for provision of private services, public funding (subsidies) of private activities, temporary labor contract for carrying out special public programs, leasing out public assets for private management, etc.

And when the transactions are characterized with the high assets specificity, uncertainty and frequency, then an *internal mode* and a *bigger public organization* would be necessary – e.g. permanent public employment contracts, in-house integration of crucial assets in a specialized state agency or public company, etc.

Initially, it is necessary to specify the ways to correct existing and emerging eco-problems in market and private sector (difficulties, costs, risks, failures, etc.). The appropriate public involvement would be to create an environment for: decreasing uncertainty surrounding market and private transactions, increasing intensity of exchange and cooperation, protecting private rights and investments, and making private investments less dependent.

For instance, the State establishes and enforces quality, safety and eco-standards for the farm inputs and produces, certifies producers and users of natural resources, transfers water management rights to farms associations, sets up minimum farm-gate prices, etc. (Table 1). All these facilitate and intensify private eco-initiatives and (market and private) eco-transactions, and increase efficiency of the economic organizations.

Next, practically possible modes for increasing appropriability of rights, results of activity, and investment have to be considered.

The low appropriability is often caused by the unspecified or badly specified private rights [Bachev, 2004]. In that case, the most effective

government intervention would be to introduce and enforce *new private property rights* – e.g. rights on natural, biological, and environmental resources; rights on issuing and trading eco-bonds and shares; tradable quotas for polluting; private rights on intellectual agrarian property and origins, etc. That would be efficient when the privatization of resources or the introduction and enforcement of new rights is not associated with significant costs (the uncertainty, recurrence, and level of specific investment are low).

Such public intervention effectively transfers the organization of transactions into the market and private management, liberalizes market competition and induces private incentives (and investments) in certain eco-activities.

Table 1. Modes for public intervention in agro-eco-management

New property rights and enforcement	Public regulations	Public taxation	Public assistance and support	Public provision
Rights for clean, beautiful environment, biodiversity; Private rights on natural, biological, and environmental resources; Private rights for (non) profit management of natural	Regulations for organic farming; Regulations for trading of protection of ecosystem services; Quotas for emissions and use of products, resources; Regulations for introduction of foreign species, GM crops; Bans for certain activity, use of inputs, technologies; Norms for nutrition and pest management;	Tax rebates, exception, breaks; Eco-taxation on emissions, products; Levies on manure surplus; Levies on farming or	Recommenda-tion, information, demonstration; Direct payments, grants for eco-actions of farms, businesses, communities; Preferential credit; Public eco-contracts;	Research, extension; Market information; Agro-meteorologic al forecasts; Sanitary and veterinary control, vaccination, prevention measures;

Tradable quotas (permits) for polluting; Private rights on intellectual property, origins, (protecting) ecosystem services; Rights to issue eco-bonds, shares; Private liability for polluting	Regulations for water protection against nitrates pollution; Regulations for biodiversity, landscape management; Licensing for water or agro-system use; Quality, food safely standards; Standards for good farming practices; Mandatory eco-training; Certifications, licensing; Compulsory eco-labeling; Designating environmental vulnerable, reserve zones; Set-aside measures; Inspections, fines, ceasing activities	export for innovation funding; Waste tax	Government purchases (water, other limited resources); Price, farm support for organic production, special origins; Funding eco-training; Assistance in farm, eco-associations; Collecting fees for paying ecosystem service contributors	Public agency (company) for important ecosystems; Post disaster recovery agency and organization; Pertaining “precaution principle”; Eco-monitoring; Eco-foresight; Risk assessment

For instance, the tradable permits (quotas) are used to control the overall use of certain resources or level of a particular type of pollution. They give flexibility allowing farmers to trade permits and meet their own requirements according to their adjustment costs, specific conditions of production, etc.

That form is efficient when a particular target must be met, and the progressive reduction is dictated through permits while trading allows the compliance to be achieved at least costs (through a private management).

What is more, the tradable rights could be used a *market for environmental quality* to develop. The later let private agents to realize new eco-strategy purchasing permits from the market and taking them out of market turnover and utilization. In that way the environmental quality could be practically raised above the initially “planned” (by the Government) level, and would not have been achieved without these additional private eco-initiatives.

In other instances, it would be more efficient to put in place *regulations* for trade and utilization of resources, products and services – e.g. standards for labor safety, product quality, environmental performance, animal welfare; norms for using natural resources, introduction of foreign species and GM crops, and (water, soil, air, comfort) contamination; a ban on application of certain chemicals or technologies; regulations for trading ecosystem service protection; foreign trade regimes; mandatory eco-training and licensing of farm operators, etc.

The large body of environmental regulations in the European Union and other developed countries aim changing farmer's behavior, and directing toward new strategies, which restrict the negative impact on environment. It makes producers responsible for the "environmental effects" (externalities) of their products or the management of products uses (e.g. waste).

This mode is effective when a general improvement of the performance is desired but it is not possible to dictate what changes (in activities, technologies) is appropriate for a wide range of operators and environmental conditions (a high uncertainty and information asymmetry). When the level of hazard is very high, the outcome is certain and the control is easy, and no flexibility exists (for timing or the nature of socially required result), then the bans or strict limits are the best solution.

However, the regulations impose uniform standards for all regardless of the costs for compliance (adjustment) and give no incentives to over-perform beyond a certain (regulated) level.

In other instances, using the incentives and the restrictions of *tax system* would be the most effective form for public intervention. Different sorts of tax preferences (exception, breaks, credits) are widely used to create favorable conditions for certain (sub)sectors and regions, forms of agrarian organization, or specific types of activities.

The environmental taxation on emissions or products (inputs or outputs of production) is also applied to reduce the use of harmful substances. Eco-

taxes impose the same conditions for all farmers using a particular input and give signals to take into account the “environmental costs” inflicted on the society as a whole (or big communities of affected individuals).

Taxing is effective when there is a close link between the activity and the environmental impact, and when there is no immediate need to control the pollution or to meet the targets for reduction. However, an “appropriate” level of the charge is required to stimulate a desirable change in farmers’ behavior. Furthermore, some emissions (e.g. nitrogen) vary according to the conditions of application (fertilization with N) and attempting to reflect this in the tax system often results in complexity and high administrating costs.

In some cases, a *public assistance and support* to private organizations is the best mode for intervention.

The public *financial* support for environmental actions is the most commonly used instrument for improving the environment performance of farmers. It is easy to find an economic justification for the public payments as a compensation for the provision of an “environmental service” by farmers.

However, the share of farms participating in various agri-environmental support schemes (in EU, Japan, USA, etc.) has not been significant. That is a result of voluntary (self-selection) character of this mode, which does not attract farmers with the highest environment enhancement costs (the most intensive and damaging environment producers). In some countries the low-rate of farmers’ compliance with the environmental contracts is a serious problem[18]. The later cannot be solved by augmented administrative control (enormous enforcement costs) or introducing a bigger penalty (politically and juridical intolerable measure). Principally, it is estimated that the agri-environmental payments are efficient in maintaining the current level of environmental capital but less successful in enhancing the environmental quality.

[18] 40% of French farmers experience problems implementing public eco-contracts [Dupraz *et al.*].

Another disadvantage of “payment system” is that once introduced it is practically difficult (“politically unacceptable”) to be stopped when goals are achieved or there are funding difficulties. Moreover, withdraw of subsidies may lead to further environmental harm since it would induce the adverse actions (intensification, return to conventional farming strategies). Other critics of subsidies are associated with their “distortion effect”, negative impact on “entry-exit decisions” from polluting industry, unfair advantages to certain sectors in the country or industries in other countries, not considering the total costs (such as transportation and environmental costs, “displacement effect” in other countries).

Often providing public *information, recommendations, training* and *education* to farmers, rural agents, and consumers are the most efficient form since they improve their capability and strategies.

In some cases, a *pure public organization* (in-house production, public provision, etc.) will be the most effective one as it is in the case of important agro-ecosystems and national parks; agrarian research, education and extension; agro-meteorological forecasts; border sanitary and veterinary control; post-disaters recovery organisations; interventions by international organizations, etc.

Usually, the effective implementation of a long-term environmental conservation strategy requites *combined public intervention* (a governance mix).

The necessity of multiple public intervention is caused by the fact that: different natural resources and diverse challenges associated with them need different instruments and form of public intervention; individual modes are effective if they are applied alone with other modes; frequently the combined effect is higher that sum of individual effects; the complementarities (joint effect) of individual forms; restricted potential of some less expensive forms to achieve a certain (but not the entire) level of socially preferred outcome; possibility to get an extra benefits (e.g. “cross-compliance” requirement for

participation in public programs); particularity of problems to be tackled; specific critical dimensions of managed activity; uncertainty (little knowledge, experience) associated with the likely impact of new forms; needs for “precaution”; practical capability of the State to organize (administrative potential to control, implement) and fund (direct budget resources and/or international assistance) different modes; and dominating (right, left) policy doctrine.

Besides, the level of an effective public intervention (management) depends on the *scale of ecosystem* and the *type of eco-problem*.

There are public involvements, which are to be executed at *local* (farm, agro-ecosystem, community, regional) level, while others require *nationwide* management. There are also activities, which are to be initiated and coordinated at *international* (regional, European, worldwide) level due to the strong necessity for *trans-border actions* (needs for a cooperation in natural resources and environment management, for exploration of economies of scale/scale, for prevention of ecosystem disturbances, for governing of spill-overs, etc.) or consistent (national, local) *government failures*.

Often the effective governance of many challenges and risks of agro-ecosystems requite multilevel management with combined actions of different levels, and involving various agents, and different geographical and temporal scale.

The public (regulatory, inspecting, provision etc.) modes must have built special mechanisms for *increasing competency* (decrease bounded rationality and powerlessness) of the bureaucrats, beneficiaries, interests groups and public at large as well as *restricting the possible opportunism* (opportunity for cheating, interlinking, abuse of power, corruption) of public officers and other stakeholders.

That could be made by training, introducing new monitoring, assessment and communication technologies, increasing transparency (e.g. independent assessment and audit), and involving experts, beneficiaries, and interests

groups in management of public modes at all levels. Furthermore, applying *"market like"* mechanisms (competition, auctions) in public projects design, selection and implementation would significantly increase the incentives and decrease the overall costs.

Principally, a "pure" public organization should be used as a *last resort* when all other modes do not work effectively [Williamson]. "In-house" public organization has higher (direct and indirect) costs for setting up, running, controlling, reorganization, and liquidation. What is more, unlike market and private forms there is not automatic mechanism (competition) for sorting out the less effective modes[19]. Here a *public "decision making"* is required which is associated with high costs and time, and it is often influenced by strong private interests (power of lobbying groups, policy makers and their associates, employed bureaucrats) rather than the efficiency.

What is more, widespread *"inefficiency by design"* of public modes is practiced to secure (rent-taking) positions of certain interest groups, stakeholders, bureaucrats, etc. Along with the development of general *institutional environment* ("The Rule of Law", transparency) and the monitoring, measurement, communication, etc. *technologies*, the efficiency of pro-market modes (regulation, information, recommendation, etc.) and contract forms would get bigger advantages over the internal less flexible public arrangements.

Usually *hybrid modes* (public-private partnership) are much more efficient than the pure public forms given coordination, incentives, and control advantages. In majority of cases, involvement of farmers, farmers organizations and other beneficiaries increases efficiency - decreases asymmetry of information, restricts opportunisms, increases incentives for private costs-sharing, and reduces management costs [Bachev, 2004].

[19] It is not rare to see highly inefficient but still "sustainable" public organizations around the world.

For instance, a hybrid mode would be appropriate for carrying out the supply of preservation of environment, biodiversity, landscape, historical and cultural heritages, etc. That is determined by the farmers information superiority, the strong interlinks of activity with the traditional food production (economy of scope), the high assets specificity to the farm (farmers competence, high cite-specificity of investments to the farm and land), and the spatial interdependency (needs for cooperation of farmers at a regional or wider scale), and not less important – the farm's origin of negative externalities.

Furthermore, enforcement of most labor, animal welfare, biodiversity, etc. standards is often very difficult or impossible at all. In all these cases, stimulating and supporting (assisting, training, funding) private voluntary actions are much more effective then the mandatory public modes in terms of incentive, coordination, enforcement, and disputing costs.

If there is a strong need for a third-party public involvement but an effective (government, local authority, international assistance) intervention is not introduced in a due time, then the agrarian "development" is substantially deformed. Consequently, all class of socially needed eco-activities and investment are blocked, natural resources are degradated or pollutes in large scales, sustainability of farms structures in reduces, etc.

Defining and evaluating efficiency of agro-eco-management

The "efficiency of agro-eco-management" represents the specific effectiveness of the analyzed form of management and/or the system as a whole in relations to the extent of realization of practically (technologically, socially, economically, etc.) possible eco-effects and the minimization of overall costs for eco-management.

When the effects, costs and efficiency of individual components of eco-management is evaluated it is to be taken into account their different temporal scale, joitness, complementarity, special and temporal apartness, and the potential for development in the conditions of constantly changing socio-economic and natural environment.

In some cases, it is possible to determine the relation between the eco-action (costs) and the eco-effect in the space and time through measurement, statistical (factors) analysis or simulation models.

For example, it is possible to determine with a high precision the correlation between the optimization of nitrogen fertilization in farms of a particular region and the decreasing the ground waters nitrogen pollution in the region; the relationship between farms involvement in the public agro-ecological measures and the restoration of biodiversity in participating farms; or the link between improved eco-behavior of farms and the preservation of the natural landscape in rural areas.

However, often it is extremely difficult (too expensive) or practically impossible to monitor, measure, and separate the specific effect (costs) of the individual elements of the management or the entire system. For instance, it is impossible to determine (quantitatively) precisely the positive or the negative impact of the (Bulgarian, Thai, etc.) agriculture on the climate preservation and/or change.

In these instances it is to be used a system of qualitative and quantitative indicators for characterization of:

- *the state and the dynamics of eco-behavior and/or eco-intention of agents*. For example, the following indicators could be used: extent of application of effective crop-rotation; introduction of good practices for chemical storing, fertilization, crop protection, irrigation and agro-technics; application of good agricultural and ecological practices; introduction of professional eco-codes and standards; transition to eco- or organic production; introduced and registered eco-products and services; amount of

costs for environmental protection and restoration; amount and character of eco-investment (e.g. building of modern manure storage site, drop irrigation system, etc.); number and scope of signed private and/or public eco-contracts; membership in eco-cooperatives or associations; number of participants and the scope of public eco-contracts and agro-ecological payments; plans for sustainable land and water exploitation, landscape and biodiversity conservation, system for waste management, etc.

- *the extent and the dynamics of the eco-pressure of agriculture*. Following indicators are appropriate: type of farmland utilization, number and kind of livestock per ha, intensity of water use, quantity and balance of chemical fertilization and crop protection, total and per ha yields for agricultural products, nitrogen and pesticides emissions in waters, emissions of dust, harmful particles, odors, noise and greenhouses gasses, the system of utilization of farmland and farming (intensive, extensive, ecological), intensity of application of heavy machineries, type of utilization of livestock manure and biomass, amount and type of agricultural waste, number and scope of protected zones, etc.

- *the impact on and/or state of the natural environment and its individual components*. The following indicators can be employed: scale and scope of farmlands erosion, scale and scope of degradation (acidification, saltification, pollution, desertification, stuffing) of soils, extent of conservation of the natural landscape, scale and scope of air and waters pollution, number of endangered species, diversity of populations of wild animals and plants, number and size of zones with environmental problems, frequency and type of extreme climate phenomena (storms, rainfalls, flooding, droughts, hails, frosts, extreme hot and cold days, etc.); the extend and the pace of post disaster recovery of natural environment (cleaning land from debris, water drainage, desalination, radioactive decontamination, etc.).

According to the type and the goals of analysis some of (or similar) indicators could be used simultaneously for characterization of the eco-

behavior, eco-pressure, eco-state and eco-impact of agriculture. For instance, the increased number of livestock on underutilized pasture or fertilization of exhausted farmlands could express decreased eco-pressure.

Similarly, the implementation of good agricultural practices, transition to organic farming, or protected zones, all they could indicate both improved eco-behavior as well as diminished pressure on natural environment. The amount of emissions of chemicals, greenhouse gasses, bad odors and noise in agriculture could be used as indicators for pressure, state, emissions, etc.

In many cases, there is not enough information for some (or all) elements of the effects and/or costs, or it is impossible to determine the effective potential of certain forms and mechanisms. Then it is appropriate to apply quantitative analysis as well, which would reveal the specific incentives, costs, effects, obstacles, and capability for improvement of eco-behavior of the diverse participants in the process.

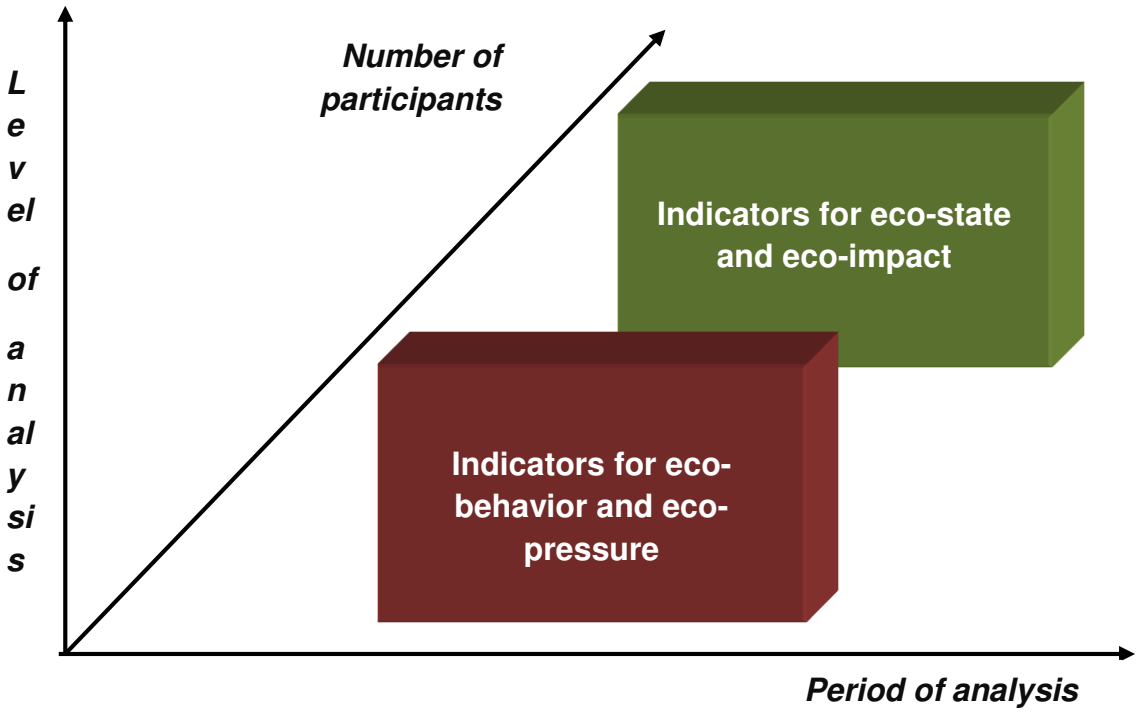
The specific indicators selected will depend on the level of analysis (farm, national, etc.), the type of analysis (particular form or instrument for eco-management, individual component of the natural environment, specific eco-challenges, integral, etc.), and the available (statistical, monitoring, experts, etc.) information in agricultural farms, in other agents of agro-eco-management (farmers and business organizations, Ministry of Agriculture, Ministry of Environment, etc.), and independent sources (Environment monitoring agency, research institutes, etc.).

As a rule, for the current and short-term analysis (a year, planed period), at the lower levels of management (farm), and for a smaller number of participating agents (individual farm or group of farms) mostly indicators for the eco-behavior and eco-pressure would be appropriate (Figure 12).

For longer periods of analysis (programs, life-cycle of investment or products), at upper levels of management (sector, eco-system, national), and for a larger number of agents who are necessary for achieving a positive eco-effect, the indicators for eco-state and eco-impacts would be more suitable.

Uncompleted list of commonly used and other appropriate indicators for assessing the eco-behavior, eco-pressure, eco-state and eco-impact in agriculture is presented in Table 2.

Figure 12. Type of indicators for assessing agro-eco-management efficiency depending on level, time-span, and number of participants



The assessment of the *comparative* and the *absolute efficiency* of agro-eco-management are to be made.

The first one assess the efficiency of a particular mode or the system as a whole in comparison to another feasible alternative form (system) or with the state before the introduction of the specific form/system of agro-eco-management.

For instance, the assessment is made on the comparative efficiency (additional costs, additional farm and ecological effect) of organic farming in relation to the farms with the traditional technology or the state of farming before introduction of that eco-innovation; on private eco-contract in comparison with the participation in eco-cooperative; on public agro-eco-subsidies comparative to the introduction eco-taxes, etc.

Table 2. Eco-behavior, eco-pressure, eco-state, and eco-impact indicators

Eco-behavior	Eco-pressure	Eco-state	Eco-impact
Implementation of effective crop rotation; Good practices for chemical storage; Good practices for fertilization; Good practices for crop protection; Good practices for irrigation; Good agri-technic practices; Good agricultural and ecological practices; Professional eco-codes and standards; Transition to eco or organic production; Introduction of eco-products and services ;	Size and share of arable land; Size and share of permanent crops; Size and share of grasslands and pastures; Size and share of abandoned land; Number and kind of livestock per farmland; Intensity of water use; Total and per farmland amount of N, K, and P fertilizers; Balance of chemical fertilization; Total and per farmland amount of	Scale and size of water erosion of farmlands; Scale and size of wind erosion of farmlands; Scale and size of farmland acidification ; Scale and size of salinized farmland; Scale and size of farmlands polluted with heavy metals etc.; Scale and size of farmland desertification; Scale and size of pressed farmlands;	Agricultural impacts on: - soil quality; - water quality; - air quality; - conservation of landscape; - conservation and recovery of biodiversity; - climate changes; - quality of ecosystem services

Registered eco-products and services; Expenditures for eco-protection; Expenditure for eco-restoration; Eco-investment; Modern manure storage; Drop irrigation; Number and scale of private eco-contracts; Number and scale of public eco-contracts; Eco-cooperation; Number of participants and scale of public eco-contracts; Number of participants and scale of agri-environmental payments; Plans for sustainable land management; Plans for sustainable water management; Plans for sustainable landscape management; Plans for biodiversity protection; Systems for waste management	chemical crop protection; Crop output and yields; Water emission of N and poeticized; Emissions of dust and pollutants; Emissions of odor; Noise emissions; Green-house gas emissions; Share of intensive land use and farming; Share of extensive land use and farming; Share of ecological land use and farming; Intensity of heavy machineries; Amount and share of manure use; Amount and share of biomass use; Amount and kind of agricultural wastes; Number and scale of protected zones	Scale of conservation of natural landscape; Kind, size and scale of air pollution; Kind, size and scale of ground water pollution; Kind, size and scale of surface water pollution; Kind, size and scale of drinking water pollution; Number of endangered wild habitats; Diversity of wild habitat populations; Number and scale of zones with eco-problems; Frequency and type of extreme climate (storms, floods, droughts, hails, freezes etc.); Extend and pace of post disaster recovery of natural resources	

At the management decision stage, the analysis of comparative efficiency is a mean for selecting the most-efficient option of eco-management (behavior, investment, cooperation, benefits) between institutionally, financially, and technologically possible alternative forms. Therefore, they are tools for increasing the absolute efficiency of the agro-eco-management.

At the project implementation stage, these estimates express the comparative advantages (or disadvantages) of the chosen form for agro-eco-management in relation to the feasible alternatives.

The absolute efficiency assesses the overall effectiveness of a particular form or the entire system in relation to the achievements of standards for environmentally friendly and sustainable agriculture.

Here as criterion for assessing the effect is used:

- the contemporary scientifically recommended ecological norms and standards for behavior, pressure, emission, acceptable pollution, balance of fertilization, state of soils, waters, biodiversity, landscape, etc. For instance, achieving the norms for ecologically efficient fertilization and restoration of soil fertility, efficient number of livestock per ha pasture land, limits for minimum pollution of waters for drinking and irrigation; standards for balance of wild species in agro-eco-systems, for storage of manure and other agrarian waste, etc.

- or the planned socio-economic (farm, ecological, etc.) objectives or standards in the program for agro-eco-management. For instance, transition and certification for the organic and eco-production, number of farms and amount of farmland included in the public measures for agro-ecology; extent of realization of the plan for restoration of polluted waters and soils, for recycling of wastes, etc.

The criterion for assessment of the costs is weather it is possible to achieve the same goals with less overall costs or it is possible to achieve a higher (ecological, other positive) effect with the same costs.

The evaluation of the sustainability of eco-management for a farm is also made though analysis of the absolute efficiency. For example, the absolute efficiency of public, private or market eco-contract for a particular farm is to be estimated through the additional income from the agro-ecological subsidy, contract cash flow, and/or increased prices of eco-product/service, in relation with the costs for management and implementation of eco-contract terms (including missed benefits from the decreased yields and productivity as a result of transition to the eco-production). The existence of a net benefit (profit) means that the eco-activity is economically efficient for the farm[20].

The benefits for a particular farm are to be searched in other directions as well. For instance, the improved system of eco-management leads to conservation of natural resources employed in the farm, preserved or improved farm productivity in a longer-term, avoided future costs for compensation of decreased productivity and/or for the restoration of quality of natural resources, preserved or increase value of natural assets of the farm, etc.

At lower levels of analysis (farm, industry) the direct (internal farm, program) and indirect (external and social) eco-costs and effects are to be distinguished. At higher levels of analysis (most) costs and effects are “internal”. In any case, all (positive, negative, interlinked) effects and the overall social costs associated with individual forms of eco-management are to be taken into account.

The assessment of costs for eco-management is to include:

- *purely “production” costs and investment* for eco-friendly agriculture, which are associated with the technology of conservation, improvement and restoration of natural environment; and

[20] Often the assessment requires more complicate calculations (comparing current and long-term effects, “discounting”, etc.) similar to the analysis of efficiency of long-term investment.

- *the transaction costs,* which are associated with the management of relations with other agents – costs of labor, and payments for acquiring information, negotiation, organizational development, registration and protection of eco-rights and products, controlling opportunism, conflicts resolution, adaptation to market and institutional environment, etc.

For instance, in assessment of the public form the overall costs is to be included which usually comprise: direct (tax payer, assistance agency) expenses, *and* transacting costs of bureaucracy (for coordination, stimulation, control of opportunisms and mismanagement), *and* costs for individuals' participation and usage of public modes (adaptation, information, paper works, payments of fees, bribes), *and* costs for community control over and for reorganization of bureaucracy (modernization, liquidation), *and* (opportunity) costs of public inaction.

A part of the transaction costs could be determined directly, since they are object of a separate (including accountancy) reporting or could be easily specified from the traditional (production, program) costs. Examples for these type are costs for licensing, certifications, tests, purchase of information, registration, hiring consultants, payments for guards and lawyers, lawsuits, bribes, etc.

However, another (significant) part of the transaction costs is impossible or very expensive to be separated or determined. Here already presented *Comparative structural (qualitative) analysis* is to be employed which will determine whether the eco-activities and transactions with specific dimensions (frequency, uncertainty, assets specificity, and appropriability) are governed/organized with the most effective mode(s). The effective are structures, which minimize the transaction costs and maximize the transaction costs of the participants in the specific socio-economic, institutional, technological and natural environment [Bache, 2004].

When the aggregation and/or the comparison of data for effects and costs are made it is necessary to correct differences, which are associated with the

application of unequal methods of calculation and/or dissimilar precisions in different farms, public agencies and periods of time.

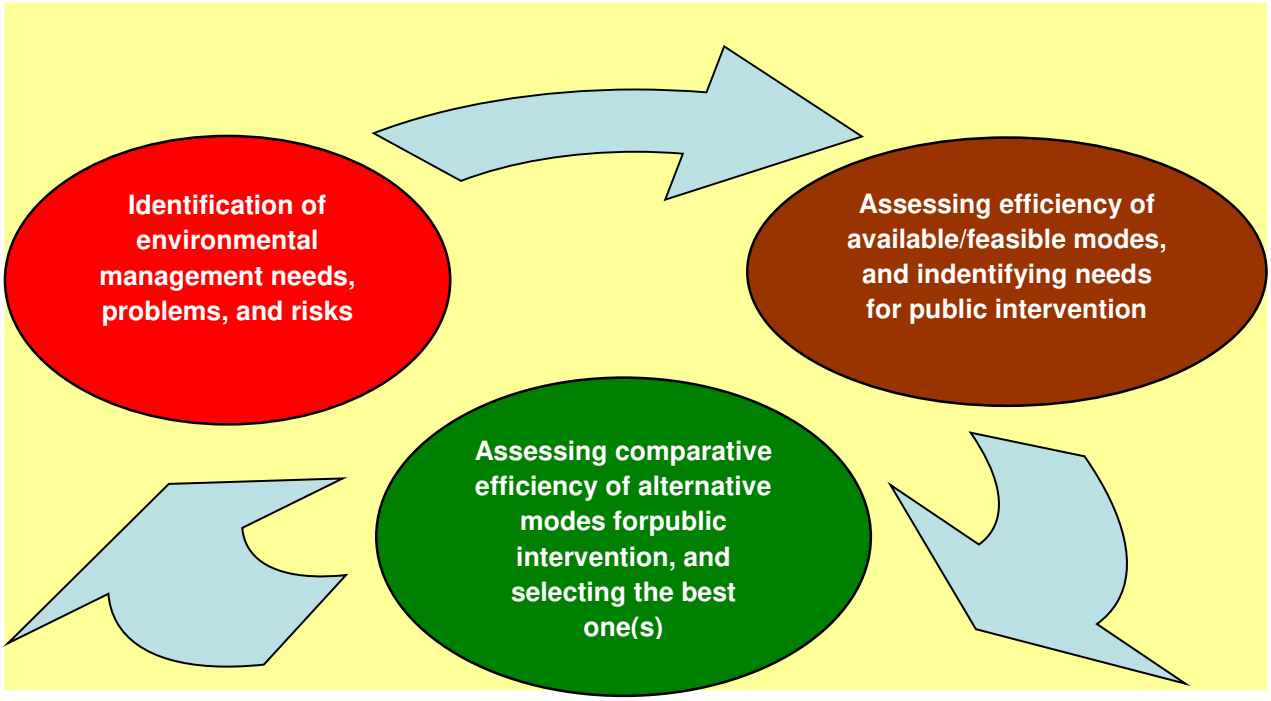
The adequate assessment of efficiency often requires collection of first hand microeconomic, ecological, etc. data from different levels and participants in agro-eco-management as well. For this purpose, it is to be organized interviews with managers and stakeholders, laboratory tests, scientific experiments, etc. Very often, it is also necessary to use experts' assessments of leading specialists in the area.

The selection of the type and the importance of the criterion and indicators for the analysis and assessment of efficiency of the agro-eco-management at different levels are to be done by the experts in the field.

Stages in analysis of agro-environmental management

The analysis and the *improvement* of agro-eco-management and strategies is to include following stages (Figure 13):

Figure 13. Stages in analysis and improvement of agro-eco-management



First, assessment of the specific management needs of conservation of natural environment utilized and/or affected by agriculture. The later depends on the particular characteristics of diverse natural resources and ecosystems they are part of, and the number, interests and strategies of related agents.

For instance, persistence of serious eco-problems and risks is an indicator that an effective system of eco-management is not put in place. Therefore, trends, factors, problems, and risks associated with the natural environment and its individual elements (land, water, air, biodiversity, eco-systems, climate, etc.) are to be identified.

Modern science offers quite precise methods to assess the state of environment, and detect existing, emerging and likely challenges - environmental changes, degradations, destructions and depletion of natural resources, eco-risks, etc. [MEA; Bachev, 2013c].

What is more, science offers reliable instruments to estimate agricultural contribution to and impact on the state ("health") of environment and its different components, including in different spatial and temporal scales. For instance, there are widespread applications of numerous eco-indicators for

pressure, state, respond, and impact as well as for integral assessment of agrarian environmental sustainability [FAO, 2010a].

The lack of serious eco-problems, conflicts and risks is an indicator that there is an effective system for eco-management, and therefore there is no need for changing public strategy for environmental conservation. However, usually there are significant or growing environmental problems and risks associated with the agriculture in developed and developing countries alike.

Second, assessment is to be made on the efficiency and the potential of *available* and *other feasible* modes and mechanisms of management for environmental conservation, and for overcoming the existing, emerging and likely eco-problems and risks associated with agriculture.

The analysis is to embrace the system of agro-eco-management and its individual components – *institutional environment* and *various* (formal, informal, market, private, contract, internal, individual, collective, public, specialized, multifunctional, simple, complex, etc.) *forms* for governing eco-activities of agrarian agents (farms of different type). In fact, most analyses are restricted to a certain form (formal, farm, cooperative, public program) ignoring other important, dependent, or complementary modes.

The efficiency of individual modes are to be evaluated in terms of their *strategies* and (comparative) *potential* to safeguard and develop agents eco-rights and investments, stimulate socially desirable level of environment protection behavior and activity, rapid detection of eco-problems and risks, cooperation and reconciliation of eco-conflicts, and to save and recover total environmental (conservation, recovery, enhancement, transaction, direct, indirect, private, public etc.) costs.

Furthermore, the efficiency of individual forms cannot be fully understood without analyzing the *complementarities* and/or *contradictions* between different forms and strategies – e.g. the high complementarities between (some) private, market and public forms for eco-management; conflicts

between the “gray” and “light” sector of agriculture and natural resources exploitation, etc.

Most assessments include only direct, production (eco-recovery, eco-maintenance, eco-enhancement), or program (international assistance, taxpayer) costs. The analysis is to include all (social) costs associated with different forms of eco-management – private, third party, public, current, long-term, production, transaction, etc. In addition to the proper individual and third-party production (technological, agronomic, ecological etc.) costs, the eco-management is usually associated with significant transaction (governance) costs.

The efficiency checks are to be performed periodically even when the system of agro-eco-management seems *“works well”.* That is because the good conservation of natural resources could be done at *excessive* social costs or *further improvement of the environment* may be done at the same social costs. In both cases there is an alternative *more efficient* organization of agro-eco-management, which is to be introduced. For instance, often the too expensive for the taxpayer “state eco-management” (in terms of incentives, total costs, adaptation and investment potential) could be replaces with more effective private, market or hybrid mode (public-private partnership).

Besides, the assessments are usually limited to the absolute efficiency of individual forms of eco-management (related costs, environmental effects) ignoring their comparative efficiencies. The analysis is to incorporate both absolute and comparative (in relation to other feasible modes) efficiency of the diverse management modes.

The comprehensive analysis let determine the *deficiencies* (“failures”) in dominating market, private, and public modes to manage effectively existing, emerging and likely eco-problems and risks, and specify the *needs for (new) public intervention* in agrarian eco-management. They could be associated with the impossibility for achieving socially desirable and practically possible

environmental goals, significant transaction difficulties (costs) of participating agents, inefficient utilization of public money and resources, etc.

Third, the *alternative* and practically possible modes for *new public intervention* able to correct (market, private and public) failures are to be identified, their *comparative efficiency* and *complementarities* assessed, and the *most efficient one(s) selected*. Only technically, economically, and politically *feasible* modes of new public intervention in the environmental management are to be specified. Their comparative (goal achieving, coordinating, stimulating, costs-minimizing, etc.) efficiency to and complementarities with other practically possible modes of public involvement (assistance, public-private partnership, property rights modernization, etc.) is to be assessed, and the best one(s) introduced.

The public modes not only support (market *and* private) transaction, but are also associated with significant (public *and* private) costs. Therefore, the assessment is to comprise *all* costs for implementation *and* transaction - direct (tax payer, assistance agency) expenses, *and* transacting costs of bureaucracy (for coordination, stimulation, control of opportunisms and mismanagement), *and* costs for individuals' participation and usage of public modes (adaptation, information, paper works, payments of fees, bribes), *and* costs for community control over and for reorganization of bureaucracy (modernization, liquidation), *and* (opportunity) costs of public inaction[21].

Suggested analysis is to be made at *different levels* (farm, eco-system, regional, sectors, national, international) according to the *type of eco-challenge* and the *scale of collective actions* necessary to mitigate specific eco-problems and risks for *each component* of the natural environment (soils waters, air, etc.) and *integrally* for the natural environment as a whole.

[21] Some of the *environmental losses* are expressed in economic terms (e.g. decline in income in related industries, replacement and recovery costs, negative effects on human welfare). However, a significant part of the social value cannot be expressed in monetary terms – e.g. negative impact in biodiversity, other ecosystems, human health, future generations etc.

It is not one time exercise completing in the last stage with a perfect system of eco-management. It is rather a *permanent process*, which is to improve eco-management along with the evolution of natural environment, individual and communities (social) awareness and preferences, and the modernization of technologies and institutional environment. Besides, the *public* (local, national, international) *failure* is also possible (and often prevail) which brings us into the next cycle in the improvement of eco-management in agriculture.

The comparative institutional analysis let define the efficiency and the potential of divers mechanisms and modes of management to deal with diverse problems and risks associated with the natural environment. Moreover, it let improve the *design* of the new forms of public intervention according to the specific market, institutional and natural environment of a particular farms, eco-system, region, sub-sector, country, and in terms of the perfection of coordination, adaptation, information, stimulation, restriction of opportunism, controlling (in short – minimizing transaction costs) of participating actors (decision-makers, implementers, beneficiaries, other stakeholders).

What is more, that analysis unable us to *predict* likely cases of a *new* public (local, national, international) *failures* due to impossibility to mobilize sufficient political support and necessary resources and/or ineffective implementation of otherwise “good” policies in the specific socio-economic environment of a particular country, region, sub-sector etc. Since public failure is a *feasible option* its timely detection permits foreseeing the persistence or rising of certain environmental problems, and informing (local, international) community about associated risks.

Part 2. Evolution of eco-management in Bulgarian agriculture

Institutional environment

During most of the post-communist transition period (1989-1990), the rights on agrarian resources (farmland, water) and the diverse eco-rights (on clean, aesthetic nature; preservation of nature resources, biodiversity) were not defined or were badly defined and enforced (Table 3). Inefficient public enforcement of the laws, and the absolute and contracted rights was common. That has had negative consequences on the development of farming structures, and the forms and efficiency of eco-management [Bachev, 2010a].

Privatization of the farmland and the assets of ancient public farms took almost 10 years to complete. During a good part of that period, the management of critical agrarian resources was in ineffective and “temporary” structures (such as organizations under privatization, liquidation or reorganization; Land commissions, etc.) with no interests in effective and sustainable exploitation. Besides, short-term lease of the natural resources and material assets was a major form for the farm extension [Bachev, 2010a].

Out-dated and sectoral system of public policing, regulations and control dominated until recently, which corresponded little to the contemporary needs of eco-management. There was no modern system for monitoring the state of soils, waters, and air quality, and credible information on the extent of environmental degradation.

Table 3. Evolution of agro-environmental management in Bulgaria

Institutions	Private modes	Market modes	Public modes
Post-communist transition (1989-2000)			
Not well defined eco- and resource rights, bad enforcement; Sustainability concept absent	Provisional lease in contracts on natural resources; Unregistered farms; Firms; Cooperatives	Trade with informal brands, origins, and ecosystem services; Free (monopoly) agricultural water pricing	State and cooperative farms; Organization under privatization, liquidation and reorganization; Outdated system of eco-regulations, monitoring and information
Pre-accession to EU (2001-2006)			
Better defined and badly enforced rights on agrarian and eco-resources, and contracts	Unregistered farms; Firms; Cooperatives; Water User Associations; Vertically integrated modes	Trade with formal brands, origins, organic products, and ecosystem services; Free (monopoly) agricultural water pricing	Special Accession Program for Agrarian and Rural Development; Cross-compliance; Environmental regulations, standards, and agencies; Regulations for organic farming; Agricultural Advisory Service
EU membership (since January 1, 2007)			
Well-defined rights, and better enforcement; EU Community Acquis; Collective institutions	Unregistered farms; Firms; Cooperatives; Water User Associations; Vertically integrated modes; NGOs; Codes of behavior; Eco-labels	Trade with formal brands, origins, organic products, and ecosystem services; Free (monopoly) agricultural water pricing; Insurance against natural disasters	EU eco-regulations, standards; EU Operational Programs; National eco-programs; NPARD; Direct payments; Advisory Service; Eco-monitoring and assessment; Protected zones (NATURA); Compensations for natural disasters; Mandatory eco-training; Garbage taxation; State companies for Natural Parks; Support to trans-border initiatives

There was neither awareness of the “concept” of sustainable development nor any needs to include it in the public policy, and private and community agenda. The lack of “culture of sustainability” has also impeded the evolution of voluntary measures, and private and collective actions (and institutions) for effective eco-management.

Before the EU accession (January 1, 2007), the country’s laws, standards and institutions were harmonized with the Community Acquis. That introduced a modern framework for eco-governance including the new rights (restrictions) on protection of environment, integrated territory, water and biodiversity management, preservation of traditional varieties and breeds, animal welfare, “polluter pay principle” as well as corresponding control, monitoring, and assessment institutions (e.g. Executive Environmental Agency, Hydro-melioration Agency, etc.).

The EU accession has introduced and enforced a “new order” - strict regulations and control; tough quality and environmental standards; environmentally friendly zoning; financial support for eco-conservation and market instability, etc. Moreover, the huge European markets have been opened which enhanced competition and let local farms explore their comparative advantages (low costs, high quality, specificity and purity of produce) giving strong incentives for investments in farm modernization and conforming to the high (EU) product, labor, technology, animal welfare, and eco-standards.

The external demand, monitoring, pressure, and sanctions by the EU lead to a better enforcement of the laws and the standards. What is more, internal collective actions and social demand for good governance have also got momentum leading to some improvement of public management. Good examples for the later are the success of eco-organizations putting a 5-year ban on GM crops, timely reaction against eco-violation in protected zones, revoking unlawful “exchanges” of valuable public lands, etc.

Nevertheless, the new “rules of the game” have not been always clearly understood by the public authorities, private organizations and individuals. There is not yet readiness for effective (full) implementation of the new public order because of the lack of information and experience or administrative capacity (lack of comprehension, deficient court system, corruption). Often, the enforcement of eco-standards is difficult since costs for detection and penalizing of the offenders are high, or there is no direct links between the performance and the eco-impact – e.g. banned fields burning after harvesting is still widespread in the country [EEA, 2010].

The institutional modernization has been also associated with new conflicts between the diverse private, collective and social interests. However, the results of the public choices have not always been for the advantage of the effective eco-management. For instance, strong lobbying efforts of certain private groups and businesses led to a 20% reduction in numbers and 50% reduction in the area of initially identified sites for the pan-European network NATURA 2000 [MWE].

Private modes and strategies of eco-management

The newly evolving market and private structures were inefficient in dealing with various economic and eco-issues. The privatization of farmlands and the assets of ancient public farms took 10 years to complete while some state assets (e.g. irrigation, services, etc.) have not been not effectively reorganized until recently. During much of the period, the management of farmland, land related assets (permanent crops; buildings; irrigation, drainage and flood protection facilities), eco-systems and water-resources, was in ineffective “temporary” structures (such as organization under privatization, liquidation or reorganization; Privatization Boards, Liquidation Councils, Land Commissions, etc.). The sales and long-term lease markets for land and other natural resources did not emerge until 2000, and the annual leasing was the

major form for management until recently. That was combined with a high economic and institutional uncertainty and a big inter-dependency of agrarian assets leading to domination of primitive and low productive structures [Bachev, 2010a].

Much of the farming activities were carried in inefficient and unsustainable structures – public farms, part-time and subsistence farms, production cooperatives, and huge business farms based on provisional lease-in contracts, etc. (Table 4). Most livestock holdings have been also miniature “unprofessional” farms breading the majority of animals in the country (Table 5).

The farms adjustments and the intensifying competition have been associated with a significant decrease in the number of unregistered, cooperative and livestock holdings without adequate transfer of the land, livestock, and environmental management to other structures. Despite some augmentation of the average farm size, the share of abandoned agricultural lands and the primitive domestic livestock operations has been considerable from the beginning of the transition now.

Dominating modes for carrying out the farming activities have had little incentives for current and long-term investment to enhance productivity and environmental performance [Bachev, 2008].

For instance, the cooperative’s big membership makes the individual and collective control on the management very difficult and costly. That focuses managerial efforts on the short-term indicators, gives a great possibility for mismanagement and using the cooperatives in the best private (managers and associates) interests.

Table 4. Number, size and importance of different farms in Bulgaria

	Public	Unregistered	Cooperatives	Agro-firms	Total
Number of farms					
1989	2101	1600000	na	na	1602101
1995	1002	1772000	2623	2200	1777000
2000	232	755300	3125	2275	760700
2010		350900	900	6100	357900
Share in number (%)					
1989	0.13	99.9			100
1995		99.7	0.1	0.1	100
2000		99.3	0.4	0.3	100
2010		98.0	0.25	1.7	100
Share in farmland (%)					
1989	89.9	10.1			100
1995	7.2	43.1	37.8	11.9	100
2000	1.7	19.4	60.6	18.4	100
2010		33.5	23.9	42.5	100
Average size (ha)					
1989	2423.1	0.4			3.6
1995	338.3	1.3	800	300	2.8
2000	357.7	0.9	709.9	296.7	4.7
2010		2.9	807	211.6	8.5

Source: National Statistical Institute

Besides, there are differences in the investment preferences of diverse coops members due to the non-tradable nature of the cooperative shares ("horizon problem"). Given the fact that most members are small shareholders, older in age, and non-permanent employees, the incentives for long-term investment for land improvement, environmental conservation, and renovation of material and biological assets have been low. The "member-oriented" (non-for-profit) nature of the cooperatives also prevents them to adapt to diversified needs of members, and market demand and competition.

Table 5. Number and size of livestock holdings

Type of holdings	Share		Share		Share		Average heads
	farms	heads	farms	heads	farms	heads	
Dairy cows	***1-2***		***3-9***		***20 and >***		
2003	87.3	56.3	11	23.3	0.6	13.5	1.9
2009	79.6	30.1	14.6	20.0	2.3	36,3	3.3
Buffalo cows							
2003	85.3	47.5	11.4	20.6	1.2	23	2.3
2009	63.5	11.4	21.6	11.5	6.9	60,7	7.3
Ewes	***1-9***		***10-49***		***100 and >***		
2003	56.7	89.3	26	9.6	9.5	0,4	5.9
2009	29.8	82.8	22.6	13.2	33.2	1,7	10
She-goats							
2003	98.2	86.8	1.2	5.8	0.1	3	2.6
2009	96.2	67.3	3.3	20.2	0.01	5	3.1
Breeding pigs	***1-2***		***3-9***		***200 and >***		
2003	87.1	34.5	10.2	14.0	0.2	35.1	3.0
2009	78.8	12.8	14.9	8.8	0.5	57.4	7.8

Source: Ministry of Agriculture and Food

On the other hand, the small-scale and subsistent farms[22] possess insignificant internal capacity for investment, and a small potential to explore economy of scale and scope (big fragmentation and inadequate scale). Besides, they have little incentives for "non-productive" environment and biodiversity conservation, animal welfare etc. spending.

Moreover, there has been neither administrative capacity nor a political will to enforce the quality and eco-standards in that vast informal sector of the economy. Consequently, the primitive technologies and a low compliance with the modern agronomic, safety and eco-standards have been

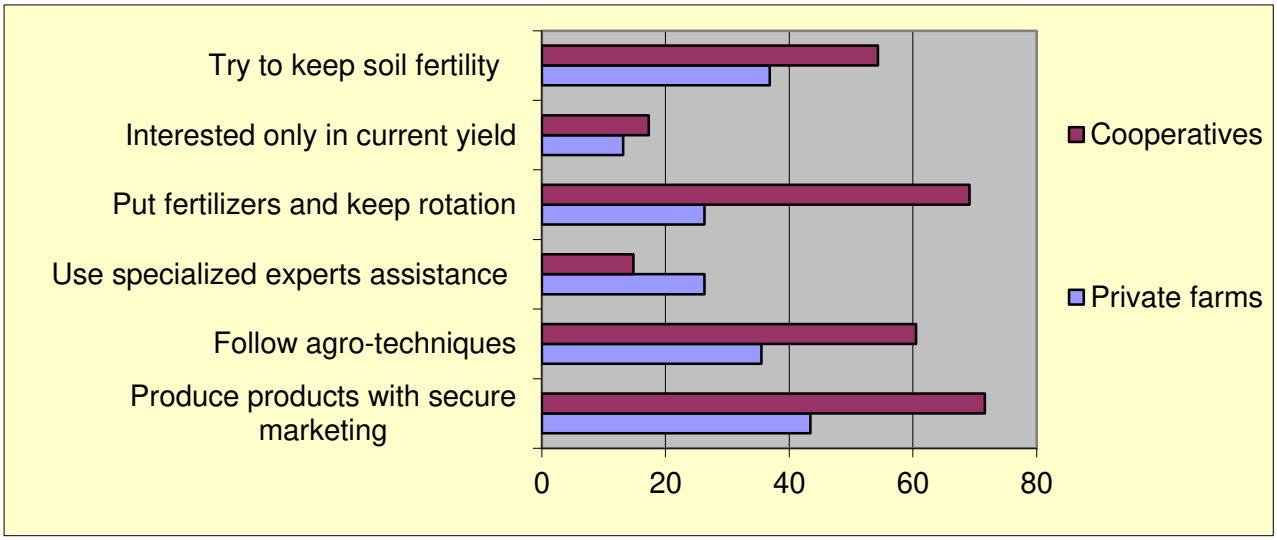
[22] Subsistence and semi-market farms comprise the best part of the farms in the country as almost 1 million Bulgarians are involved in farming mostly on a part-time base and for "supplementary" income [MAF].

widespread. The dairy sector is particularly vulnerable since only one-third of the holdings meet formal EU standards until recently [MAF].

The larger business farms operate mainly on leased land and concentrate on high pay-off investment with a short payback period (e.g. cereals, sunflower, other industrial crops). They have been more sensitive to the market demand and the institutional regulations since largely benefit or lose from the timely adaptation to the new standards and market preferences. Besides, these enterprises have a higher capability to fund and adapt to the new formal and market requirements. However, until recently, there has been no effective outside (authority, community, international) pressure for respecting the eco-rules by the business enterprises.

Restructuring of the commercial farms continues as most of them apply "survival tactics" ("concentration on products with secure marketing") rather than a long-term strategy toward sustainability (preserving soil fertility, observing crop rotation and agro-techniques requirements) (Figure 14).

Figure 14. Share of farms implementing different strategies in Bulgaria (percent)



Source: interviews with farm managers, 2012

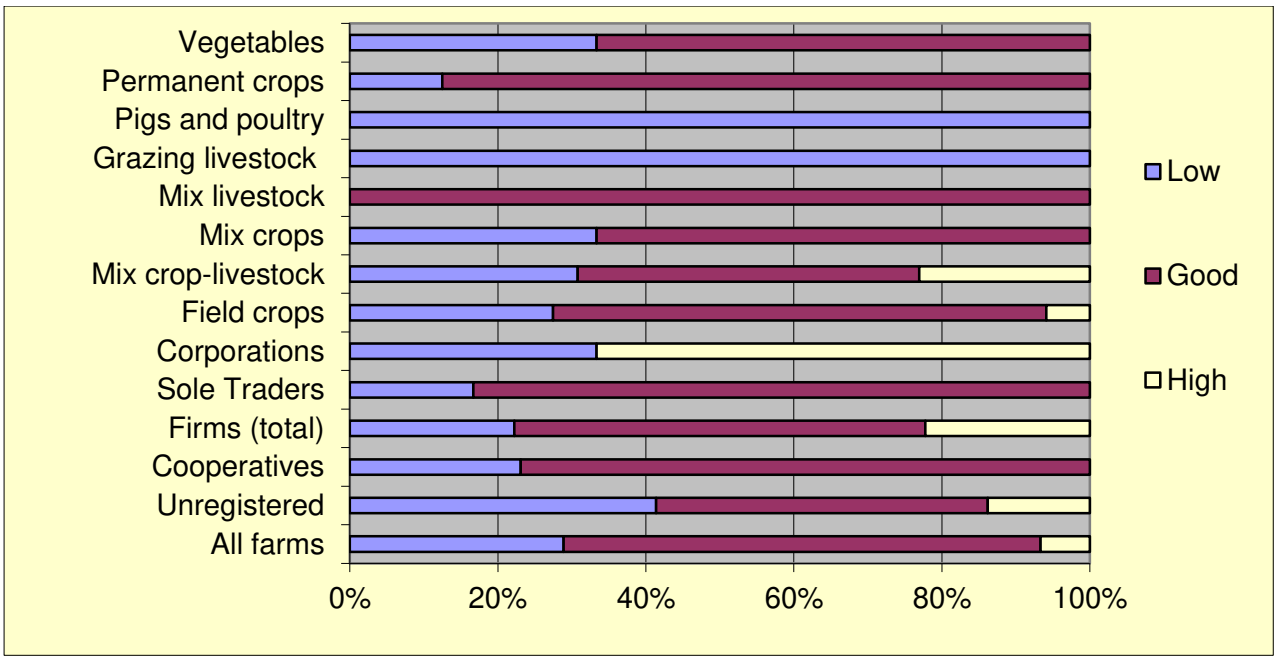
What is more, a great portion of the subsistent, smaller commercial farms and the cooperatives have been unable to adapt to the evolving market, institutional and natural environment – intensified market competition; new EU quality, safety, and eco-standards; challenges associated with climate change, etc. [Bachev, 2013a].

For example, our survey has found out that more than a quarter of the farms are with a low potential for adaptation to the new state and EU quality, safety, and environmental standards, almost 37% of them are less adaptable to the market demand, prices and competition, and every other one is inadaptable to the evolving natural environment (warning, extreme weather, droughts, floods, etc.).

The “medium-term sustainability” of the farms is estimated as “low” for the unregistered holdings, grazing livestock, and pigs and poultry farms (Figure 15). Furthermore, less that 7% of all farms “forecast” a high sustainability. A particular type of firms (the Companies) is the only exception where the majority of enterprises envisages being highly sustainable in years to come. The later reflects both the environmental sustainability and the ability of holdings to manage eco-projects.

The smaller size, owner operating and extensive nature of the majority of farms let avoid certain problems of the large public enterprises from the past such as over-intensification, lost natural landscape, biodiversity, nitrate and pesticide contamination, huge livestock and manure concentration, and uncontrolled erosion [Bachev, 2010]. The subsistent and small-scale farming has also revived some traditional and more sustainable technologies, varieties, and products, and avert some livestock epidemics such as the Mad cow disease and the Avian flu.

Figure 15. Share of farms with different levels of medium-term sustainability in Bulgaria



Source: interviews with farm managers, 2012

The private mode has introduced incentives and possibilities for integral eco-management (including revival of the eco- and cultural heritage; anti-pollution, esthetic, and comfort measures, etc.), investing in eco-system services, origins, labels, and profiting from the inter-dependent activities such as farming, fishing, agro-tourism, processing, and marketing. There are numerous good examples for private introduction and enforcement of quality and eco-standards by the individual farms (voluntary and trade initiatives), a vertical integrator (dairy and vine processor, retailer, exporter), or a foreign investor (cereals, oil crops) [Bachev, 2004, 2010, 2013a].

The private management has been associated with the improved environmental stewardship on owned and marketed resources, but less concern to the manure and garbage management, over-exploitation of leased and common resources, and contamination of soils, waters and air [Bachev 2008]. However, the process of farms adaptation leads to the intensification of production, which could revive or even deepen some of the eco-problems unless a pro-environmental management is put in place.

Moreover, the “free market” management of the giant and semi-monopoly servicing (water, insurance, mechanization, etc.) companies usually comes with unfavorable pricing and terms for the majority of farms.

In 1990s the State monopoly “Irrigation Systems” was reorganized into a Joint-stock company owned by the Ministry of Agriculture and responsible for the management of state assets, provision of irrigation and drinking water, drainage and flood protection. Furthermore, the Union of Water Users was initiated and 176 Water User Associations (WUA) emerged. Nevertheless, the later collective form was unable to improve the efficiency (low incentives, lack of “real” ownership, etc.) and deal with the monopoly position of the 21 semi-autonomous regional branches of the Irrigation Systems.

Since 2001 the user-rights on irrigation assets of the Irrigation Systems have been freely transferred to newly reestablished WUA. Around 70 WUA have been formed servicing 30% of the total equipped for the irrigation area. However, expected “boom” in the efficiency from the collective management of irrigation has not materialized because of the semi-monopoly situation (terms, pricing, etc.) of the regional water suppliers, few incentives for the water users to innovate facilities and expand irrigation, and uncompleted privatization of the state assets [Bachev, 2011].

What is more, the evolution of various farmers and eco-associations in the country has been hampered by the big number and the diversified interests of agents – a different ownership size, operation, type of farming, preferences, age, and horizon.

However, there have been few examples for the effective agrarian organizations mostly with the small-membership and strong common interests of participants - e.g. tobacco, silk-warm, bee-honey etc.

Furthermore, in recent years some the environmental organizations have been quite successful in the eco-monitoring, campaigns against GM crops cultivation and removal of the restrictions in protected areas, and other actions such as garbage cleaning, etc. For instance, among other activities

the Bulgarian Society for Bird Protection monitors the birds' species varieties and numbers in different type of territories [BSBP].

Market modes

A market-driven organic farming has also emerged and registered a significant growth. There has been almost 70 folds increase in the number of organic operators since 2003, and the organic producers comprise the largest part (95.1%) of the organic operators totaling 2016 farms, processors, and traders in 2012 [EUROSTAT, MAF].

There has been enormous augmentation of the organic areas and the number of livestock ("fully converted" or "in transition" to organic production) but they are still a tiny portion of the Utilized Agricultural Area (UAA) and overall livestock population (Table 6).

The "fully converted organic areas" accounts for 25.4% of the total organic areas with the "Industrial crops" and the "Permanent crops" comprising the biggest shares (27.1%) of the organics areas (Figure 16). In addition there have been few livestock farms and apiaries certified for the bio-production with the highest growth in the organic goats and sheep, and a lion share of the bees. There are also more than 470 thousands ha approved for gathering of wild organic fruits and herbs [MAF].

Table 6. Evolution of organic production in Bulgaria

Organic indicators	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Farming area, ha	650	1113	2432	3061	11808	16663	11789	25647	26622	40378

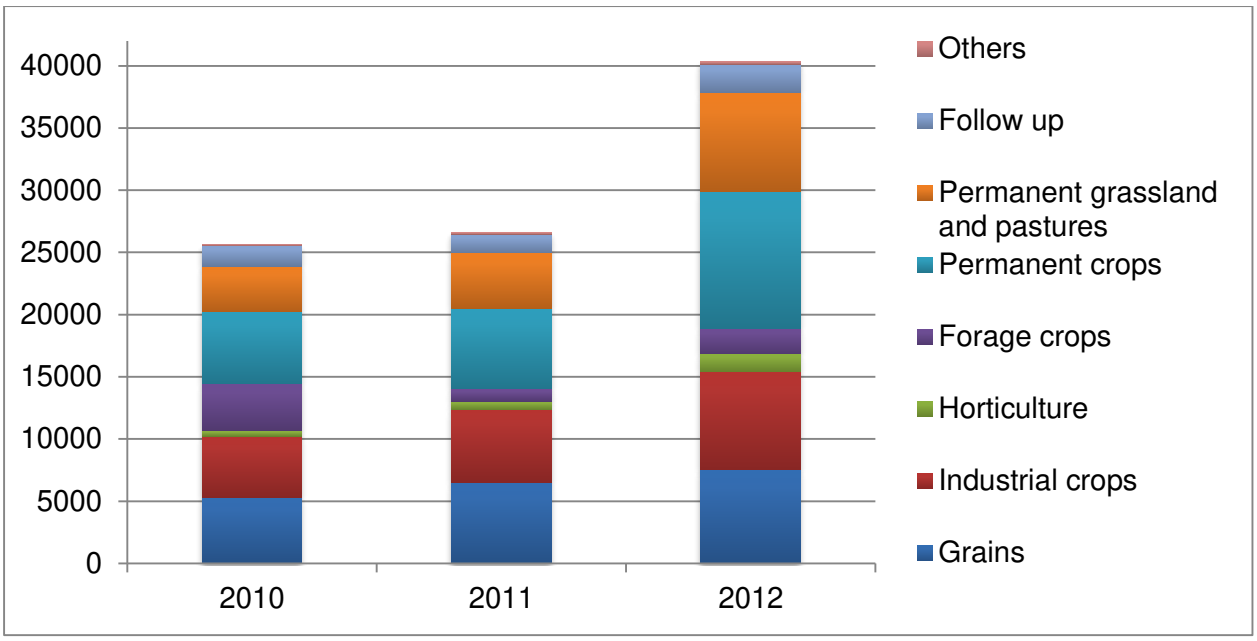
% in UAA	0.01	0.02	0.05	0.06	0.23	0.33	0.23	0.51	0.52	0.79
Wild fruits, herbs, etc. thous. ha	-	-	-	110.1	397.8	489.1	401.4	546.2	543.6	472.7
Cattle % in all	na	na	395 0.11	329 0.05	395 0.07	470 0.14	272 0.05	364 0.07	976 0.17	1173 0.22
Sheep % in all	na	na	294 0.02	1054 0.07	1690 0.11	2471 0.21	5831 0.42	6698 0.49	6648 0.46	9175 0.67
Goats % in all	na	na	32 0.01	131 0.03	1058 0.28	1624 0.45	2732 0.75	2773 0.78	3397 0.99	2831 0.96
Bees colonies	na	na	23508	33981	35747	44861	41089	46429	58855	85346

Source: Ministry of Agriculture and Food, EUROSTAT

The organic form has been introduced by the business entrepreneurs who managed to organize and fund this new venture arranging independent certification and finding buyers for the highly specific ("organic") output. In addition, there have been few examples for successful integration of small-scale producers in the organic supply chains nationally and internationally. A case study on a "typical" model for the integration of a small-scale dairy producer in the modern supply chain for the organic produce is presented in another publication [Bachev, 2014].

Produced bio-fruits, vegetables, oil plants, herbs, spices, and honey have been mostly for the export since a tiny market for the organic products exists in the country. The slow development of the internal organic market is caused by the high prices of products, and limited consumer confidence in the authentic character of products and certification.

Figure 16. Areas with organic cultivation in Bulgaria (ha)



Source: Ministry of Agriculture and Food

Eco-labeling of the processed farm products (based on "self-regulation") has also appeared but it is perceived more as a part of the marketing strategy of companies rather than a genuine eco-action [Bachev, 2008}. What is more, the (free) market management of the semi-monopoly servicing, supplying etc. companies comes with unfavorable pricing and terms for the farmers, and only few among them purchase water, insurance against natural disasters (draughts, floods etc.), and other services presently.

Public modes

During the transitional period the public (Government and local authority) intervention in the environmental management was not significant, comprehensive, sustainable, or even related to the matter [Bachev, 2008]. The eco-policies were fragmented and reactive to the urgent problems (natural disasters such as flooding, droughts, etc.) with different agencies responsible for the individual aspects of eco-management.

In passed years a number of national programs have been developed to deal with the specific eco-challenges in accordance with EU rules such as: for the preservation of biodiversity and environment; limitation of emissions of Sulphur Dioxide, VOC, Ammonia; waste management; development of water sector; combating climate change; developing organic agriculture; management of lands and fights against desertification; agrarian and rural development etc.

Moreover, the national monitoring systems of the environment and biodiversity are also set up, and the mandatory eco-assessment of the public programs introduced.

Nevertheless, the actual eco-policies rest fragmented and largely reactive to the urgent eco-problems (floods, storms, drought) rather that based on a long-term strategy for sustainable development. As a result of the inefficient priority setting, management and enforcement (bad coordination, gaps, incompetence, ineffective enforcement, corruption, etc.), and administrative capability[23] a minor impact of the public programs prevails [Bachev, 2008, 2010, 2013a].

Indicative for the public inefficiency is the level of the “national expenditures for protection and restoration of environment” which have been

[23] e.g. due to organizational and financial reasons Ministry of Water and Environment often does not get the relevant water information from the institutes of Bulgarian Academy of Sciences [EEA, 2010].

merely 1.9% of the GDP, and the agriculture getting a tiny portion of the total public eco-spending [MEW].

What is more, recent financial and economic crisis further deteriorated funding of the public (including environmental) projects. For instance, the recultivation of degradated farmlands by the MAF was initiated recently but it accounts only for 200-250 ha per year [EEA, 2010]. Similarly, serious eco-challenge is still caused by the state deficiency in storing and disposal of the out-of-dated pesticides, which are responsible for a good part of all polluted localities in the country [EEA, 2010].

There has also been a numerous international (UN, EU, unilateral, NGOs, etc.) assistance projects to “fill the gap” in the local failures. However, they have been limited in scale, unsustainable in time; often overtaken by local groups, funding improperly used; and with no significant positive impact [Bachev, 2008, 2013a].

Furthermore, the agrarian education and the National Agricultural Advisory Service (NAAS) has not been effectively reorganized and provide modern and continues training on the rural development and eco-, climate change, and water-management issues. Neither they reach all agents via effective methods of education, advice and information suited to the specific needs of different agents.

What is more, the integral approach of the soil, water and biodiversity management in the planning, funding, management, monitoring, controlling and assessment has not been completely applied, and the stakeholders involved in the decision-making process at all levels. Neither the modern “eco-system services”, “life-cycle”, “water accounts”, “eco-foot-prints” and other modern approaches have been incorporated into the program management.

The environmental data collection and monitoring have significantly improved in the last few years caching up with the modern EU standards. However, the adequate information and independent assessment has not

been secured yet and include: agricultural benefits and impacts; waters quality; total costs; eco- and water-foot prints; impacts on and of climate change; existing and likely eco-risks, etc. Nor mechanisms for timely disclosure and effective communication of data to the decision-makers, stakeholders and public at large are assured.

The agrarian and environment related research has not been modernized and severely underfunded in the last twenty-five years. Consequently, the agro-environmental innovation as well as the understanding of the agricultural use and the impacts on natural environment, and the various aspects, factors and efficiency of eco-management greatly deterred.

Furthermore, during most of the transition the agrarian long-term credit market was practically blocked while newly evolving farming structures left unassisted by the government. Until 2000 the Aggregate Level of Support to Agriculture was close to zero, and very small afterward [Bachev, 2010a]. Besides, the multifunctional role of farming was not recognized, and the provision of “environmental service” funded by the society.

There has been enormous progress in the public support in recent years – e.g. National Fund Agriculture, EU Special Pre-accession Program for the Agrarian and Rural Development (SAPARD), EU CAP measures, etc.

For instance, the SAPARD introduced measure “Agro-ecology” but it was not approved by the end 2006 and only few projects were actually supported. What is more, in 2008 the EC suspended SAPARD due to mismanagement and a significant funding lost.

The EU accession has brought new opportunities for the public support to private and collective agrarian and eco-activities.

The EU CAP and the National Plan for Agrarian and Rural Development 2007-2013 (NPARD) provide significant funding for the EU Area-based payments and the National top-ups; agro-environmental payments and other measures (e.g. organic farming, management of agricultural lands with high

natural value and handicaps, traditional livestock, protection of soils and water, preservation of landscape); modernization of farms, processing, and marketing; diversification of agrarian and rural activity; infrastructural development; keeping traditions; training, etc.

The specialized budget of the NPARD directed for the various eco-measures accounted for 27% of the total in 2007-2013 period. In addition, funding for eco- and other projects has been also available from the EU Fund LIFE+ and the Operational Programs “Environment”, “Fishery and Aquaculture”, and “Regional Development”.

The “cross-compliance” (with safety, animal-welfare, environmental, etc. standards) for receiving a public support has been also introduced. Consequently, the area-based direct payments and the other subsidies improved farms income and eco-performance, induced farming on abandoned lands, and brought about some amelioration of the environmental situation [Bachev, 2013a].

However, it becomes difficult to reform the inefficient system of the management of the public programs. In 2007 no public payment was made for the projects associated with the NPARD measures but the Area-based payments for the regions with handicaps.

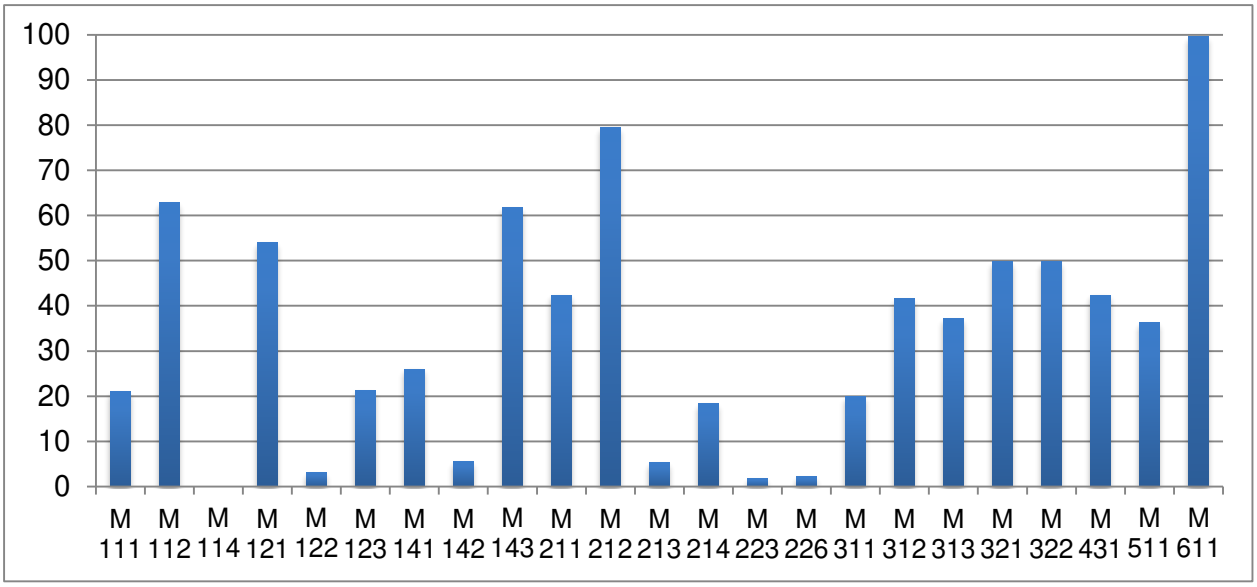
The progression in the implementation of public support has been slow and far behind the targets (Table 7, Figure 17). While few measures such as the “Setting up of young farmers” and “Payments to farmers in regions with handicaps” have been successful, the number of approved and funded projects in other areas has been insignificant.

Table 7. Progress in implementation of NPARD in Bulgaria (% of target)

Measures	Dec. 31, 2008		Dec. 31, 2009		Dec. 31, 2010	
	Projects	Euro	Projects	Euro	Projects	Euro
111 Training and information	0	-	0	-	na	-
112 Setting up young farmers	11.25	-	55.20	-	99.73	-
121 Modernization of farms	6.77	6.27	27.86	16.09	35.62	25.49
122 Economic value of forests	0	0	0	0	0	0
123 Value to agricultural and forestry products	0	0	0	0	5.81	4.41
141 Semi-subsistence farm	0	-	0	-	3.37	-
142 Producer groups	0	0	0	0	0	0
143 Advice and consultation	3.62	-	9.30	-	24.38	-
211 Payments to mountainous areas with handicaps	40.04	-	43.50	-	43.50	-
212 Payments to other areas with handicaps	100.17	-	107.85	-	107.85	-
214 Environment payments	2.80	-	4.45	-	4.45	-
223 First afforestation	0	-	1.00		1.85	-
226 Restoring forestry	0	-	0.90	-	2.30	-
311 Diversification into non-agricultural activities	0	-	0	-	0.09	0
312 Business development	0	-	0	-	2.09	-
313 Agro and rural tourism	0	0	0	0	0	0
321 Rural services	0	-	4.77	-	8.15	46.19
322 Village development	0	-	18.00	-	19.50	43.07
431-32 Local cooperation	0	-	0	-	7.92	-

Source: Ministry of Agriculture and Food

Figure 17. Utilization of the NPARD funds by December 31, 2012 (percent)



Source: Ministry of Agriculture and Food

Due to the restrictive criteria [24], widespread lack of formal land management titles, complicated and costly procedures, and massive mismanagement and corruption, the new public support has not been effectively utilized and benefited unevenly different farms. Consequently, mostly bigger farms and groups with "good connections" have participated in the public programs because of the superior entrepreneurial experience, available resources, "personal and political connections, and capability for adaptation to the formal requirements and for wining projects.

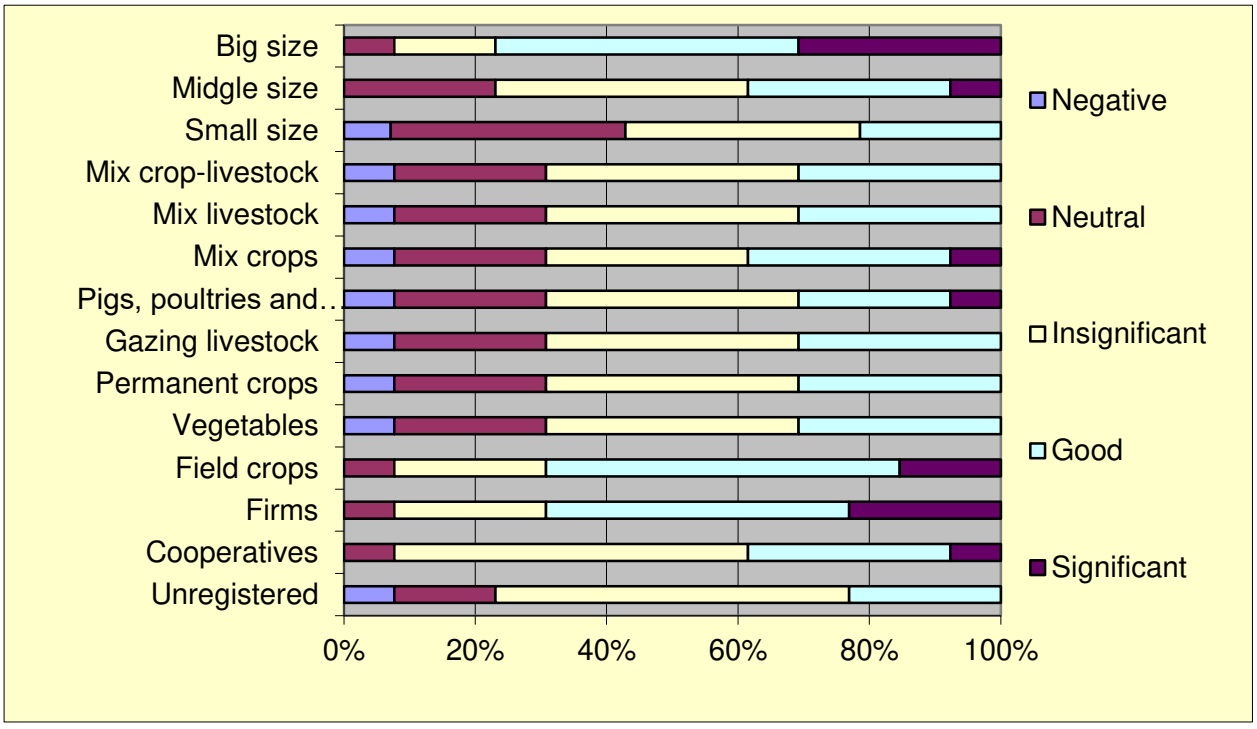
Up to date experience shows that the bulk of the public subsidies go to few large agri-firms and cooperatives specialized in field crops. At the same time, many effective small-scale farms receive no or only a tiny fraction of the public support.

[24] For area-based payments the minimum farm size is 1 ha (for permanent crops 0.5 ha), and for agro-ecological payments 0.5 ha, while landless livestock holdings are not-eligible for these type of support.

For instance, despite it increased number only 24% of all farms currently receive Area based payments, and merely 6% of the cattle holdings, 4% of the sheep and pig holdings, and 3% of the poultry farms [MAF, 2013]. Moreover, less than 7% of the beneficiaries get the lion share (more than 80%) of all direct payments. Similarly, around 2% of the biggest farms (more than 500 ha) manage around 60% of the supported by the environmental Measures 211 and 212 areas [MAF, 2013].

The overall support to agriculture continues to rest low, and a small proportion of the farms benefits from the public aid most of them being large enterprises from regions with less socio-economic and eco-problems [Bachev, 2010, 2013a].

Figure 18. Impact of CAP on economic, social and environmental sustainability of Bulgarian farms



Source: expertise with leading experts, 2012

The experts assessment indicates that there is a “good” or “significant” impact of the CAP implementation on the economic, social and

environmental sustainability of the large farms, agri-firms, and farms specialized in field crops, while the CAP effect on other type of farms is “insignificant” or “neutral” (Figure 18). Therefore, public assistance further enlarges “transitional” disparities between different farms, sub-sectors, eco-systems, and regions. The minor amount of supported farms and agro-ecosystems, deficiency of clear criteria for eco-performance, and the lack of effective control leads to little contribution of new public (CAP) measures to improvement of eco-situation in the country.

Efficiency of environmental management in agriculture

Farmland management

A by-product from the new market and private management has been a considerable disintensification of agriculture, ease of the general eco-pressure and pollution comparing to the pre-reform level.

The market adjustment has been associated with a sharp decline in all crop (but sunflower) and livestock (but goat) productions since 1989[25]. Some traditional crop varieties and livestock breeds have been also recovered. A considerable portion of the agricultural lands has been left uncultivated for a long period of time – e.g. in some years the abandoned land reached one third of the total [MAF]. In recent years, the unutilized farmlands have been 10% of the total while the fallow land accounts for 9% of the arable land. Besides, the average yields for the major products shrunk to 40-80% of the pre-reform level.

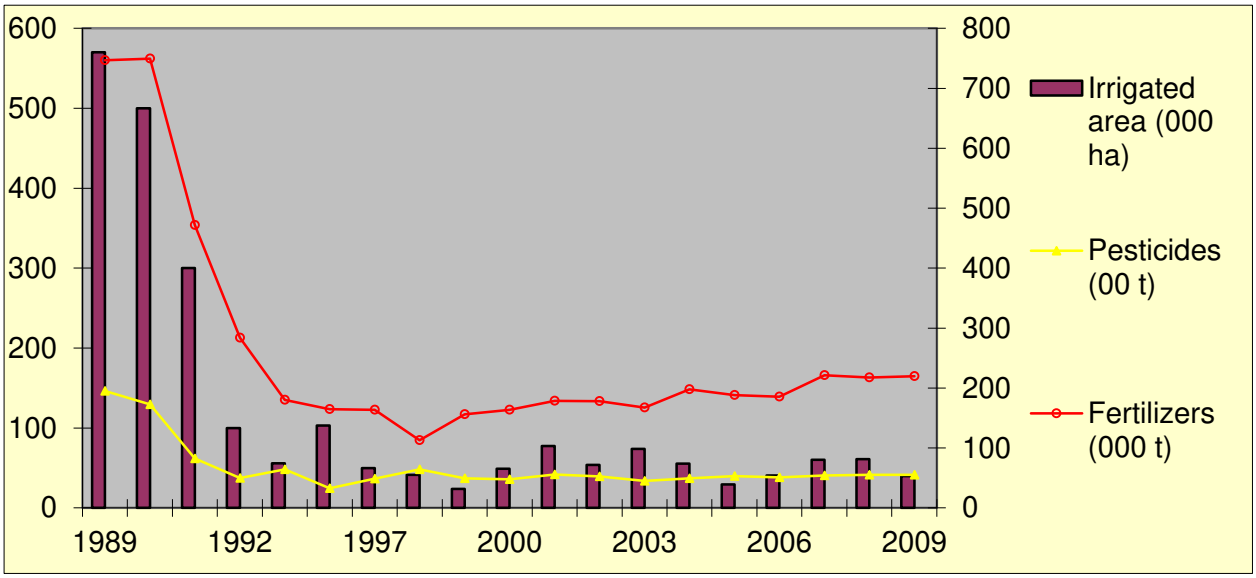
[25] For potatoes by 33%, wheat 50%, corn and burley 60%, tomatoes, Alfalfa hay and table grape 75%, apples 94%, pig meat 82%, cattle meat 77%, sheep and goat meat 72%, poultry meat 51%, cow milk 45%, sheep milk 66%, buffalo milk 59%, wool 85%, eggs 45%, and honey 57% [NSI].

The number of livestock has also decreased significantly – 51% for the cattle, 53% for the poultry, 80 % for the pigs, and 81% for the sheep [MAF]. Consequently, the Aggregate Livestock Index[26] in the country has been one of the smallest in Europe - 0.4 in recent years [EEA, 2011].

The tractors and combines employed in agriculture have diminished by 64%, and now 5.6% of the farms own tractors and 0.7% own harvesters while 30-40% hire or use them in association [MAF]. All these have further relaxed the overall agricultural pressure on the environment.

The amount of fertilizers and pesticides used in agriculture has also declined considerably, and now their per ha application is 22% and 31% of the 1989 level (Figure 19). In recent years, N, P and K fertilizers are applied for 37.4%, 3.4% and 1.9% of the UAA [MAF].

Figure 19. Irrigation and chemical application in Bulgarian agriculture



Source: National Statistical Institute

The sharp reduction in the chemical use has diminished drastically the risk of chemical contamination of soils, waters, and farm produce. A good

[26] the number of livestock units (equines, cattle, sheep, goats, pigs, poultry and rabbits) per UAA.

part of the farm production has informally got (semi) “organic” character obtaining a good reputation for he high quality and safety locally and internationally.

However, a negative rate of fertilizer compensation of N, P, K intakes dominate and the average of 23595,4t N, 61033,3t P_20_5 and 184392t K_20 have been irreversibly removed annually from the soils since 1990 [EEA, 2010].

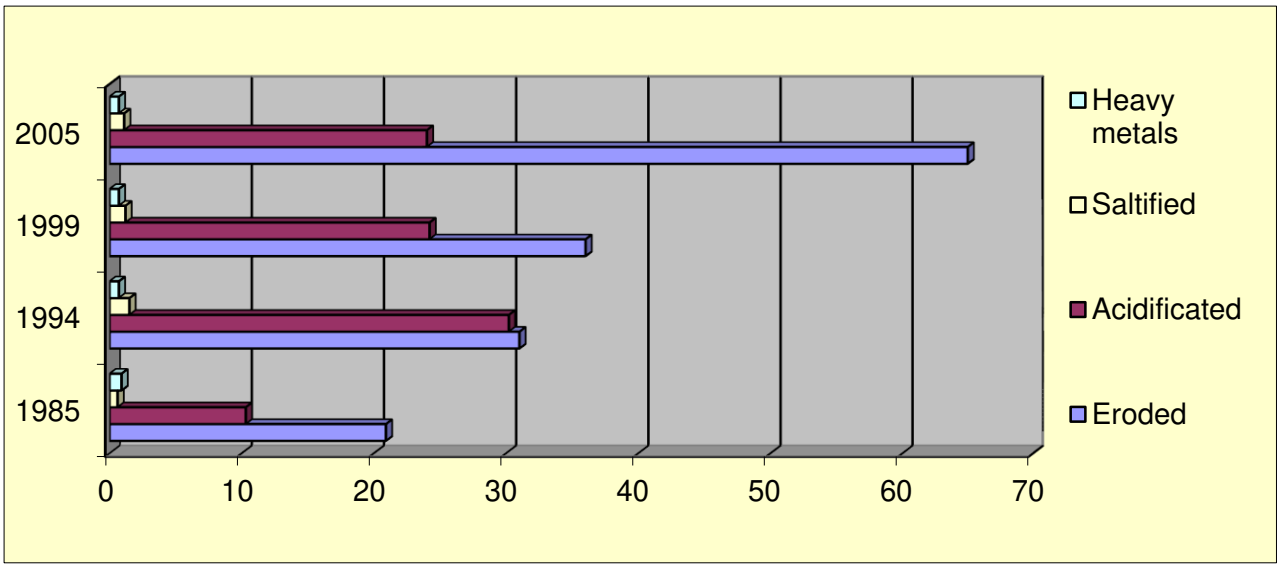
Besides, unbalance of nutrient components has been typical with the application of 5.3 times less P and 6.7 times less K with the appropriate N rate. What is more, monoculture or simple rotation has been constantly practiced by the large operators concentrating on few profitable crops (sunflower, cereals, etc.). All these practices further contributed to the deterioration of soil quality and soil organic matter content.

There has been considerable increase in the farmland affected by acidification (Figure 20). That has been a result of the long-term application of specific nitrate fertilizers and unbalanced fertilizer application without adequate input of phosphorus and potassium The share of acidified soil decreased after 1994, but in recent years there has been a reverse tendency along with the augmentation of N use. As much as 4.5% of the acidified farmlands are with level harmful for the crops [EEA].

The fraction of salinized land doubled after 1989 but it has been merely 1.1% of the total farmland [EEA, 2010]. The widespread application of primitive irrigation techniques, and inappropriate crop choice, rotation and agro-techniques augment inefficiency of the water use and local soil erosion. What is more, since 1990 no effective measures have been taken to normalize soil acidity and salinity.

Pollution of the soils and waters from the industrial activities, waste management, and improper farming activities has been also a serious environment and health risk.

Figure 20. Share of degradated agricultural lands in Bulgaria (percent)



Source: Executive Environment Agency

The illegal garbage yards in the rural areas have noticeably increased reaching an official figure of 4000 with a real number far bigger than the reported amount [EEA, 2011]. The farms have contributed extensively to the waste "production" with organic and industrial materials adding significantly to the local pollution of air, water, soils, and disturbing population comfort (noise, odor, dirty roads, etc.).

Nevertheless, data for the last years show that soils in the country have been in good ecological state both in terms of the organic content and the contamination with heavy metals and metalloids [EEA, 2011]. Moreover, polluted with the heavy metals and pesticides soils represents bellow 1% of the farmlands.

The erosion has been a major factor contributing to the land degradation (Figure 20). Its progressing level has been a result of the extreme weather but it has been also adversely affected by the dominant agro-techniques, deficiency of anti-erosion measures, uncontrolled deforestation, and recultivation of permanent grasslands.

Due to ineffective management 34% of the arable lands have been subjected to the wind erosion and 64% to the water erosion [EEA, 2010]. Since 1990, the erosion affects 25-65% of the farmland and losses varied from 0.2 to 40 t/ha in different years.

The annual losses of earth masses from the water erosion are estimated at 145Mt and a two-third of it comes from the arable land. The soil losses from the water erosion depend on the cultivation practices and range from 8 t/y for the permanent crops to 48 t/y for the arable lands. Losses from the wind erosion are around 30 t/y and depend on the deforestation, uncontrolled pasture, ineffective crop rotation, plowing pastures, etc.

The soil compression affects (mostly) agricultural lands due to the untimely transportation and inappropriate agro-techniques - e.g. using heavy machineries when soil moisture is high. It is considered as a threat for the soils in the country but no data are available for the extent in agricultural lands.

Water management

The restructuring of farms and production has been accompanied with a sharp reduction in the irrigated farmland and a considerable distortion of the irrigation facilities (Figure 19).

Consequently, there has been more than 21 folds decline in the water used in agriculture comparing to 1989 (Table 8). In recent years, sector “Agriculture, hunting, forestry and fishery” comprises merely 3.2% of the total water use, and 0.3% of the generated waste waters [NSI].

All these contribute to a considerable reduction of the water stress in the country - since 1990 the Water Exploitation Index declined considerably from 55% (the second in Europe) to 33% [EEA, 2010].

Table 8. Evolution and agricultural use of water resources in Bulgaria

Indicators	1988-1992	1993-1997	1998-2002	2003-2007
Total water resources ($10^9/m^3$/year)	21	21	21	21
Water resources per capita (m^3/inhabitant/year)	2427	2562	2661	2748
Total water withdrawal ($10^9/m^3$/year)	14,04	na	8,674	na
Agricultural water withdrawal ($10^9/m^3$/year)	3,058	0,141	0,144	0,143
Share of agricultural water withdrawal in total (%)	21.78	-	1.66	-
Share of total actual renewable water resources withdrawn by agriculture (%)	14.36	0.66	0.68	0.67
Area equipped for irrigation (1000 ha)	1263	789	622	104,6
Share of cultivated area equipped for irrigation (%)	29.17	17.55	17.36	3.18
Area equipped for irrigation actually irrigated (%)	na	5.42	4.96	51.29

Source: FAO, AQUASTAT

There is a huge reduction of the irrigated farmland after 1990 as 2-5% of the irrigation network has been actually used[27]. What is more, a considerable physical distortion of the irrigation facilities has taken place affecting most part of the internal canals.

As a result the area equipped for irrigation in agriculture substantially decreased. Furthermore, primitive irrigation techniques have been

[27] Irrigation water accounts for the major share in total agricultural water use – 74.2% [NSI].

widespread and augmented inefficiency of the water use and the local soil erosion.

The water losses in the irrigation system amount 70% as consequence of the poorly maintained facilities, low efficiency, and water stealing [Alexandrov]. Nevertheless, the overall negative irrigation impact of irrigation on the erosion and the salinization has been diminished considerably after 1990 [EEA, 2010].

The decline in irrigation has also had a direct harmful effect on the crop yields and the structure of rotation [Bachev, 2010b]. The level of irrigation depends on the humidity in each year, the kind of irrigated crops and the water prices. The irrigation has not been effectively used to correct inappropriate seasonal and regional distribution of rainfalls, and mitigate effect of climate change[28] on farming and land degradation. Subsequently, the farms little capability for adaptation has resulted in huge crop, livestock and property losses during recent droughts and floods.

There has been a considerable amelioration of the quality of surface and ground waters as a result of unintended decrease of the negative impact of agriculture and the sharp decline in the chemical fertilizers and pesticides application. This trend has diminished drastically the pressure on environment and the risk of chemical contamination of soils and waters.

Nitrate and phosphate content in surface water decreased throughout transition and slightly increase in the last several years [EEA, 2012]. Currently only 0.7% of the samples exceeds the Ecological Limit Value (ELV) for the nitrate.

[28] Eighteen of the past 21 years are with positive anomalies in average temperatures and there is a trend for increasing soils' water deficiency [EEA, 2010]. According to climate forecasts temperature will continue to increase, rains quantity to decrease, more extreme events (thunderstorms, floods, droughts, hurricane winds) to occur, and water stress experienced around the country.

Despite all improvement, many water eco-systems have been at risk cased by the agricultural emissions in the water and increasing application of chemicals. For instance, in drinking water around 5% of the analyses show deviation of the nitrates up to 5 times above the appropriate level [EEA, 2010]. The later is mostly restricted to 400 small residential locations but it is also typical for almost 9% of the big water collection zones. Improper use of the nitrate fertilizers, inappropriate crop and livestock practices, and non-compliance with the specific rules for farming in water supply zones, all have been responsible for that problem.

Furthermore, around a quarter of the riverlength does not meet the standards for water quality [MAF]. Monitoring of the waters for irrigation show that in 45% of the samples, the nitrates concentration exceeds contamination limit 2-20 folds [EEA, 2010].

Nitrates have been also the most common polluter of ground waters with slight excess over the ecological limit [EEA, 2010]. A moderate concentration of N (bellow 25 mg per liter) in different levels of the underground waters dominates with increasing trends in shallow waters and downward trends in others.

Besides, around country a tendency for the reduction in pesticides concentration in the underground water has been reported with occasional cases of the Triasines over the ELV after 2000. There has been further improvement since 2007 and the concentration of pesticides in all samples has been bellow the water quality standards.

The Nitrate Vulnerable Zones cover 53% of country's territory and 68% of UAA [MAF]. The lack of effective manure storage capacity and sewer systems in the majority of farms, challenge posed by the inadequate storage and disposal of expired and prohibited pesticides, and the illegal garbage dumps in rural areas, all have contributed significantly to the persistence of the problem.

Most part of the post-communist livestock activity has been carried out by a great number of small and primitive holdings often located within the residential borders. Moreover, only 0.1% of the livestock farms possess safe manure-pile sites, around 81% of them use primitive dunghills, and 116 thousands holdings have no facilities at all [MAF, 2010]. Besides, decreasing amount of manure has been used for the fertilization of merely 0.2% of the utilized farmlands in recent years.

Serious eco-challenge has been posed by inadequate storage and disposal of expired and prohibited pesticides which amount has augmented since 2001 [EEA, 2010]. A good portion of country's polluted localities (28%) has been associated with these dangerous chemicals. Despite progression in management (modernization of storehouses, safe capsulation, exporting for deactivation, etc.) in the past years there are still 298 abandoned storehouses (57% of all) in 292 locations containing 1956t old pesticides (15.3% of the total amount).

In the last several years a stable amount of nullified sediments from the industrial and residential waters have been utilized in agriculture and for the recultivation of degradated lands. In 2010 the applied sediments in agriculture and for recultivation of degradated lands (13644 t dry content) increased up to 49% share of the totally utilized sediments in the country [EEA, 2010].

Biodiversity management

Since 1990 the amount of protected areas in the country almost doubled [NSI]. Specially introduced rules for the agricultural practices in the NATURA territories and EU CAP environmental and other measures additionally created conditions for the improvement of biodiversity management.

Furthermore, the market and private initiatives led to recovering of some traditional (and more sustainable) livestock breeds and plants varieties as

well as introducing new crops and livestock (novel food, industrial and energy crops; exotic animals like ostrich, etc.) increasing the agricultural biodiversity.

Nevertheless, the widespread lack of proper eco-management has affected negatively biodiversity in some agro- and related ecosystems. For instance, the intensive large-scale cereal and industrial crop enterprises have paid little attention to the biodiversity protection in enormous fields of operations.

On the other hand, a considerable portion of farmlands have been left uncultivated for a long time or entirely abandoned, and some agro-ecosystems lost their “agro” character turning into natural ecosystems. That has caused uncontrolled “development” of species allowing development of some of them and suppressing others.

Some of the most valuable ecosystems (such as natural grasslands and pastures) have been also severely damaged[29]. A part of the meadows has been left under-grazed or under mowed, and intrusion of shrubs and trees took places. Some fertile semi-natural grasslands have been converted to cultivation of crops, vineyards, or orchards. This has resulted in irreversible disappearance of plant species diversity.

In addition, certain municipal and state pastures (with official and/or practical “common access” status) have been degraded by unsustainable use (over-grazing) by the “private” and “domestic” animals.

Besides, a reckless collection of valuable wild plants (berries, herbs, flowers) and animals (snail, snakes, fish) have led to destruction of all natural habitats.

The Index of Birds in Agricultural Lands in the country has been negative and for the last 5 years the variety of bird species under monitoring living in the agricultural lands has decreased by 10% [EEA, 2010]. The birds in

[29] 20% of the agricultural lands in Bulgaria are lands of a High Nature Value [MAF].

agricultural territories are with the largest amount of diminishing number (including moderate and strong tends) but there are no studies on factors for these trends [BSBP].

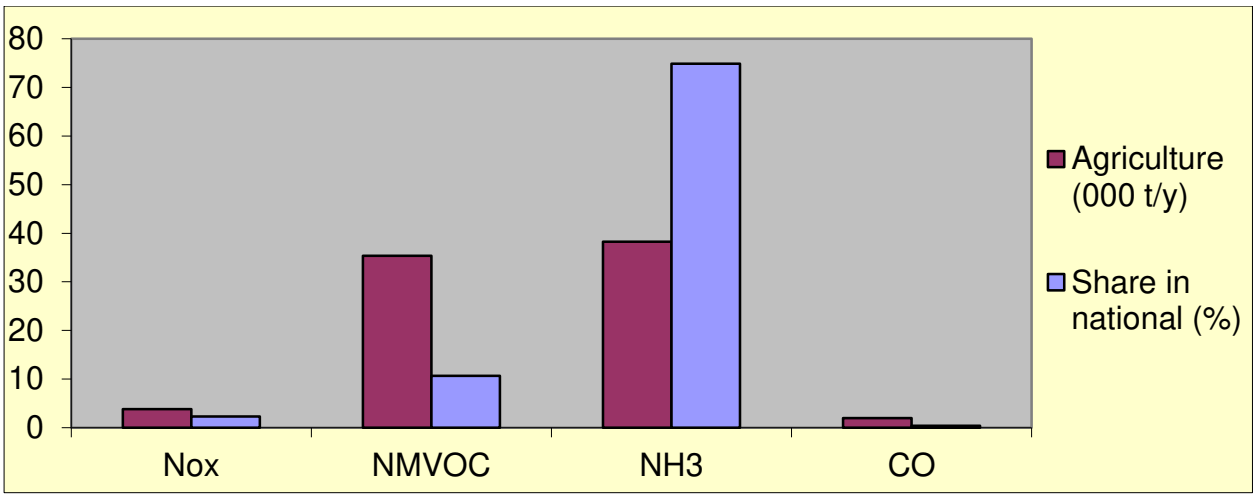
Last but not least important, during the last several decades there has been significant degrading impacts of agriculture on the biodiversity as all 37 typical animal breeds have been endangered, among them 6 have been irreversibly extinct, 12 have been almost extinct, 16 are endangered, and 3 are potentially endangered [MEW].

Air and green-house gas management

The agriculture (crop and livestock) practices contribute to a considerable dust and odor contamination of air in some areas. Particularly disturbing have been the small-scale and domestic livestock operations often located within the residential territories (villages, town) and increasing local odor and noise pollution.

The agriculture has been also responsible for the considerable emissions of certain harmful substances in the air. It releases approximately 75% of the Ammonia (NH_3) and 11% of the Non-methane organic compounds (NMVOC) in the country (Figure 21).

Figure 21. Harmful emissions in air from Bulgarian agriculture (2009)



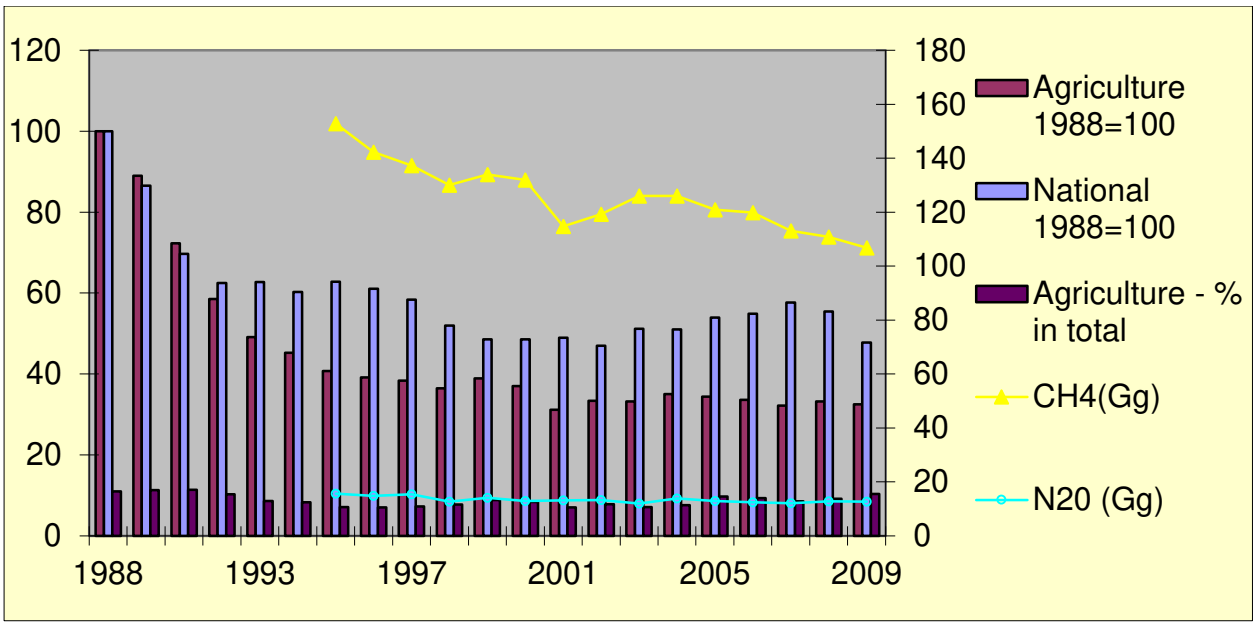
Source: Executive Environment Agency

The biggest sources of NH_3 have been cattle (dairy cows and buffalo cows) and for NMVOC – the one-year crops with fertilization [EEA, 2011]. The agricultural contribution to the Nitrogen oxides (NOx) and Carbon monoxide (CO) has been also insignificant – 2.3% and 0.4% accordingly.

There has been enormous reduction of the overall green-house gas (GHG) emissions from the agriculture[30] since 1988 (Figure 22). Moreover, the decline in the sector's contribution has been higher than the national one. That has come as "unintentional" outcome of the post-communist restructuring of the sector and the new models of farm management.

Figure 22. Trends in green-house gas emissions from Bulgarian agriculture

[30] GHGs from Agriculture" result from the production and processing of agricultural products, soil fertilization, animal manure processing and preservation. The emissions from the combustion processes for energy production and from agricultural machines are not reported but they are insignificant amount.



Source: Executive Environment Agency, 2011

During 2000-2004 there was a period of an increase and since then a stable trend for diminishing agricultural GHG emissions. The sector is the second biggest emitter of GHGs contributing between 7-10% of the total amount during the last decade. The main factors of agricultural GHGs have been agricultural soils (56%), enteric fermentation (22%), and manure management (19%) [EEA, 2011].

Agriculture mostly produces N_2O and CH_4 emissions.

In the last decade the majority of N_2O emissions comes from the agricultural soils, manure management, and fields burning. The methane emission is 36% of the agricultural GHGs and the biggest portion comes from the enteric fermentation from domestic livestock and manure management.

The reduction of livestock number has been responsible for the considerable decrease in the agricultural CH_4 emission in past years. On the other hand, there is a six-fold increase of CH_4 from the rice cultivation since 1999 as a result of the partial recovery of this sub-sector in recent years.

Illegal field burning of the residues and crops also emits GHGs-precursors, which have not been significant, but they doubled since the period before 1990.

Agro-ecosystem services management

The “ecosystem services” are the multiple resources, products, processes and other benefits, which humans obtain from the natural ecosystems [Daily; MEA]. They are generally classified into following groups:

- *provisioning services* as food; water; pharmaceuticals, biochemicals, and industrial products; energy; genetic resources;
- *regulating services* like carbon sequestration; climate regulation; waste decomposition and detoxification; purification of water and air; crop pollination; pest and disease control; mitigation of floods and droughts;
- *supporting services* like soil formation; nutrient dispersal and cycling; seed dispersal; primary production;
- *generation and maintenance of biodiversity*;
- *cultural services* as cultural, intellectual and spiritual inspiration, recreational experiences, scientific discovery.

The “agro-ecosystem services” comprise the ecosystem services provided by the agro-ecosystems [Bachev, 2009]. The later are commonly defined as spatially and functionally coherent units of the agricultural activity incorporating the living and nonliving components and their interactions [AEHP; Shiferaw et al.]. That implicitly includes as a key component the agricultural activity such as crop production, raising animals, natural resource management (land modification, set aside measures), etc.

According to their specific characteristics and the goals (and levels) of the analysis, the boundaries of the 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 cover a larger region in a country or (sub)continent. Moreover, the individual agro-ecosystem could include, be a part, or overlap with other ecosystems - dryland, mountain, coastal, urban, etc.

The concepts of the “agro-ecosystem services” and the “agro-ecosystem services management” are among the newest for the theory and practice in Bulgaria [Bachev, 2009].

There are a great variety of agro-ecosystem services in the country with quite specific components, specificities, forms of management, efficiencies, etc.

In this part of the book we briefly present a study on the forms, efficiency and challenges of the management of agro-ecosystem services in Western Stara Planina (WSP)[31].

The agro-ecosystems in the WSP are a part of the unique ecosystem of WSP. The later covers area of 4043 km^2, including 2099 km^2 in Bulgaria and 1944 km^2 in Serbia [Grigorova and Kazakova]. The greatest portion of that eco-system is forest (60%) and the rest is farmland.

The WSP is under two specific institutional environments (policies, jurisdictions, formal and informal modes of governance of Bulgaria and Serbia). Our analysis concentrate on the management forms and efficiency in Bulgarian territory.

The agro-ecosystems of WSP provide a wide range of specific services (Figure 23). A great number of agents from and outside region benefit from and affect services of these ago-ecosystems – landowners[32], farmers, residents, businesses, visitors, consumers, scientists, interest groups, etc.

Approximately 70% of the farmlands in WSP comprise meadows and pastures [MAF]. They provide abandon feed for the farm and household animals, and create good conditions for the development of grazing livestock (sheep, goats, cattle, buffalos, horses) and domestic animals (poultry, rabbits,

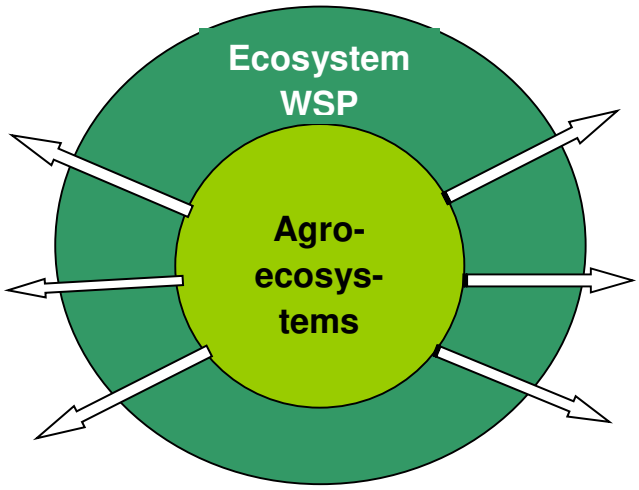
[31] It is located in westenr part of Stara Planina (Balkan Mountain) - a mountain range in the eastern part of the Balkan Peninsula which runs 560 km from the Vrashka Chuka on the border between Bulgaria and eastern Serbia eastward through central Bulgaria to Cape Emine on the Black Sea. The mountain gives the name of the Balkan Peninsula.

[32] 50% of the population in ZSP own agricultural lands [Grigorova and Kazakova].

pigs). In addition, there are plenty of wild flowers and herbs, which favor bees-keeping and herbal-honey productions as well as the collection of natural medical plants.

Furthermore, a wide range of farm products is produced in this environment used for the provisioning of the local population and marketing. Some of the local farm-based produces are well-known for the quality, unique taste and original character (e.g. strawberry, raspberry, blackberry, berry jams, herb honey, sheep yogurt and cheese, lamb meat, wool, fur, prune, plum brandy) and marketed at regional, national and international markets.

Figure 23. Services of agro-ecosystems in Western Stara Planina



Feed for private animals

Herbs for honey bees and medical products

Farm products and services

Favorite life style

Traditions

Soil quantity and quality

Landscape

Carbon sequestration

Wild fruits, mushrooms, herbs, birds, animals, fish

Clean mountain and mineral water

Purification of water and air

Biodiversity

Natural wonders

Recreation and treatment

Education and discovery

Simultaneously, they favor development of related productions and services being important income source for the local populations – (jam, dairy, brandy, leather) processing, dying wool, weaving and crafts making, on-farm and direct marketing, agro-tourism.

For many local and not-permanent residents interactions with the agro-ecosystems are favorite mode of recreation (part-time or hobby farming, short or longer term visits) or life style (weekend/summer houses).

Local traditions and ethnic culture of the *Torlaks* and *Karakachans* are closely related to the agro-ecosystems and farming system – specific agricultural and related products (e.g. Chiprovtsi hand-made carpets), crop varieties and animal breeds, production methods/technologies, festivals, cuisine, crafts.

The unique shape and quality of the landscape is a critical feature of the agro-ecosystems dominating by the natural or semi-natural high mountain pastures, riparian meadows, stony and rocky terrains. All these features of the agro-ecosystems attract many visitors from the region, country and abroad.

Next, the agro-ecosystems contribute significantly for the maintaining and improving soil quality - vegetation cover reducing soil loss and degradation and promoting water infiltration. Furthermore, carbon sequestration is important service of the grasslands, berry bushes, orchards and vineyards storing considerable amount of CO_2 stock.

The agro-ecosystems also provide *combined services* with the larger ecosystem of WSP. A great variety of wild fruits, herbs, chestnuts, mushrooms, birds, animals and fish are available and picked up or hunted by local population and visitors. What is more, some of them are commercially gathered for processing and sells bringing additional incomes for around 20% of the population [Grigorova and Kazakova].

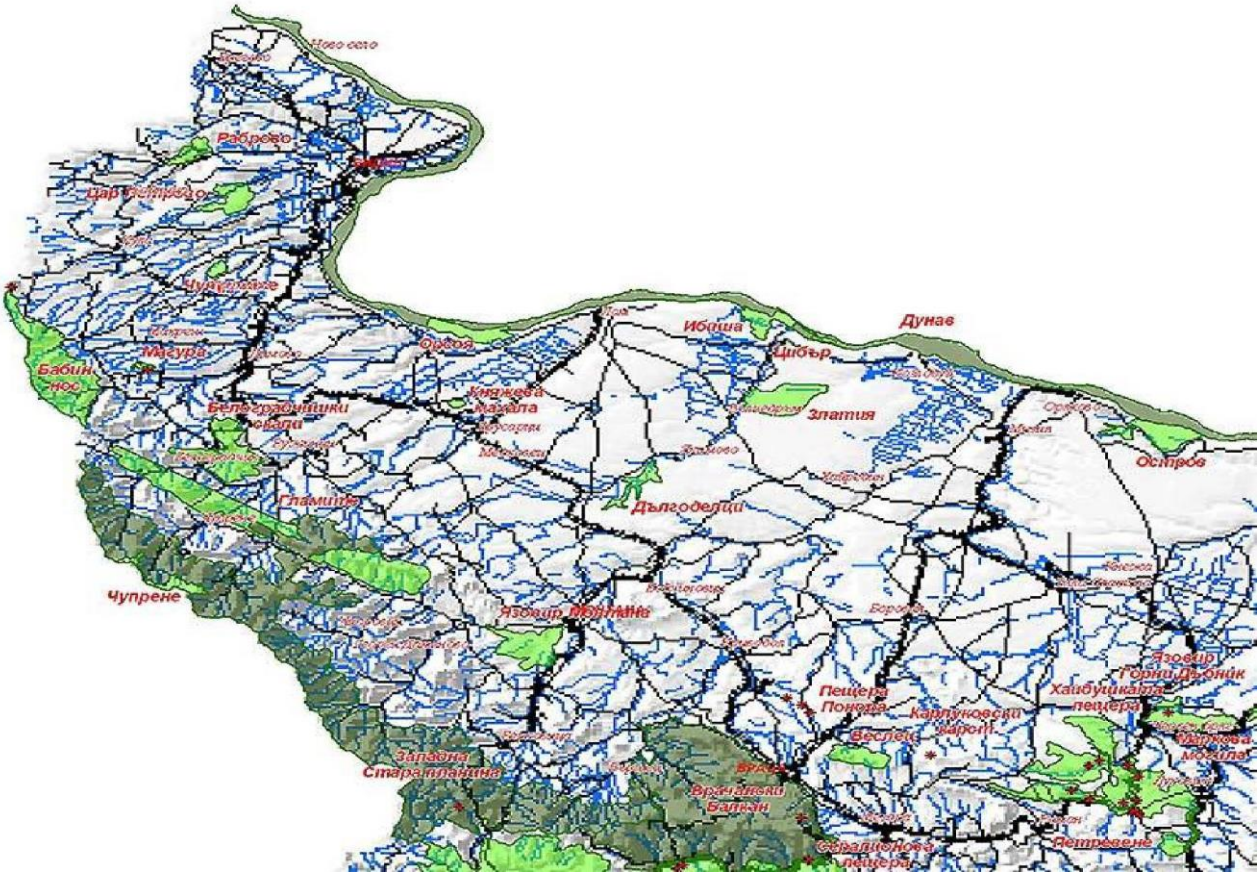
The ecosystem WSP is a source of clean mountain and mineral water used by the farmers (animals, irrigation), residents (drinking, household needs), businesses (inputs, bottling) and health centers (balneotherapy) in the region and neighboring areas.

Besides, it purifies water and air and regulate climate making region one of the favorite destination for tourism, recreation and treatment - well-known mountainous resorts Berkovitza, Varshetz, Izketz are located there.

Moreover, some of the country's most popular natural wonders like Rocks of Belogradchik[33], Iskar Gorge, and number of picks, waterfalls, and caves are located in WSP enhancing cultural services of the ecosystem.

The territory of the WSP is with high ornithological and botanical importance designated as Pan-European network NATURA 2000 site (Map 1). Maintaining this rich biodiversity is a great service of the ecosystem WSP.

Map 1. Natura 2000 Habitat directive sites (light color) and Bird directive sites (dark color)



Source: Ministry of Water and Environment

For instance, in its flora there are more than 2000 species of higher plants (among which 12 Bulgarian and 79 Balkan endemics[34]) while its fauna

[33] In 2009 it was nominated to be one of New 7 Natural Wonders of the World but did not passed through selection.

[34] Besides, hill "Vrashka Chuka" is worlds only place of *Eranthis bulgaricus.*

comprise more than 180 bird species, more than 50 species of mammals, 26 species of amphibians and reptiles, and many butterfly species of conservation importance [Grigorova and Kazakova]. That increases the educational and scientific services of this unique ecosystem as well.

We have been identified various *market, private* and *public* modes used for governing of the agro-ecosystem services in WSP (Table 9).

The post-communist private management and market adjustments has been associated with the domination of small-scale and subsistence holdings (Table 9), a sharp decline in the crop and livestock (but goat) productions, and a general desintensification of the agricultural activity.

By-product from this market and private governance has been the overall improvement of the agro-ecosystems services in WSP [Bachev, 2009]. The farm and related products got “organic” character obtaining a good reputation for high quality and safety while the region become attractive destination for many local and foreign tourists willing to experience genuine nature, traditional cuisine and lifestyle.

A market-driven organic production emerged but it is restricted to few farms, processors and traders. Nevertheless, the country’s biggest producers of the organic raspberries and the bee-honey, and one of the biggest organic sheep holdings, are all located in the WSP.

A number of effective private modes evolved to manage relations between farmers, processors, food stores, and consumers. A high specificity and capacity dependency are widely safeguarded by cooperation (services, processing), long-term contracts (marketing of milk and organic berries), interlinked organization (milk marketing against free provision of cooling vanes and credit), and compete integration (diversification of farming into processing, agro-tourism).

Table 9. Modes of management of agro-ecosystem services in Western Stara Planina, Bulgaria

Market modes	Private modes	Public modes
Informal branding	Voluntary	Environmental regulations
Organic (berry)	initiatives	Eco-information, monitoring, assessment
farming	Long-term	Promotion or joining eco-initiatives (festivals,
Organic apiaries	supply	networks, advertisements)
Organic livestock	contracts	Designated zones of eco-importance (natural
Organic wild fruits	(milk, berries)	parks, NATURA)
and herbs	Vertical	Area-based direct payments
gathering	integration of	Leasing out public land for private management
Specific origins	farming into	Cross-compliance requirement
(lamb, cheese,	processing	Agro-ecological payments (voluntary contracts)
berries, carpets,	and services	Support to traditional and original productions
crafts)	(shops, hotels,	Support to farms and processing modernization
Organic	restaurants)	Support for semi-market farms
processing	Interlink	Support to young farmers
(berries, milk,	organization	Support for adaptation of quality, safety, eco etc.
herbs)	(dairy)	standards
Eco-labeling	Diversification	Support to collective actions (producers groups,
On farm and direct	of production	cooperation)
marketing	and services	Support for diversification of activity (eco-tourism,
Clientatlisation	Cooperatives	heritage)
(cheese, meat,	NGO's	(Mandatory) environmental training
berries)	Organic	Program for development of agriculture in North-
Agro and eco-	alliances	West Bulgaria
tourism		Fox vaccination
		Recultivation of degradated farmlands
		Garbage taxation
		State company for Vratza Natural Park
		Support to trans-border initiatives

Source: field study, 2009

Table 10. Major characteristics of farms in Western Stara Planina, Bulgaria

Indicator	Value	Indicator	Value
Number of farms	12151	Share of farms with cattle (%)	17,2
Average Utilized Agricultural Area (ha)	*0,997*	*Average cattle per farm*	*2,9*
Share of arable land (%)	33,6	Share of farms with sheep (%)	51,1
Share of cereals (%)	18,4	*Average sheep per farm*	*5,5*
Share of horticulture (%)	4,3	Share of farms with goats (%)	62,7
Share of grassland (%)	58,7	*Average goats per farm*	*2,6*
Share of permanent crops (%)	4,9	Share of farms with pigs (%)	47,2
Share of farms with bees (%)	6,3	*Average pigs per farm*	*1,5*
Average bees colonies per farm	*7,1*	Share of farms with poultry (%)	69,0
		Average poultry per farm	*14,2*

Source: Ministry of Agriculture and Food

Often a non-agrarian agent (processor, food store, restaurant chain, exporter) driven by market or institutional demand initiates, funds, and integrates eco-farming. That is the case with Danon baying milk from big dairy farms (and enforcing safety, quality, environmental, animal-welfare standards), a Japanese investor financing organic apiaries and exporting bio-honey, a leading restaurant chain integrating dairy farming and processing.

The market and private voluntary, non and for-profit forms contribute significantly to the improvement of eco-management but their scope is usually restricted to a (owned) portion of the agro-ecosystems (services). For instance, a fifth of the agricultural lands have been abandoned which caused uncontrolled “development” of species and lost of farmlands quality. Furthermore, part of the permanent natural and semi-natural meadows have been left under-grazed or under-mowed, and intrusion of shrubs and trees into grassland took places putting pressure on priority species (such as *Souslik*) and related chain (*Marbled Polecat*) [Grigorova and Kazakova].

Most of the cooperatives in the region have shown serious disadvantages (ineffective management, low incentives for long-term investment, small adaptability to members and market needs, etc.) and many have gone bankrupt in last 10 years. Similarly, majority of the dairy farms and processors have failed to adapt to the tough new EU standard and had to cease commercial activity. Finally, the private interests of particular individuals and groups have harmed the legitimate public rights to the ecosystem services due to the restricting access, conversion of the proper use (farmland/or forest land into construction), or escaping public order on the natural resource management.

Furthermore, implementation of the new public order is less effective than in the other (more developed, plain, urbanized, etc.) parts of the country due to the lack of agents' awareness and experience, inaccessible training and information, inadequate administrative capacity, and mismanagement, etc.

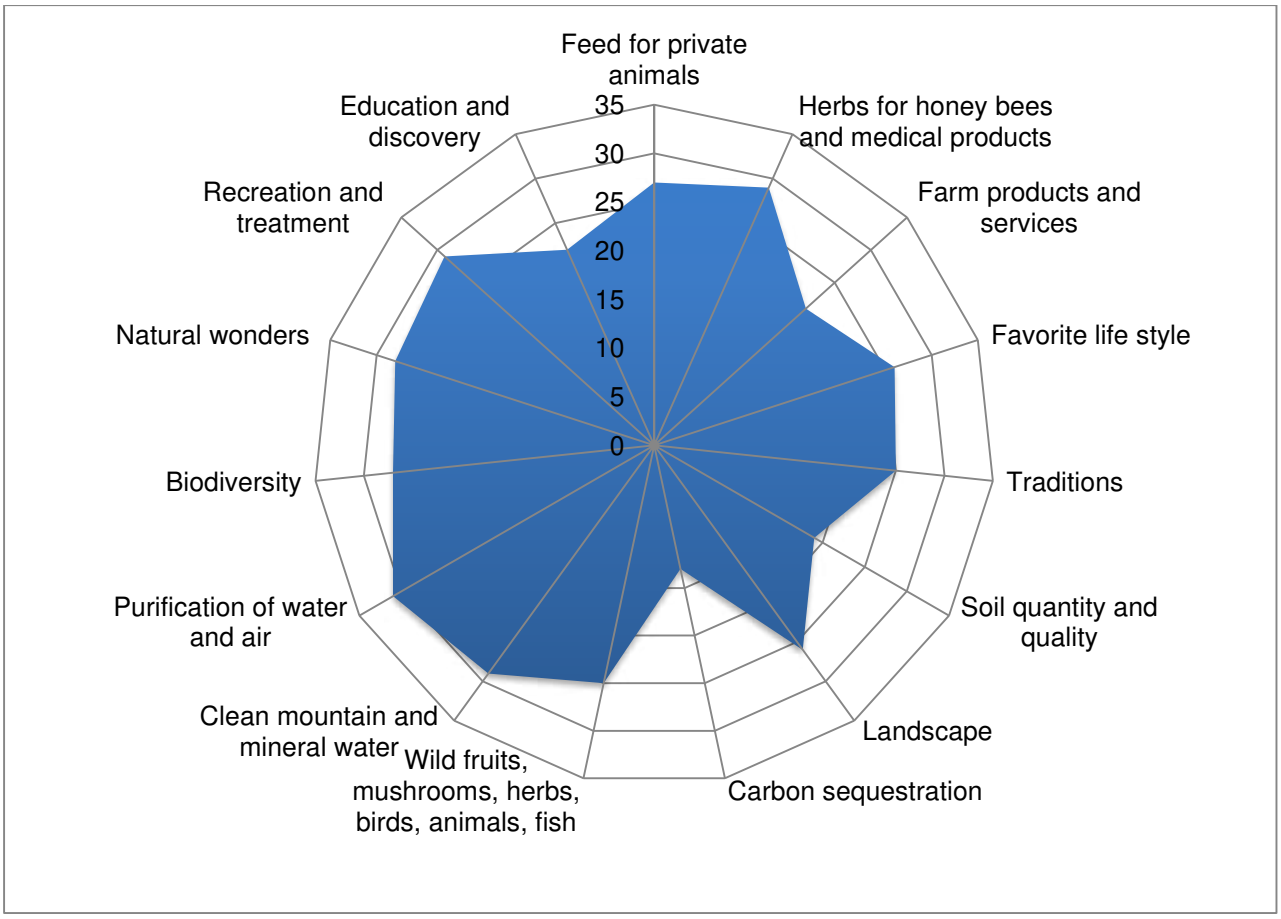
Consequently, the majority of farms (small-scale and subsistent holdings) have not been able to participate in the diverse public support schemes. For example, less than 5% of all farms from the WSP, comprising 18% of the grasslands and 8% of the arable land, are registered in the Land Parcels Identification System (indicating the land eligible for the EU CAP support).

Moreover, in many cases, the enforcement of the eco-standards has been difficult since the costs for detection of offenders are high in large and remote mountainous areas. For instance, the requirement for the minimum-maximum number of animals on pastures, and other mandatory eco-standards have been very difficult to enforce - only 5 % of the beneficiaries being subject to inspection, high costs, corruption, etc.

Finally, the WSP ecosystem services management is comprised by two distinct systems in Bulgaria (implementing the EU CAP) and Serbia (in a negotiation process for EU membership since 2014).

The assessment of experts[35], has found out that the highest value among the agro-ecosystem services of the WSP is given to the "purification of water and air" while the lowest estimate is for the "carbon sequestration" (Figure 24).

Figure 24. Estimates of Services of agro-ecosystems in Western Stara Planina, Bulgaria



Source: expert assessment, 2013

[35] Panel of 7 experts, including providers, stakeholders, and annalists, evaluated each type of the agro-ecosystem services in a scale 1 (lowest combine value) to 5 (highest combine value).

Impacts of EU CAP implementation on farms eco-management

CAP effect on environmental sustainability of farms

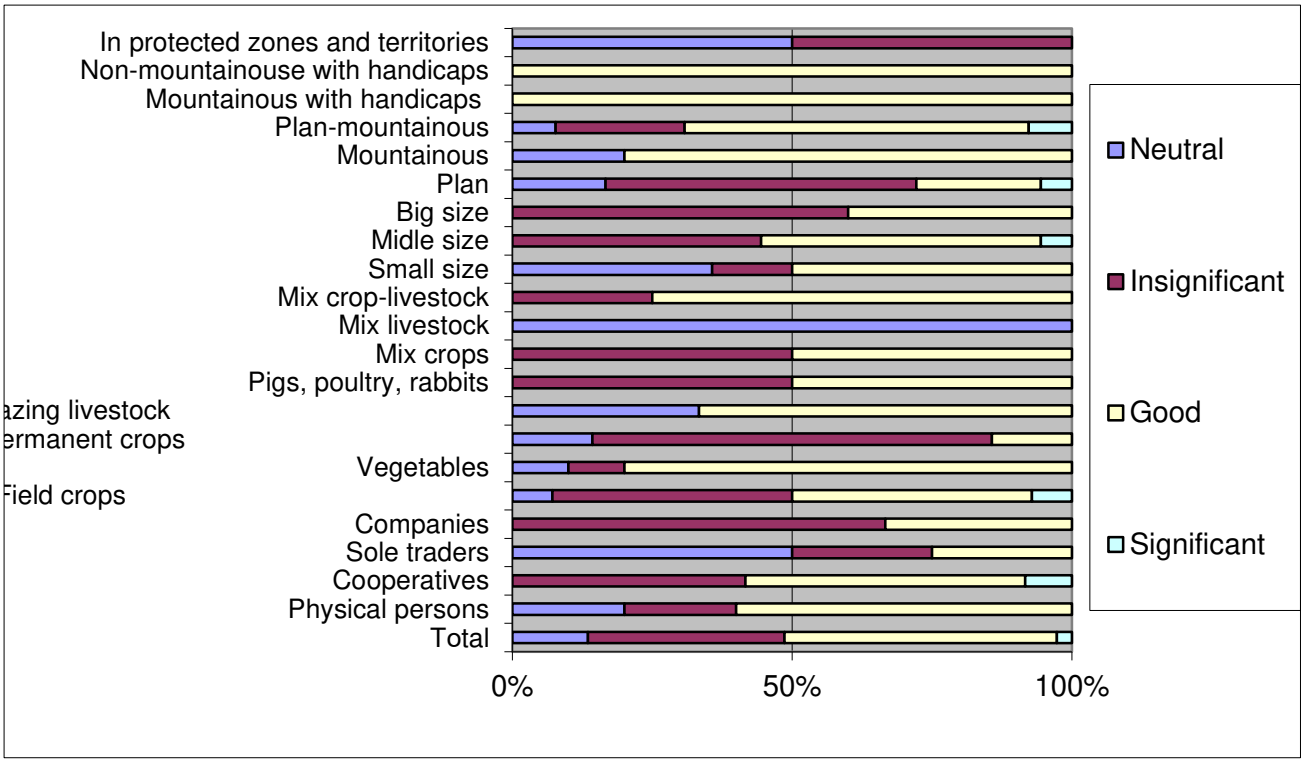
According to the more than a half of the farm managers[36] *the overall impact* from implementation of the different mechanisms and instruments of the EU CAP (common market, new standards and regulations, direct payments, NPARD measures, etc.) on their environmental sustainability is "good" (Figure 25).

The favorable effect of the CAP on eco-sustainability is felt by all holdings in the regions with natural handicaps, four out of five farms specialized in vegetables production and located in the mountainous regions, three quarters of the farms in mix crop-livestock production, more than two-third of holdings with the grazing livestock, more than 69% of farms in the plain-mountainous regions, 60% of the Unregistered holdings, more than 58% of the Agricultural Cooperatives, every other farms with the small and middle size, in field crops, mix crops, and the pig, poultry and rabbits.

None of the surveyed farms indicates a *negative* impact of the CAP of the ecological aspects of their activity. Nevertheless, for all farms specialized in the mix livestock, those located in the protected zones and territories, and for the majority of firms with permanent crops, plain regions and big size, the impact from the implementation of CAP instruments on the environmental sustainability of farms is *insignificant* or *neutral.*

[36] Survey was carried in the end of 2012 with the managers of 84 commercial farms. The structure of the juridical type, size, specialization and location of surveyed farms corresponds to the real structure of the commercial farms in the country.

Figure 25. Impact of EU CAP on environmental sustainability of Bulgarian farms



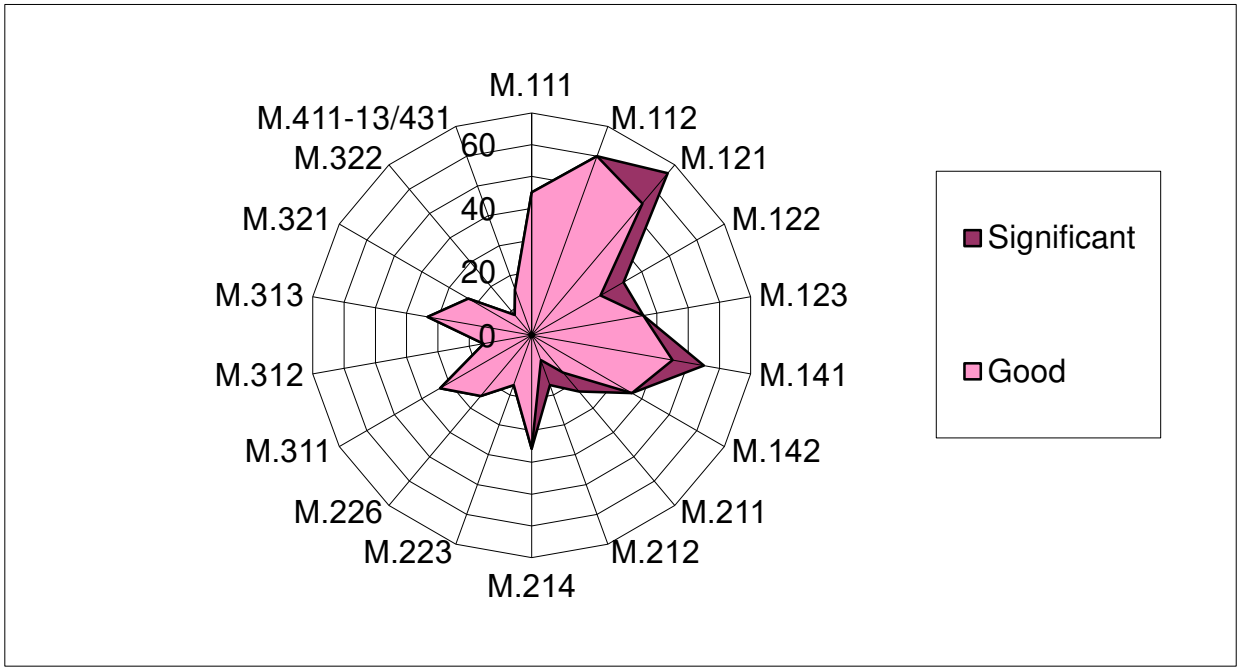
Source: interviews with farm managers, 2012

More than a third of farms, receiving *agri-environmental payments* (Measure 123) report, that effect of that support on their farm in *good* (Figure 26). Also a good portion of the farms with payments for mountainous areas with handicaps (Measure 121) and in the areas with handicaps different from mountainous (Measure 122) assess as *good* (accordingly 15,4% and 8,3%) and significant (accordingly 7,7% and 8,3%) the effect on these measure on their holdings.

Nearly a quarter of the managers of farms supported by the *„Payments to farmers in mountainous areas with handicaps*" (Measure 211) assess as *good* or *significant* the effect of this public instrument on their farm. The impact of this type of payment is strongest for the holdings with small size, unregistered farms, and farms specialized in permanent crops and vegetables. The positive effect of these payments covers the two-third of smalls-scale farms, every other of the unregistered holdings and those

specialized in permanent crops, and 40% of the farms specialized in vegetables.

Figure 26. Share of Bulgarian farms assessing as good or significant the impact on NPARD measures on their farms (percent)



Source: interviews with farm managers, 2012

Less than 17% of the managers of surveyed farms supported by the *"Payments to farmers in other areas with handicaps"* (Measure 212) evaluate the impact of this instrument as *good* or *significant*.

The effect of *Agri-environmental payments"* (Measure 214) is estimated as *good* by the two-third of the managers of Cooperatives supported by these payments, and a half of the holdings with small size, agri-corporations, and those specialized in vegetables and permanent crops, and 40% of the farms specialized in field crops, one third of the holdings with big size and mix crop-livestock operations, and nearly 29% of the unregistered holdings and farms with a middle size. The impact of this public instrument on all other farms is either *insignificant* or *neutral* (including for all Sole Traders, and the farms specialized in livestock, and the holdings in protected zones and territories).

Dynamics of farms indicators during CAP implementation

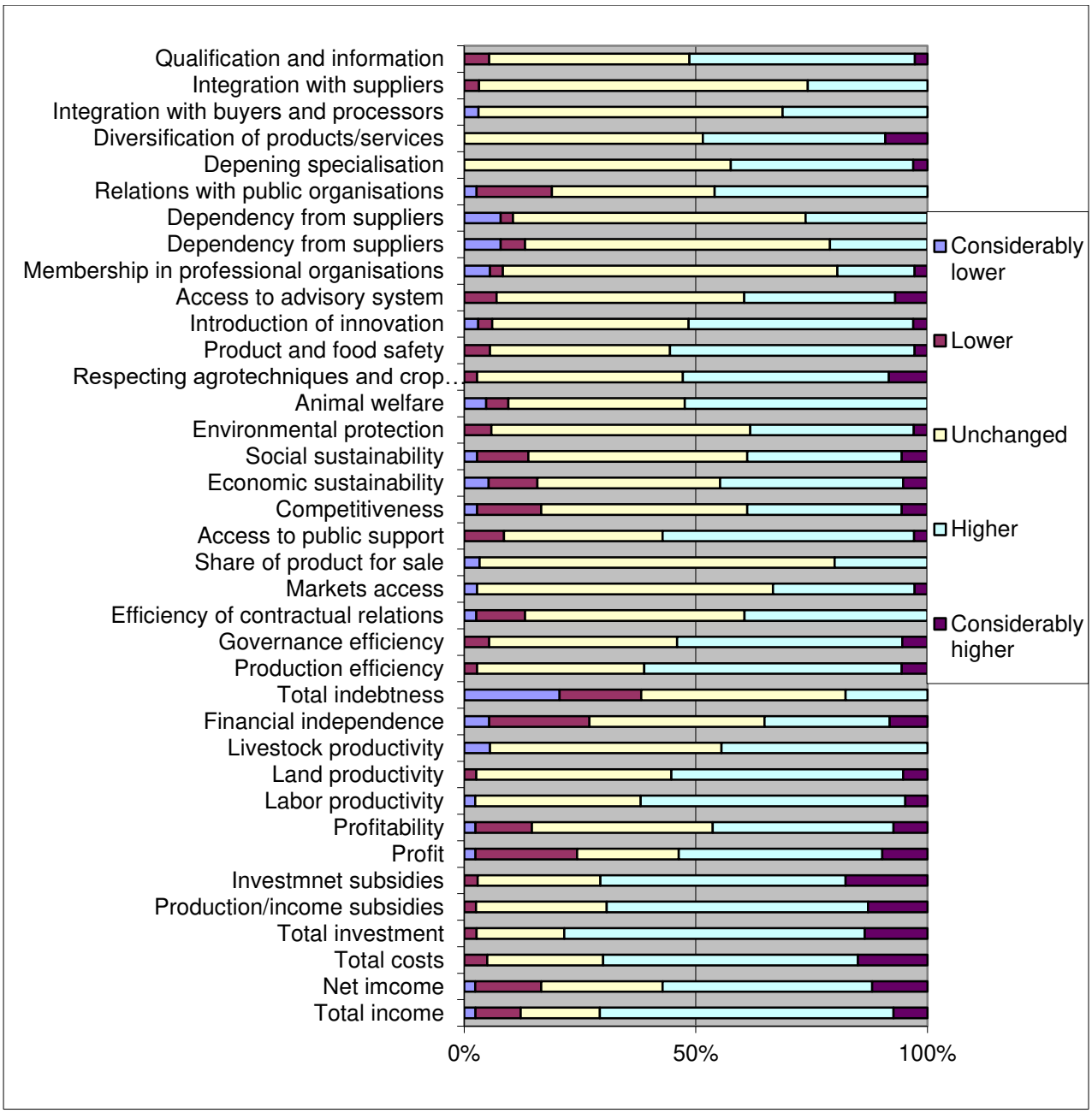
The greatest share of surveyed farms indicates an increased level of a part of the main indicators in the present time comparing to the levels in the period before the EU CAP implementation (Figure 27).

For instance, *higher* or *considerable higher* is the level of the total income, costs, investments, profit, labor productivity, efficiency of the production and management in the majority of farms. Also the biggest portion of the holdings has an improved access to the public support, and augmented amount of the subsidies for production, income and investment support. At the same time, the share of farms with *lower* total indebtedness comparing to the pre-accession period is 38%, while with a *higher* one bellow 18%.

According to the more than a half of the farms they have an improved qualification and information, agro-techniques and crop rotation, and livestock conditions, as well as increased product and food safety, and innovation activity comparing to the period before the CAP implementation. All that is a direct or indirect result of the favorable impact of the different CAP mechanisms on the key aspects of the activities of majority of surveyed farms.

However, a good fraction of the farms report *lack of change* in the share of sold output, market access, diversification of products and services, deepening of specialization, and in the environmental preservation. Also a big part of the farms have no changes in their dependency from suppliers and buyers, increased integration with suppliers and buyers, and improved involvement in the professional organizations and access to the agricultural advisory system.

Figure 27. Levels of farms indicators comparing to level before CAP implementation in Bulgaria



Source: interviews with farm managers

Furthermore, a big portion of the holdings do not report changes in the profitability, land and livestock productivity, overall indebtedness and financial independency, efficiency of production, management and contractual relations, competiveness, economic and social sustainability, agro-techniques and crop rotation, livestock conditions, product and food safety, introduction of innovation, qualification and information.

Besides, more than a third of the farms have no improvement in the relations with the state organizations and in the access to the public support in comparison to the pre-accession period.

Therefore, the implementation of diverse instruments of the EU CAP does not lead to a progressive change in the main indicators of a good part of Bulgarian farms. The later is either due to the lack of the positive effect from the CAP on a portion of the holdings (for example, lack of effective public support) or due to the neutralized effect of the CAP on other negative factors which could have deteriorated even further the state of farms (in conditions of the lack of the counterbalancing the existing negative trends CAP instruments).

For a considerable share of the farms the current levels of the main indicators is lower or significantly lower comparing to the level before the CAP introduction.

For instance, 27% of the surveyed holdings indicate deteriorated financial independence, more than 24% are with diminished profit, almost 17% are with reduced net income and competitiveness, around 16% are with inferior economic sustainability, almost 15% are with lower profitability, and 14% are with deteriorated social sustainability.

Similarly, nearly 19% of the farms are with worsened relations with the state organizations, above 13% of them have decreased efficiency of the contractual relations, every tenth is with inferior livestock conditions, almost 9% of the holdings are with decreased access to the public support, and more than 8% are with reduced membership in professional organizations.

All these show that the EU CAP implementation has been associated with deterioration of the main indicators of a considerable portion of farms. This is either because of the negative effects of the CAP on a party of farms, or due to the lack of effective mechanisms for assisting the farms adaptation and for compensating the influence of other negative factors (e.g. competition

with heavily subsidized imported products at the national and international markets, high interest rates for bank credits, big market price fluctuations, etc.).

Therefore, the CAP implementation does not contribute to the improvement of environmental conservation capability and efficiency in a great portion of the farms in the country. That necessitates improvement of the CAP implementation through perfection of the management public programs, change in the design and/or beneficiaries of some CAP instruments, or requires rethinking and reforming individual mechanisms or the policy as a whole.

Part 3. Eco-management in Bulgarian farms with high eco-activity

Characteristics of surveyed “eco-active” farms

This part of the book presents the results of a large-scale study on forms, factors and efficiency of the eco-management in “eco-active farms” of different type and location. It s based on a 2014 survey with the agricultural producers carried out during the training of farmers by the National Agricultural Advisory Service on Measure 214 “Agri-environmental payments” of the National Program for Agrarian and Rural Development (NPARD).

The training of the agricultural producers is free of charge, and it is mandatory for all beneficiaries from the Measure 214. Therefore, the interested farmers had strong incentives and low costs (time for traveling and training, etc.) for participating in the specialized training.

This first large-scale survey in the country gives a good insight for the “eco-active” agricultural producers and for the type of eco-management in these farms. We define and investigate as “eco-active” these farmers, who are interested in the environmental measures of the NPARD and in the protection of natural environment.

For the classification of farms according to the juridical type, specialization, and geographical and program (e.g. less-favored mountainous regions, less-favored region different from mountainous, lands in protected zones and territories) locations the official typology for the agricultural farms in the country is used.

Each of the surveyed farmers self-determined himself as predominately for subsistence, rather small, middle size or large for the industry, and located mainly in plain, plain-mountainous or mountainous region. This approach is

applied since the farm managers know the best their specificity and comparative characteristics in relations with other farms in the region and (sub)sector.

In the survey 306 registered agricultural producers have taken part, which accounts for 4.52% of all farms in the country registered according to the Regulation № 3, 1999 for the creation and maintaining register of agricultural producers[37].

Farmers of all juridical types, sizes, specialization and location has been surveyed (Table 11). The majority of the participants are Physical Persons, farms with small and middle sizes for the industry, specialized in field and permanent crops, and located predominately in plain and plain-mountainous regions. A fifth of the participants did not indicate [38] the region (municipalities)where the farms is located.

The most of the surveyed Physical Persons are self-determined as “small” (49%) and “middle size” (30,9%) for the sector, a portion is predominately for self-subsistence (15,1%), and a tiny segment is with “big size for the industry” (1,9%). The main part of the Physical Persons is specialized in permanent crops (34,7%), field crops (17,4%), mix crop-livestock production (14,3%), vegetables and mushrooms (11,2%), mix livestock production (10,8%), and mix crop production (7,7%), while a small portion is in grazing livestock (1,9%), beekeeping (1,5%), and pigs, poultry and rabbits (0,8%).

[37] The total number of registered agricultural producers in the country is 67614 [MAF, 2013].

[38] the reason is that organisers did not stress on the needs for participants to indicate munucipality where their farm is situated.

Table 11. Characteristics of surveyed farms in Bulgaria

Indicators	Physical Persons	Sole Traders	Coope ratives	Companies, Corporations, etc.	Number* % in tota
Share in total number	84,64	7,19	2,61	5,55	306*
Field crops	17,37	50,00	75,00	52,94	23,53
Vegetables, mushrooms	11,20	0	0	0	9,48
Permanent crops	34,75	31,82	0	5,88	32,03
Grazing livestock	1,93	9,09	0	5,88	2,61
Pigs, poultries, rabbits	0,77	4,55	0	0	0,98
Mix crops	10,81	0	0	17,65	7,52
Mix livestock	14,29	0	0	5,88	9,48
Mix crop-livestock	1,54	4,55	25,00	5,88	13,40
Beekeeping		0	0	0	1,31
Mainly subsistence	15,06	4,55	0	0	13,07
Small for industry	49,03	31,82	0	11,76	44,44
Middle size	30,89	50,00	75,00	58,82	35,29
Big size for industry	1,93	13,64	25,00	17,65	4,25
Mainly plain	59,85	50,00	87,00	70,59	60,78
Plain-mountainous	25,48	27,27	12,50	23,53	25,16
Mainly mountainous	8,88	9,09	0	0	8,17
With lands in protected zones and territories	5,41	0	0	11,76	5,23
Less-favored mountainous regions	6,95	9,09	0	0	6,54
Less-favored non-mountainous regions	3,47	4,55	0	5,88	3,59
North-west region	7,33	4,54	0	11,76	7,52
North-central region	18,15	31,82	75,00	23,53	20,91
North-east region	15,44	9,09	0,25	29,41	16,01
South-west region	9,27	4,54	0	0	8,17
South-central region	13,90	0	0	5,88	12,42
South-east region	11,97	27,27	0	11,76	12,74
Unspecified region	23,94	22,73	0	5,88	22,22

Source: survey with agricultural producers, May 2014

The Physical Persons are predominately located in plain (59,8%) and plain-mountainous (25,5%) regions, and a petite share is in mountainous regions (8,9%), with lands in protected zones and territories (5,4%), in less-favored mountainous regions (6,9%) and in less-favored regions different from mountainous (3,5%). A relatively greater portion of the surveyed Physical Persons are with unspecified region (23,9%), or situated in the North-Central (18,1%), North-Eastern (15,4%), and South-Central (13,9%) regions of the country, while participants from the North-Western, South-Western and South-Eastern regions are fewer – accordingly 7,3%, 9,3% and 12%.

A half of the Sole Traders are with middle size, 31,8% are with small size, 13,6% are large, and 4,5% are self-determined as predominantly subsistent holdings. A half of this type of firm are specialized in field crops, 31,8% in permanent crops, 9,1% in grazing livestock, 4,5% in crop-livestock production, and the same share in pigs, poultry and rabbits.

A half of the Sole Traders is located mainly in plain regions, 27,3% are in plain-mountainous regions, and a smaller portion is in mountainous regions (9,1%), in less-favored mountainous regions (9,1%), and in less-favored regions different from mountainous (4,5%). The greatest share of this type of farms are in the North-Central (31,8%) and South-Eastern (27,3%) regions, a good part is with unspecified region (22,7%), and the rest are located in the North-Eastern (9,1%), North-Western (4,5%) and South-Western (4,5%) regions of the country.

In the group of the “Companies, corporations, etc.” there are mostly Corporations (82,3%) and the rest are equally distributed different types of (Limited Liability, etc.) Companies - by 5,6%.

The biggest part of the Companies, Corporations, etc. self-determined themself with middle for the industry sizes (58,8%), 17,6% are large farms, while 11,8% are with small size. Most of this type of farms are specialized in field crops (52,9%), while another significant portion is in mix crop production

(17,6%), and a smaller share in (each 5,9%) permanent crops, grazing livestock, mix crop-livestock production, and mix livestock production.

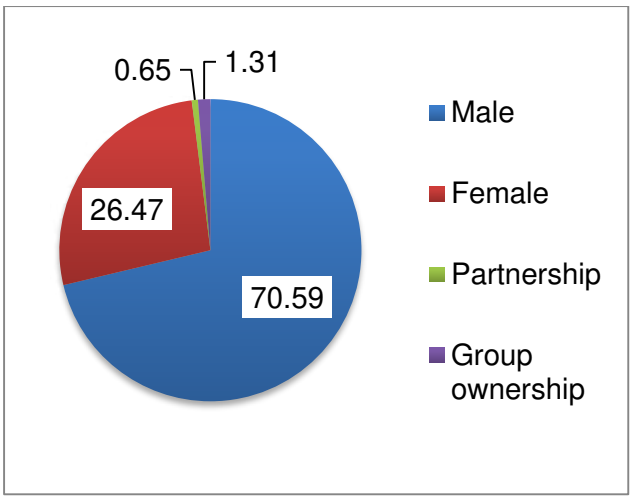
The Companies, Corporations, etc. are situated explicitly in plain (70,6%) and plain-mountainous (23,5%) regions, as part of them are with lands in protected zones and territories (11,8%), and in less-favored regions different from the mountainous (5,9%). The biggest part of this type of firms are located in the North-Eastern (29,4%), North-Central (23,5%), and North-Western (17,65) regions, in the South-Eastern and South-Central regions there are by 11,7% of them, while with unspecified regions are 5,9%.

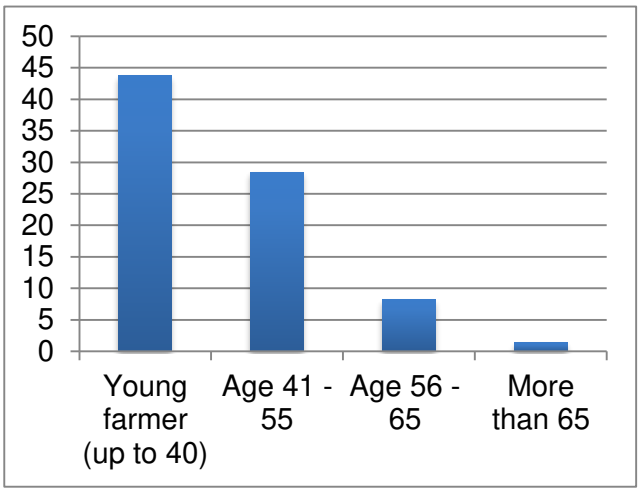
The surveyed Cooperatives are with middle (75%) and big (25%) sizes for the industry. Three-quarters of them are specializing in field crops, and the rest in mix crop-livestock production. The cooperative farms are located inclusively in plain (87,5%) and plain-mountainous (12,5%) regions, and a three quartets of them are in the North-Central region, while the rest in the North-Eastern region of the country.

The structure of surveyed farms by juridical status, geographical locations, size, etc. approximately corresponds to the real structure of all (market-oriented, registered) farms in the country. Nevertheless, among the farms with high eco-activity there are relatively more farms specialized in the permanent crops in comparison with other directions of the production specialization.

The owners and/or managers of the predominate part of the surveyed farms are males, as most of them are younger than 55 (Figure 28). Moreover, the majority of the participants are young farmers (younger than 40), which indicate the considerable interest of this group of producers toward the amelioration of environmental efficiency of farms.

Figure 28. The owner (Manager) of farm is (percent)





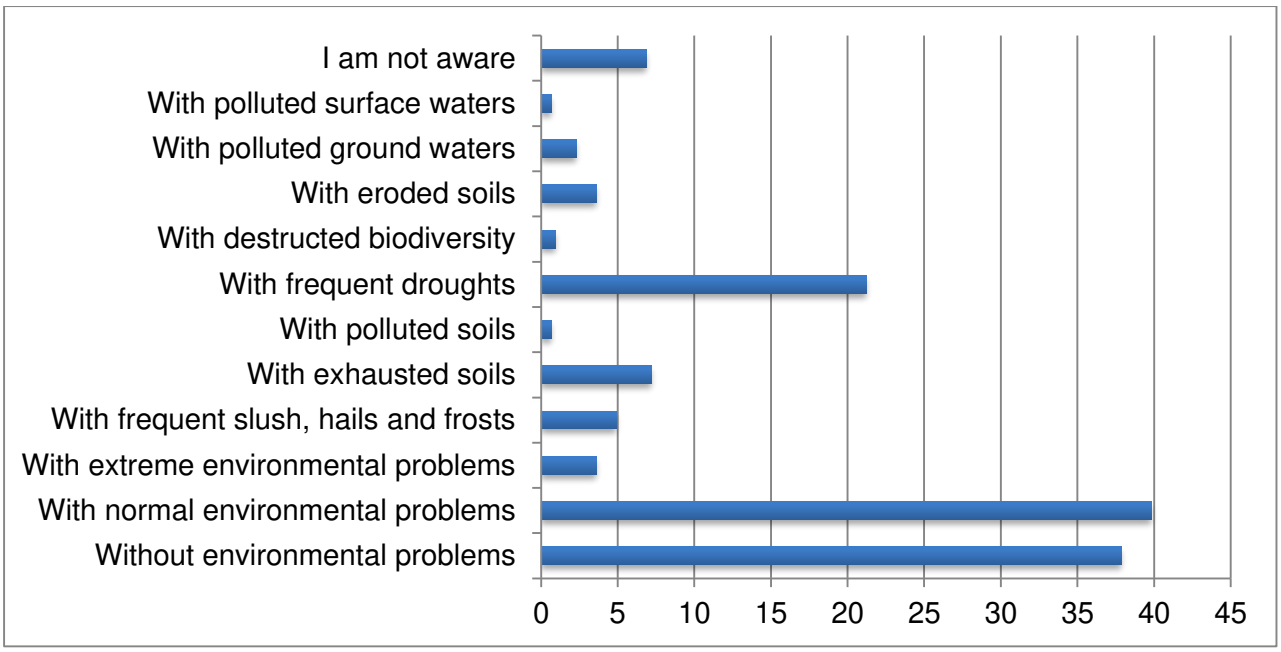
Source: survey with agricultural producers, May 2014

The survey has found out that almost 7% of the farmers are "not aware" with the environmental problems in the region where their farms are located (Figure 29). According to a good part of the farmers, their holding is located in a region "without environmental problems" (37,9%), while the biggest portion indicate that they are in a region "with normal environmental problems" (39,9%).

However, the number of farms in regions with environmental problems of different type is not minor. More than 21% of the surveyed farms are in regions with "frequent droughts", above 7% are located in regions "with exhausted soils", and almost 5% are in regions "with frequent slush, hails and frosts".

What is more, almost 4% of the farmers indicate that their farms are located in regions "with extreme environmental problems" and equal number select regions "with eroded soils ", while more than 2% of them are in regions "with polluted ground waters".

Figure 29. Type of environmental problems in region where farm is located (percent)



Source: survey with agricultural producers, May 2014

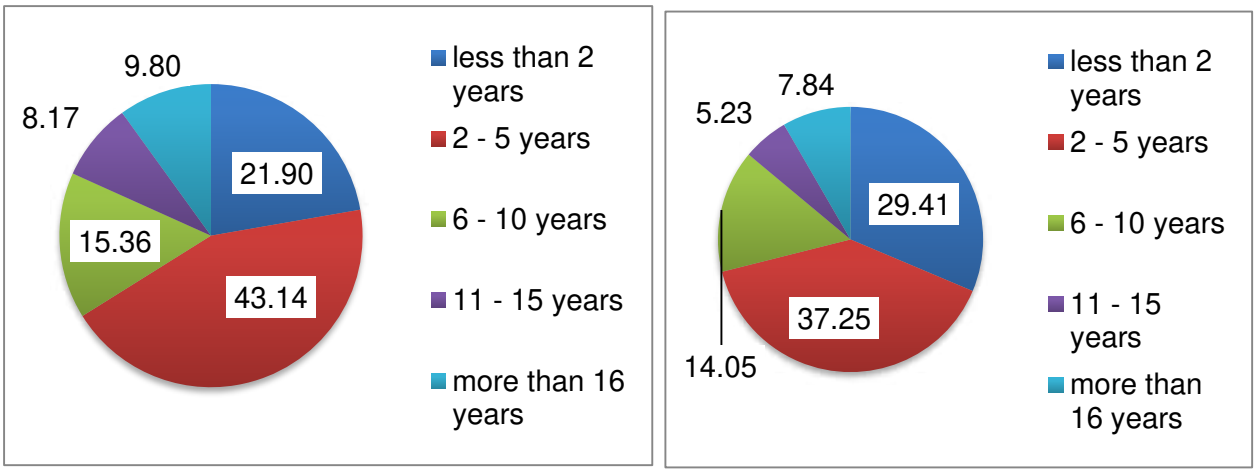
On the other hand, the number of farms in regions “with polluted soils”, “with destructed biodiversity” and “with polluted surface waters” is small (bellow 1%), which is an indicator for the insignificant problems of this sort in the Bulgarian agriculture.

The greatest part of the surveyed farms (65%) are with relatively little “agricultural experience” pointing out that they are involved in farming for a period up to 5 years, including 21,9% of them “less than 2 years” (Figure 30). The rest of the farmers are with prolong farming experience, but with needs for the additional information and training for the agri-environmental measures of the NPARD and/or formal certification in that area.

The majority of surveyed farmers indicate that the period in which they take care for the natural environment is between 2 to 5 years (Figure 28). More than 27% of them are with a long-term experience (6 and more years) in the environmental protection. Nevertheless, for a considerable portion of farms (29,4%) the period associated with the protection of natural environment is short (“up to 2 years”).

Figure 30. The period in which the farmer is involved: (percent)

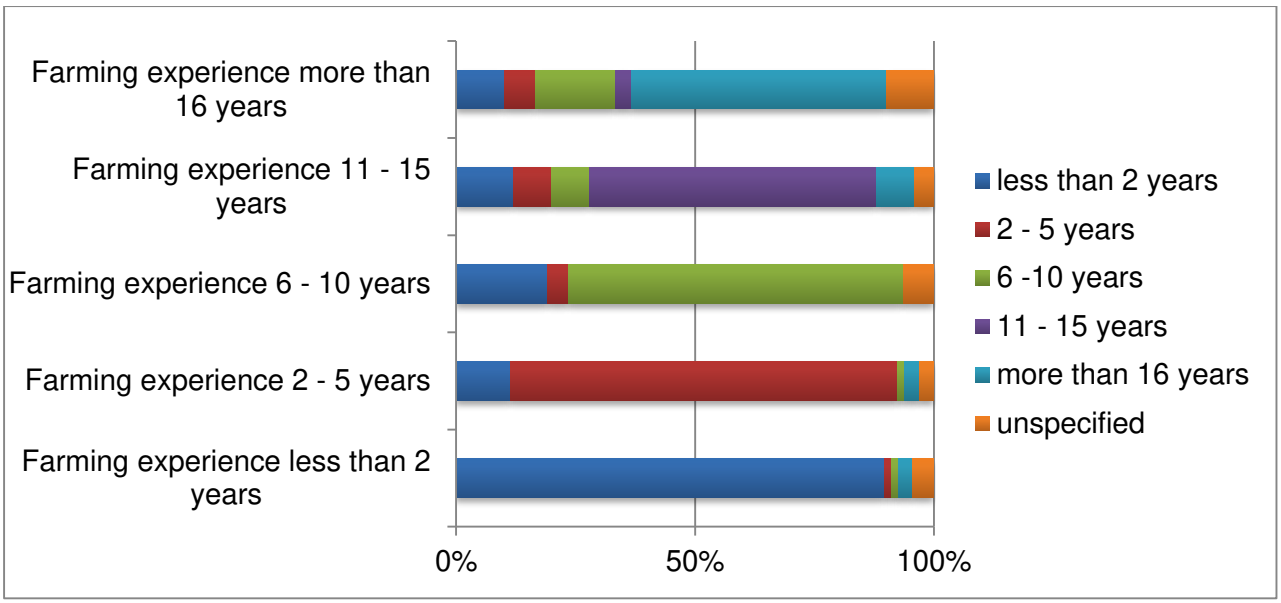
in farming **in environmental protection**



Source: survey with agricultural producers, May 2014

There is a correlation between the period in which surveyed farmers are involved in farming and the period in which they are involved in the environmental protection (Figure 31). However, the tendency is with the increasing the farming experience to decrease the share of farmers with the relevant experience in environmental protection. The later demonstrates that, the specific problem of “environmental management” is relatively new for the most farms in the country.

Figure 31. Period in which farmers with different farming experience are involved in environmental protection



Source: survey with agricultural producers, May 2014

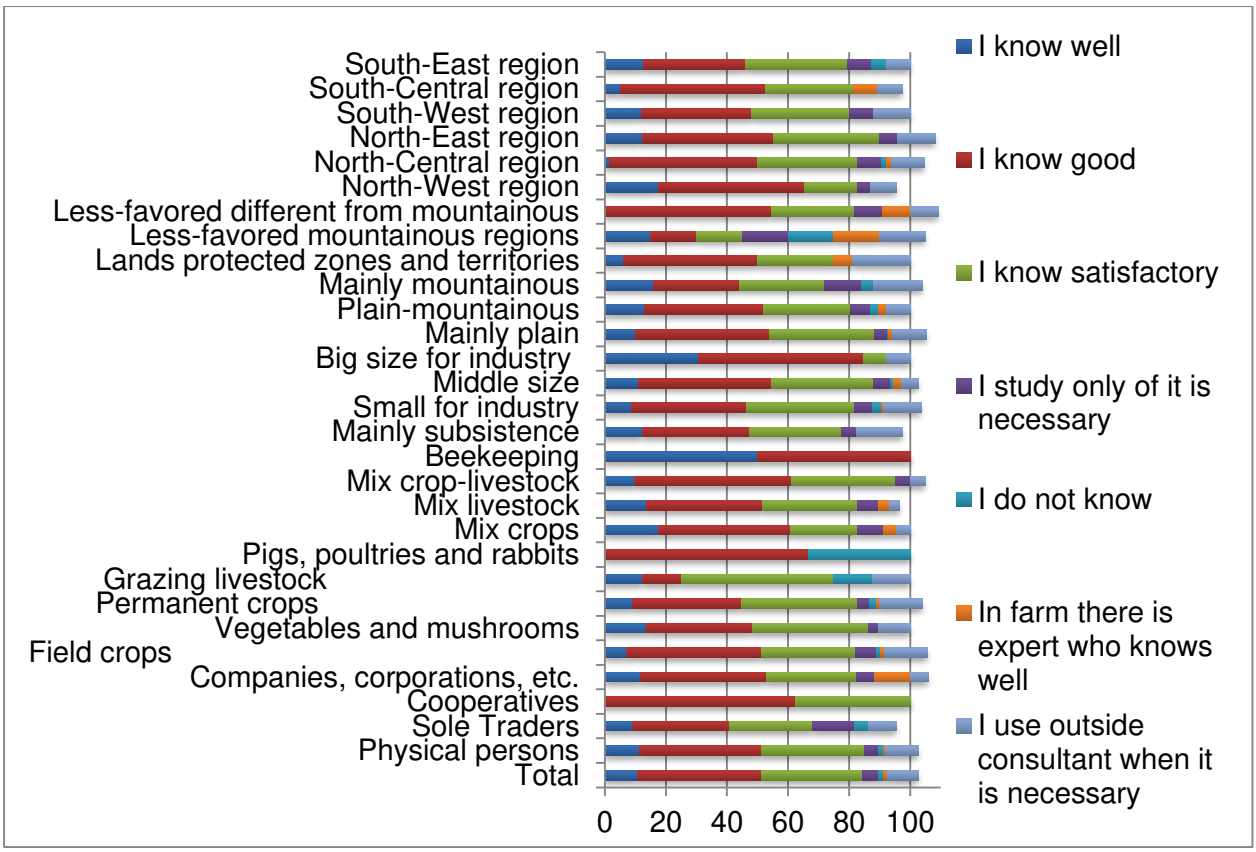
Forms and scope of environmental management in farms

The knowledge and the implementation of the principles of environmentally friendly agriculture is the base of the effective eco-management in agricultural farms.

None of the surveyed farms believe that it is “not important to know” the principles of the environmentally sustainable agriculture, which proves a good understanding of the importance of the integration of eco-management in the overall management of farms.

According to the more than a half of surveyed farms, they know “well” or “good” the principles of environmentally friendly agriculture (Figure 32). With relatively highest internal capability for the eco-management are the Cooperatives (62,5% of all number), while the share of the Sole Traders with a great ecological competency is the lowest (40,9%).

Figure 32. Extent of knowledge of principles of environmentally friendly agriculture in farms of different type and location* (percent)



**multiple answers*

Source: survey with agricultural producers, May 2014

The most numerous with a good eco-knowledge are among the farms specialized in the beekeeping (100%), pigs, poultry, and rabbits (66,7%), mix crop-livestock production (61%), and mix crops production (60,9%), while the least amount are among those specialized in the grazing livestock (25%).

The majority of large farms (84,6%) are characterized with a high knowledge acquiring capability for the eco-management, while the share of farms with small size with a high competency in the area of eco-management is relatively lower (46,3%).

Relatively more farms in plain regions of the country (53,8%) know “good” or “very good” the principles of environmentally sustainable agriculture, while in the mountainous region the portion of farms with similar knowledge is less important (44%). Also a bigger part of the farms in less-favored regions

different from the mountainous are with a high eco-competency (54,5%) comparing with the farms in less-favored mountainous regions (30%).

The North-Western is with the most significant share of farms with a high eco-knowledge (65,2%), while the South-Eastern region is with the smallest fraction of farms with a good eco-competency (46,1%).

Some farms improve their eco-capability by hiring an expert as part of the Physical Persons (0,8%) and a larger portion of the Companies, Corporations, etc. (11,8%) point out that they “have specialists in the farm, who knows well the principles of environmentally friendly agriculture”.

Besides, every tenth farm “use outside consultant if it is necessary”, as the external supply with the eco-knowledge in most popular among the Physical Persons (10,8%) and the Sole Traders (9,1%), the farms which are predominately for subsistence (15%) and with a small size (12,5%), and those specialized in the permanent crops (14,3%), field crops (13,9%), grazing livestock (12,5%), and vegetables and mushrooms (10,3%), as well as farms located in the mountainous regions (16%), with lands in protected zones and territories (18.7%), and less-favored mountainous regions (15%).

However, in a third of the farms, the level of competency in environmentally sustainable agriculture is “satisfactory”. The later means that the internal capability for the effective eco-management in the considerable portion of farms is low. The highest share of farms with such features are among the Cooperatives (37,5%), farms with a small size (35,3%), those specialized in grazing livestock (50%), vegetables and mushrooms (37,9%) and permanent crops (37,8%), and farms located in plain regions (34,4%), in less-favored regions different from the mountainous (27,3%), and in the North-East region of the country (34,7%).

Furthermore, a good portion of the Sole Traders (4,5%), farms specialized in pigs, poultry, and rabbits (33,3%) and grazing livestock (12,5%), farms located in the less-favored mountainous regions (15%), mainly mountainous regions (4%), and the South-East region of the country (5,1%)

indicate that they “do not know” the principles of environmentally sound agriculture.

Moreover, some of the farms study the eco-principles “only if that is necessary”, as a particularly big is the share of this type of farms among the Sole Traders (13,6%), farms in the mountainous regions (12%), and in the less-favored mountainous regions (15%).

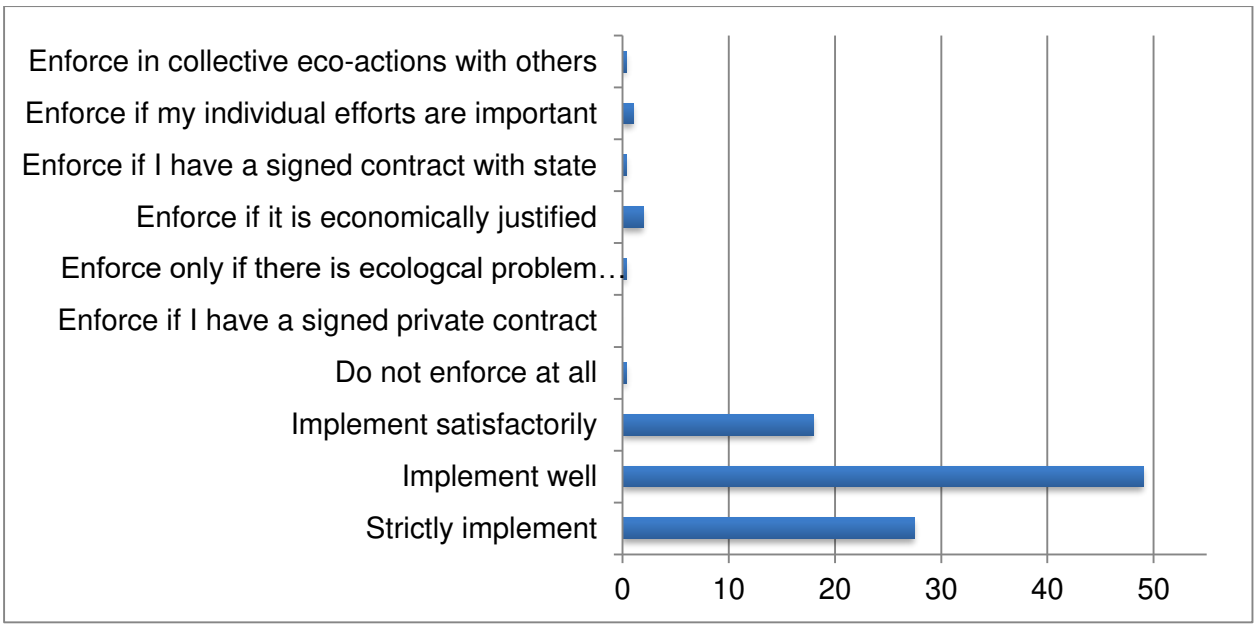
Therefore, in the future more efforts are to be put to improve the eco-competency of farms in the later groups with a low eco-culture through education, training, consultation, advises, etc.

The eco-competency is a necessary but not a sufficient condition for the effective eco-management. Due to various reasons (economic, technological, behavioral, etc.) and/or in different periods of time, the farmers not always strictly implement the principles of the environmentally friendly agriculture.

According to the majority of surveyed farms they implement “well” (49%) or “completely” (27,4%) the eco-principles in agriculture (Figure 33). Nevertheless, the share of farms implementing these principles “satisfactorily” is not small (18%), while those “not implementing at all” are minority (0,3%).

A small fraction of the surveyed Physical Persons indicate that the implementation and enforcement of the eco-principles in the farm depends on certain conditions such as the economic justification, the importance of eco-actions, an ecological problem in the farm, a contract with the state, or the collective actions with other agents.

Figure 33. Extent and conditions of enforcement of principles of environmentally-friendly agriculture in farms (percent)



Source: survey with agricultural producers, May 2014

For instance, for 2,3% of the later farms this is the “economic justification”, as these are mainly farms with a large size and predominantly for subsistence, farms specialized in field crops, vegetables and mushrooms, permanent crops, mix crops and mix livestock productions.

A part of the Physical Persons (1,2%) implement eco-principles only “if their individual efforts are important”, and those are entirely small farms in permanent crops.

A quarter of the farms specialized in beekeeping enforce eco-principles “ only if there is an ecological problem in the farm”.

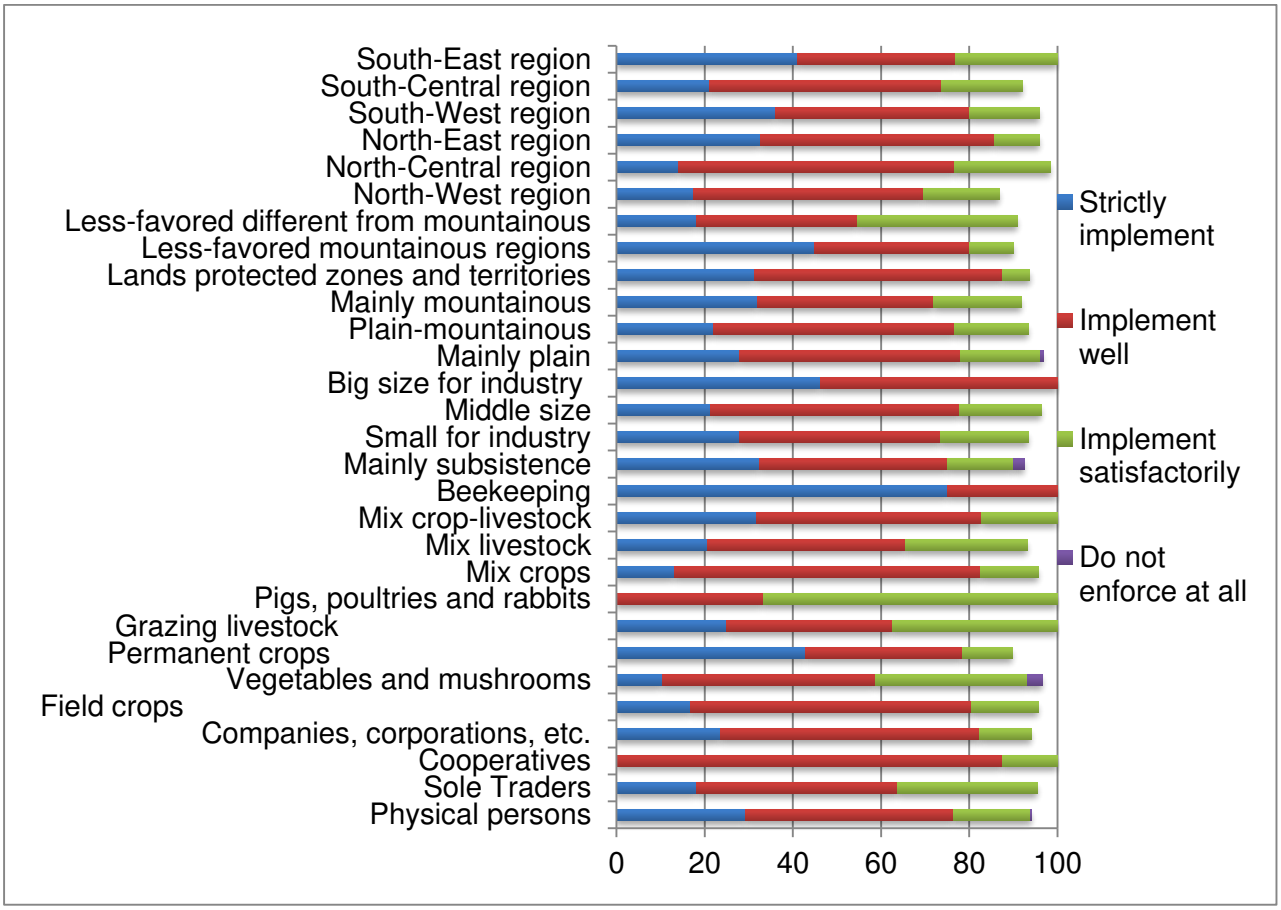
A tiny portion of the Physical persons (0,4%) implements eco-principles “if there is a contract with the state”, and those are exceptionally subsistence farms specialized in mix crops production.

Another small section of the Physical Persons (0,4%) points out implementing the eco-principles in case of “collective actions with others”, and those are small farms in permanent crops and field crops.

For none of the farms the “existence of a private contract” is a condition for the implementation of eco-principles, which shows that this form is not important for the Bulgarian farms at current stage of development.

To the greatest extent (“strictly” or “well”) implement the principles for environmentally sound agriculture the large-scale farms (100%), the Cooperatives (87,5%) and the Companies, Corporations, etc. (82,3%), the farms specialized in beekeeping (100%), mix crop-livestock production (82,9%) and mix crops production (82,6%), and those located in the plain regions (77,9%), with lands in protected zones and territories (87,5%), less-favored mountainous regions (80%), and in the North-East (85,7%) and the South-West (80%) regions of the country (Figure 34).

Figure 34. Extent and conditions of enforcement of principles of environmentally-friendly agriculture in different farms (percent)



Source: survey with agricultural producers, May 2014

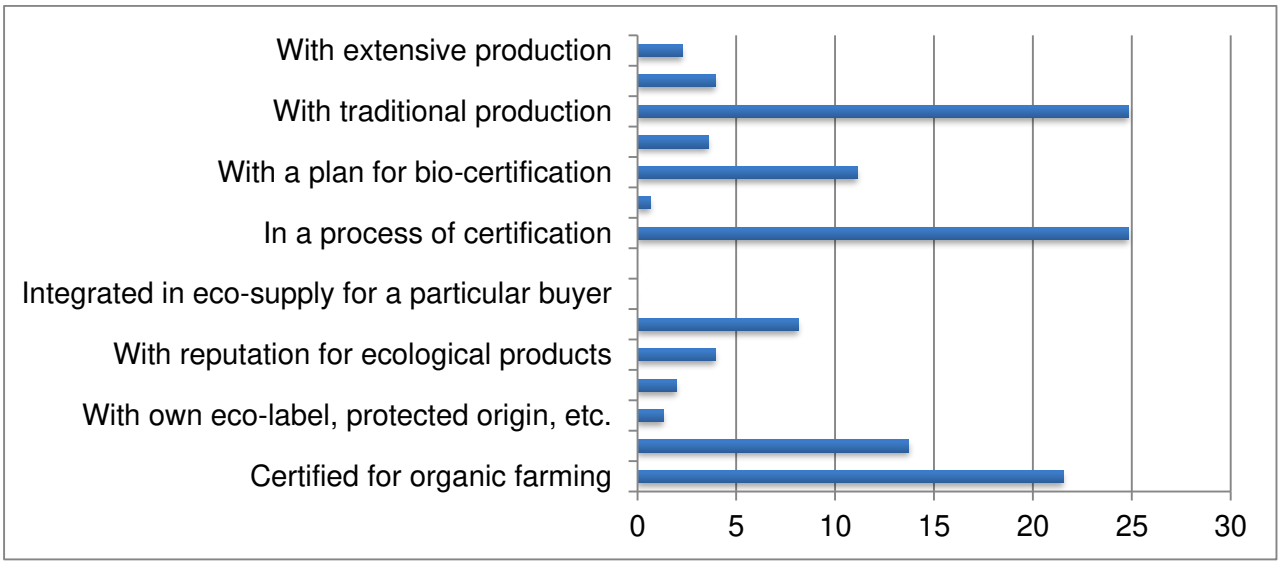
On the other hand, the share of farms “not enforcing” eco-principles is relatively smaller for the Sole Traders (63,6%), farms specialized in pigs, poultry and rabbits (33,3%) and vegetables and mushrooms (58,6%), those

with a smaller size (73,5%), and located in the mountainous regions (72%), in less-favored regions different from the mountainous (54,5%), and in the North-West region of the country (69,6%).

The transition to officially certified organic production is a major form for the eco-management in Bulgarian agricultural farms. Here the eco-behavior of the agricultural producers is regulated and stimulated by the dynamics of market demands and the premium to the market prices of certified organic products. Simultaneously, the authenticity of products and the adequacy of the eco-activity with the officially set up standards is controlled by the independent bodies.

Our survey has also confirmed that a relatively bigger portion of the eco-active farms are already “certified for the organic production” (21,6%) and around a quarter of them are “in a process of certification“ (Figure 35).

Figure 35. Share of farms applying different forms of eco-management (percent)



Source: survey with agricultural producers, May 2014

A part of the farms “experiment” with the organic agriculture along with the conventional production, as almost 14% of the surveyed inform that they are “with mix organic and traditional production”, including 14,3% of the

Physical Persons, 23,5% of the Companies, Corporations, etc., and 4,5% of the Sole Traders.

The other private and market forms for the eco-management are less used in the surveyed farms, predominately by the Physical Persons. For instance, merely 1,5% of the Physical Persons are “with own eco-label, protected origin, etc.”, 2,3% have “collective eco-label, protected origin, etc.”, and 0,8% “provide eco and related services”.

At the same time none of the surveyed farms is “integrated for eco-supply for a particular buyer” or has a “long-term contract for eco-supply for a particular buyer”.

Nevertheless, there are widely employed informal private and market forms for the eco-management as 9,3% of the surveyed Physical Persons point out that they are “with naturally ecologically pure production”, and 4,6%, of them having built a “reputation for ecologically pure products”.

In addition, a good portion of the farms has plans for a “bio-certification” (above 11%) or for a “eco-label, protected origin, etc.” (5,9% of the Companies, Corporations, etc., and 3,9% of the Physical Persons).

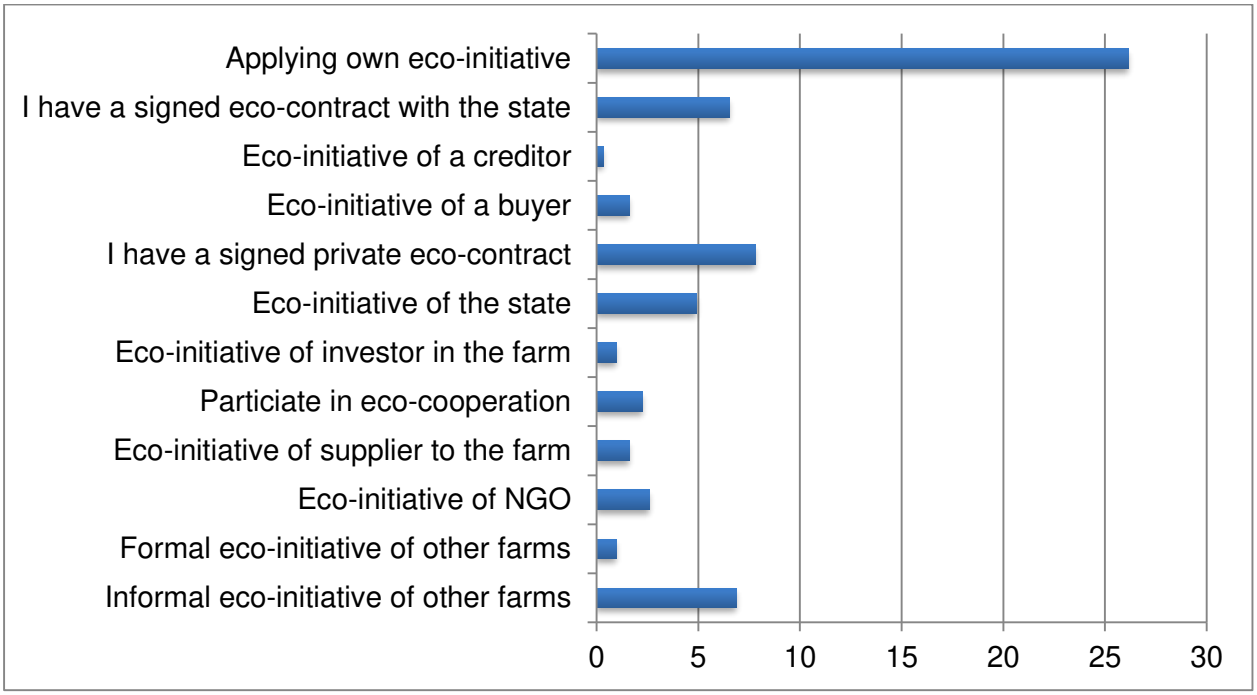
About a quarter of the surveyed farms estimate that they are with a “traditional production”, including a three-quarters of the Cooperatives, 31,8% of the Sole Traders, 23,5% of the Companies, Corporations, etc., and 22,4% of the Physical Persons.

A bigger share of firms characterize their production as “intensive” (13,6% of the Sole Traders and 17,6% of the Companies, Corporations, etc.), while among the Physical Persons this percent is 2,3% and zero for the Cooperatives. At the same time, only 5,9% of the surveyed Companies, Corporations, etc., and 2,3% of the Physical Persons describe their production as “extensive”.

A portion of the surveyed farms (with exception of the Cooperatives) also has own initiative or participates in another private, collective or state initiatives for the protection of the nature (Figure 36). For instance, 28,2% of

the Physical Persons, 18,2% of the Sole Traders, and 17,6% of other type of firms “implement own eco-initiative”.

Figure 36. Share of farms participating in various initiative for protection of nature (percent)



Source: survey with agricultural producers, May 2014

Furthermore, some of the farms implement a contractual form as 9,3% of the Physical Persons report having “a signed private eco-contract“, while 6,4% of the Physical Persons, 5,9% of the Companies, Corporations, etc., and 4,5% of the Sole Traders having “a signed eco-contact with the state”.

A part of the farms participate in the eco-initiatives of other farms and organizations.

For 8,1% of the Physical Persons this is “informal initiative of other farms“; for 17,6% of the Companies, Corporations, etc., and 4,5% of the Sole Traders, and 3,9% of the Physical Persons that is an “eco-initiative of the state“; and for 5,6% of the Companies, Corporations, etc., and for 1,5% of the Physical Persons this is an “eco-initiative of the supplier to the farm”.

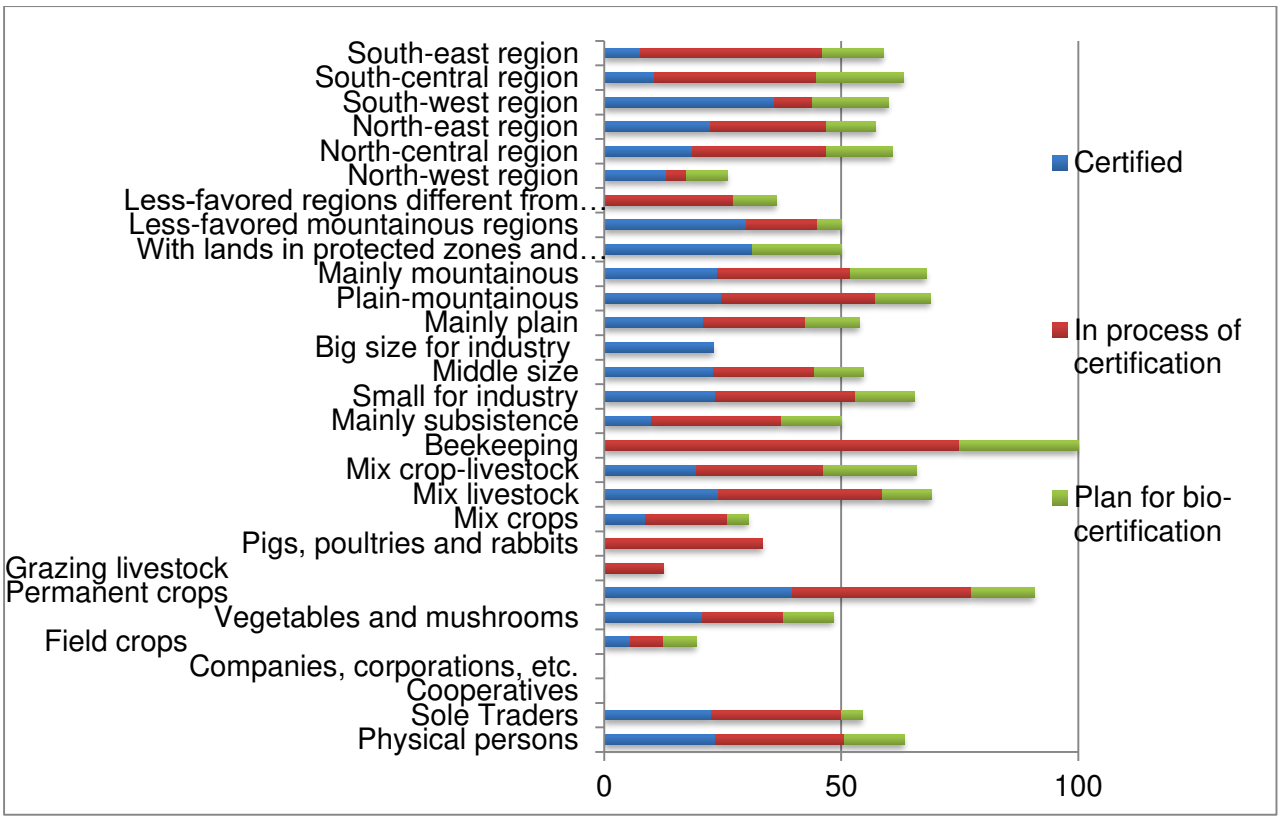
Besides, a small fraction of the Physical Persons participate in an “eco-initiative of a non-governmental organization” (3,1%), “eco-initiative of a buyer” (1,9%), “formal eco-initiative of other farms” (1,2%), “eco-initiative of the investor in the farm“ (1%), and “eco-initiative of a creditor“ (0,4%).

Also a portion of the surveyed Companies, Corporations, etc. (5,9%), and Physical Persons (1,9%) report that “participate in an eco-cooperative“. The later farms use the cooperative form for realization of a higher (“collective”) eco-effect or as a necessary condition for the participating in some public or private initiative (program).

Certified for the organic production, in a process of bio-certification or with a plan for the bio-certification are entirely the Physical Persons and the Sole Traders, where each second applies (“officially certified” or “in transition to”) the norms of the organic agriculture (Figure 37). On the other hand, none of the Cooperatives, Companies, Corporations, etc. is using or is planning that particular form of eco-management.

The greatest part of the certified for the organic production is among the farms specialized in the permanent crops (39,8%), vegetables and mushrooms, (20,7%), mix livestock production (24,1%), and mix crop-livestock production (19,5%). At the same time, the share of farms with complete certification among those specialized in field crops and mix crops production is small (accordingly 5,5% and 8,7%), while none of the farms with “pure” livestock specialization (grazing livestock, pigs, poultry, and rabbits, and beekeeping) has been officially certified.

Figure 37. Organic production in farms of different type and location (percent)



Source: survey with agricultural producers, May 2014

Simultaneously, in a process of organic certification are farms of all type of specialization, as the biggest share is among the groups specialized in beekeeping (75%), permanent crops (37,7%), mix livestock production (34,5%), and pigs, poultry and rabbits (33,3%).

Therefore, the majority of surveyed farms specialized in permanent crops (77,5%), beekeeping (75%), and mix livestock (58,6%), and a good portion of those specialized in mix crop-livestock production (46,3%), vegetables and mushrooms (37,9%), and pigs, poultry and rabbits (33,3%) practically implement (“officially” or “in a transition to”) the principles of the organic agriculture.

What is more, with a plan for the bio-certification are a part of the farms with different specialization, with exception of those in grazing livestock, and pigs, poultry and rabbits. Consequently, in a near future, all of the farms specialized in beekeeping, and almost all holdings in the permanent crops, will apply the organic form for eco-management.

The biggest part of the farms certified for the organic production or in the process of bio-certification is with a small and a middle size for the sector. On the other hand, while the share of large-scale bio-certified farms is similar to that of small and middle sized, none of them is in a process or with a plan for bio-certification.

The share of bio-certified farms among those for subsistence is small, but many of them are in a process or with a plan for bio-certification. Therefore, in near future every other of the “non/semi-market” farms (predominately for subsistence) will apply this “market-oriented” form of eco-management.

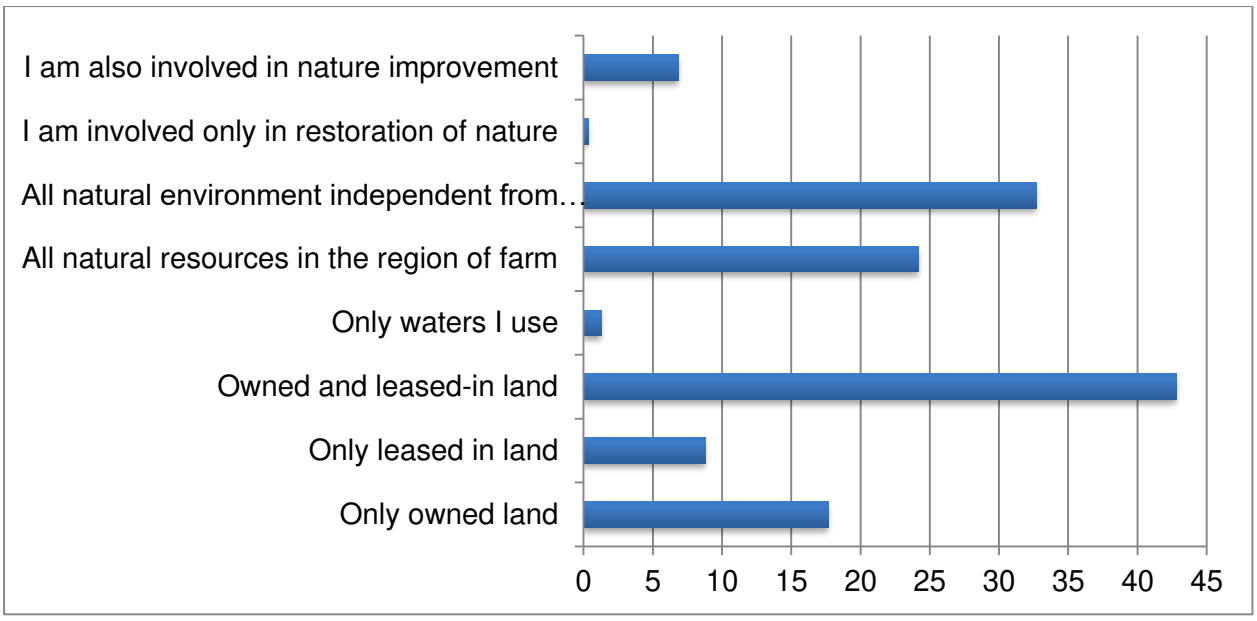
The share of farms with bio-certification, in a process of certification, or with a plan for bio-certification, in the overall number of farms in the plain-mountainous regions is in more advance stage. The same is true for the farms with lands in protected zones and territories, and in the less-favored mountainous regions in contrast to the farms in less-favored regions different from the mountainous where there is still no bio-certified farm.

The South-West region is with the greatest share of farms, which are certified for the organic production. In the other regions of the country, the portion of farms in the process of bio-certification is considerable, with the exception of the North-West region with a comparatively small fraction of the farms implementing (officially or in transition to) the norms of organic agriculture.

All these figures give a good insight on the structure and the prospect of the organic production in Bulgarian farms since no other comparable data are practically available.

The scope of the eco-management is not equal to all of the surveyed farms (Figure 38).

Figure 38. Scale of eco-management in agricultural farms* (percent)



**multiple answers*

Source: survey with agricultural producers, May 2014

For instance, for 17,6% of the farms the cares for protection of the natural environment are focused "only on owned land", including for 19,3% of the Physical Persons, 13,6% of the Sole Traders, and 12,5% of the Cooperatives.

A portion of the farms are looking after protection "only of leased-in land" (8,8%), and the later concerns 12,5% of the Cooperatives, 9,3% of the Physical Persons, and 9,1% of the Sole Traders.

However, the greatest share of the farms concentrate their efforts on the protection of the "owned *and* leased-in land" (42,8%), as such approach apply 64,7% of the surveyed Companies, Corporations, etc., 62,5% of the Cooperatives, 40,9% of the Sole Traders, and 40,5% of the Physical Persons.

Also some small fraction of the Companies, Corporations, etc. (5,9%) report focusing its care "only on waters which they use".

Besides, a considerable portion of the surveyed farms take care for "all natural resources in the region of the farm" (24,2%), including 25,9% of the Physical Persons, 29,4% of the Companies, Corporations, etc., and 9,1% of the Sole Traders.

What is more, for 32,6% of the surveyed farms the cares for the protection of natural environment cover the “natural environment as a whole independent from the region”, including for a half of the Cooperatives, 32,4% of the Physical Persons, 29,4% of the Companies, Corporations, etc., and 27,3% of the Sole Traders.

Furthermore, a small portion of the Physical Persons are “only involved in restoration of the natural environment“. A little bit bigger fraction of the surveyed farms “ are involved also with the improvement of the natural environment” (6,9%), including 12,5% of the Cooperatives, 6,6% of the Physical Persons, 5,9% % of the Companies, Corporations, etc., and 4,7% of the Sole Traders.

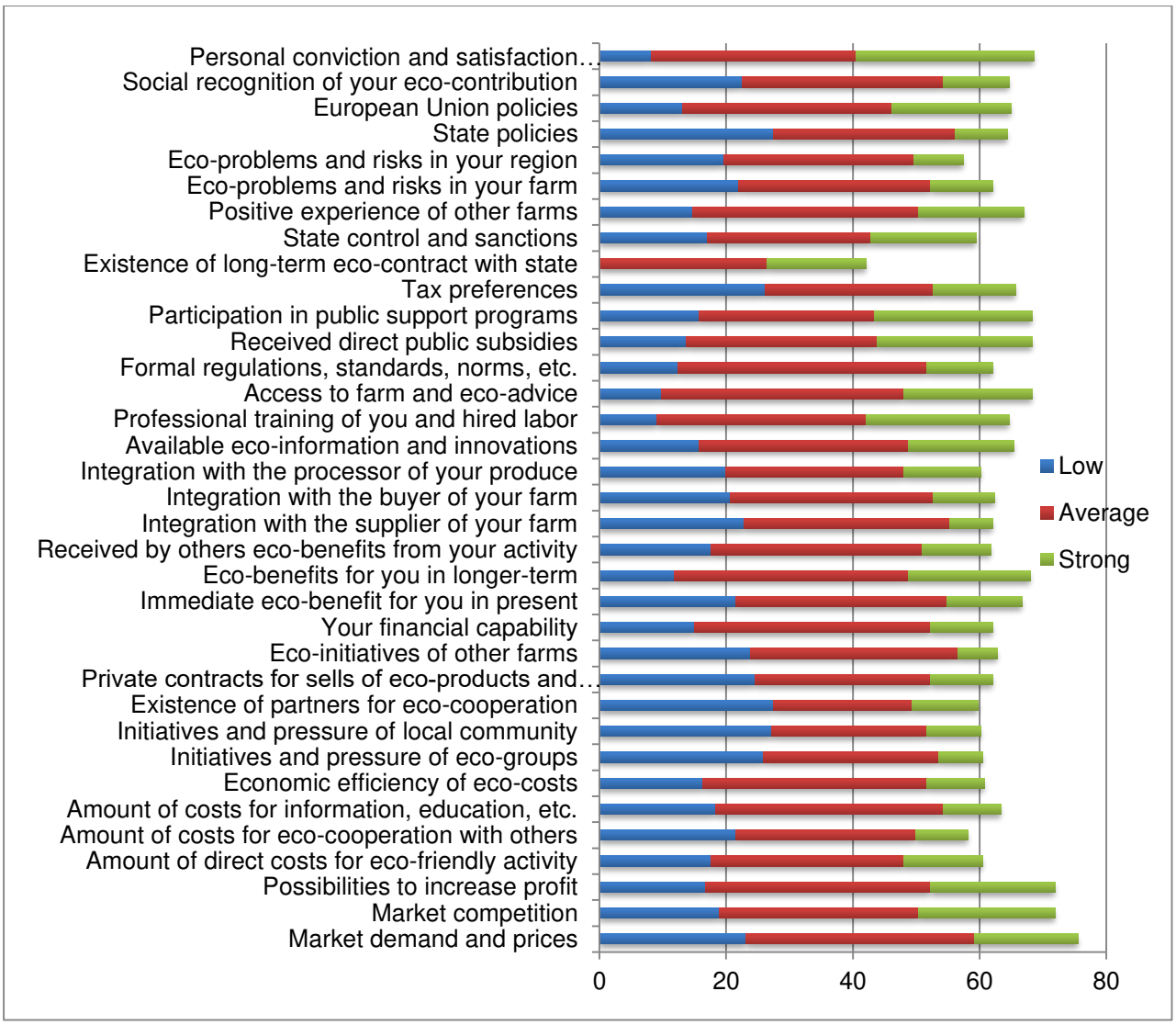
Factors for eco-management in agricultural farms

The different ideological, economical, market, public, etc. factors in various extent stimulate or restrict the activities of agricultural producers for the protection of natural environment.

To the greatest extent the eco-activity of a big part of the surveyed farms is stimulated by: the “personal conviction and satisfaction of farmers from the eco-activity” (28,1%), farm “participation in the public support programs” (24,8%), “received direct public subsidies” (24,5%), “professional eco-training of the farmer and the hired labor” (22,5%), “market competition” (21,6%), “access to the farm and eco-advices” (20,3%), “possibilities to increase profit” (19,6%), “eco-benefits for your farm in the longer-term” (19,3%), and “European Union policies” (18,9%) (Figure 39).

For the different type of farms there is a considerable variation in ranging of the factors, which stimulate their eco-activity.

Figure 39. Extent in which eco-activities of farms is stimulated by various factors (percent)



Source: survey with agricultural producers, May 2014

For instance, the eco-actions of the most Physical Persons to the greatest extend in stimulated by: the “personal conviction and satisfaction of the farmer from the eco-activity” (29%), “participation in the public support programs” (23,5%), “received direct public subsidies” (22,4%), “professional eco-training of the farmer and the hired labor” (21,6%), “access to the farm and eco-advices” (20,8%), “market competition” (20,5%), and “possibilities to increase profit” (20,5%).

The eco-actions of the majority of the Sole Traders to the greatest extent are stimulated by: the “participation in the public support programs” (50%), “professional eco-training of you and the hired labor” (45,4%), “received direct

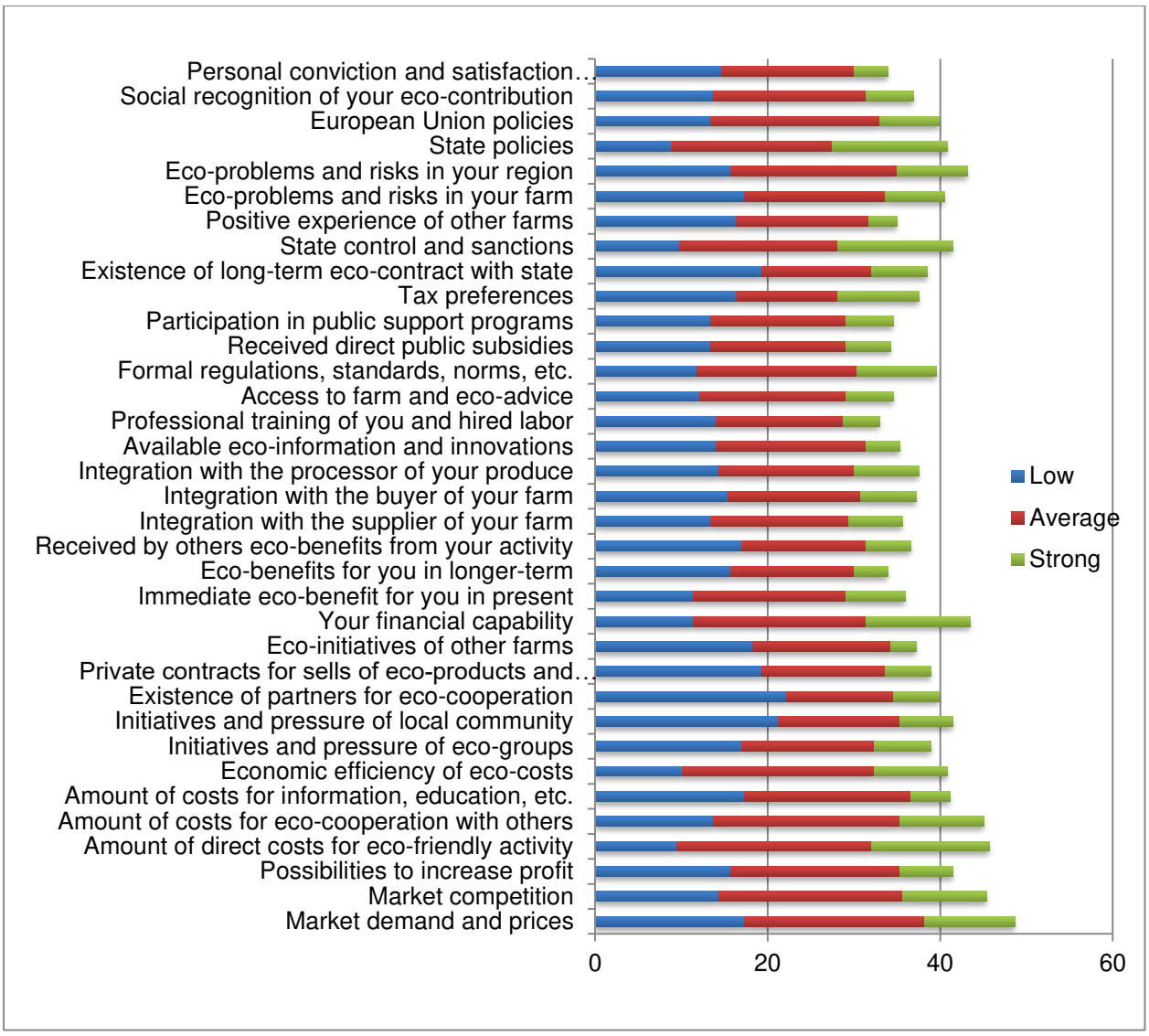
public subsidies" (36,4%), "integration with the processor of your produce" (31,8%), "personal conviction and satisfaction of the farmer from the eco-activity" (27,3%), "European Union policies" (27,3%), "possibilities to increase profit" (22,7%), "economic efficiency of eco-costs" (22,7%), "immediate eco-benefit for the farm in the present" (22,7%), "eco-benefit for the farm in the long run" (22,7%), "integration with the supplier of your farm" (22,7%), "available eco-information and innovations" (22,7%), and "tax preferences" (22,7%).

For the most Companies, Corporations, etc. the factors, which mostly stimulate the eco-actions are: the "received direct public subsidies" (47,1%), "market competition" (41,2%), "European Union policies" (41,2%), "state control and sanctions" (35,3%), "eco-benefit for the farm in the long run" (35,3%), "personal conviction and satisfaction from the eco-activity" (29,4%), "immediate eco-benefit for the farm in the present" (23,5%), "market demand and prices" (23,5%), "participation in the public support programs" (23,5%), "access to the farm and eco-advices" (23,5%), "financial capability of the farm" (23,5%), and "social recognition of the eco-contribution of your farm" (23,5%).

For the Cooperative farms there has not been reported factors strongly stimulating and restricting eco-activities, which are common for the majority of this type of holdings.

According to the biggest part of the surveyed farms their eco-activities to the greatest extent is restricted by the following factors: the "amount of direct costs for eco-friendly activity" (13.7%), "state control and sanctions" (13.4%), "state policies" (13.4%), "financial capability of the farm" (12.1%), "market demand and prices" (10.5%), "market competition" (9.8%), and "amount of costs for eco-cooperation with others" (9.8%) (Figure 40).

Figure 40. Extent in which eco-activity of farms is restricted by various factors (percent)



Source: survey with agricultural producers, May 2014

For the different type of farms the factors, which mostly restrict the eco-activity are quite specific.

The eco-actions of the biggest part of the Physical Persons to the greatest extend are restricted by: the “amount of direct costs for eco-friendly activity” (14,3%), “state control and sanctions” (14,3%), “state policies” (13.9%), “financial capability of the farm” (12,7%), “market competition” (10,4%), and “tax preferences” (10,4%).

For the most part of the Sole Traders the eco-activity to the greatest extent is restricted by: the “amount of direct costs for ecofriendly activity” (9,1%), “financial capability of the farm” (9,1%), “market competition” (9,1%).

For the most Companies, Corporations, etc. the dominant obstacles for the eco-activities are: the “amount of costs for eco-cooperation with others” (29,4%), “official regulations, standards, norms, etc.” (23,5%), “state policies” (23.5%), “amount of direct costs for ecofriendly activity” (17,6%), “immediate private eco-benefits in the present moment (17,6%), “private eco-benefit in the long run” (17,6%), “eco-benefits from your activity received by others” (17,6%), “access to the farm and eco-advices” (17,6%), “existence of a long-term contract with the state” (17,6%), “economic efficiency of eco-costs” (11,8%), “availability of partners for eco-cooperation” (11,8%), “financial capability of your farm” (11,8%), “integration with the processor of your produce” (11,8%), “available ecological information and innovations” (11,8%), “professional eco-training of the farmer and the hired labor” (11,8%), “state control and sanctions” (11,8%), “environmental problems and risks in your farm” (11,8%), and “tax preferences” (11,8%).

The identified above incentives and restrictions for the different type of agricultural farms are to be taken into account in the process of improvement of the public policies and programs for agro-ecology and eco-management.

The public support with diverse instruments of the EU CAP is an important factors for the improvement of eco-management of agricultural farms in the country.

For instance, the direct Area base payments are linked with the requirement to “keep farmland in good agronomical and ecological state”, the participation in the measures of the NPARD is associated with the compliance of the “good agricultural practices” (including appropriate protection of soils, waters, biodiversity, animal welfare, etc.), the involvement in the “environmental measures” of the NPARD aims at implementation of higher eco-standards in comparison to the good agricultural practices, etc.

What is more, the public intervention (subsidizing, zoning, mandatory eco-norms and standards, market support, etc.) leads to development of diverse bilateral, trilateral, hybrid, etc. forms of governance of the agrarian

sphere as well as of the eco-management in the sector. All they let improve the overall and the environmental protection capabilities of agricultural farms, and conserve, restore and/or improve natural resources through agricultural activity.

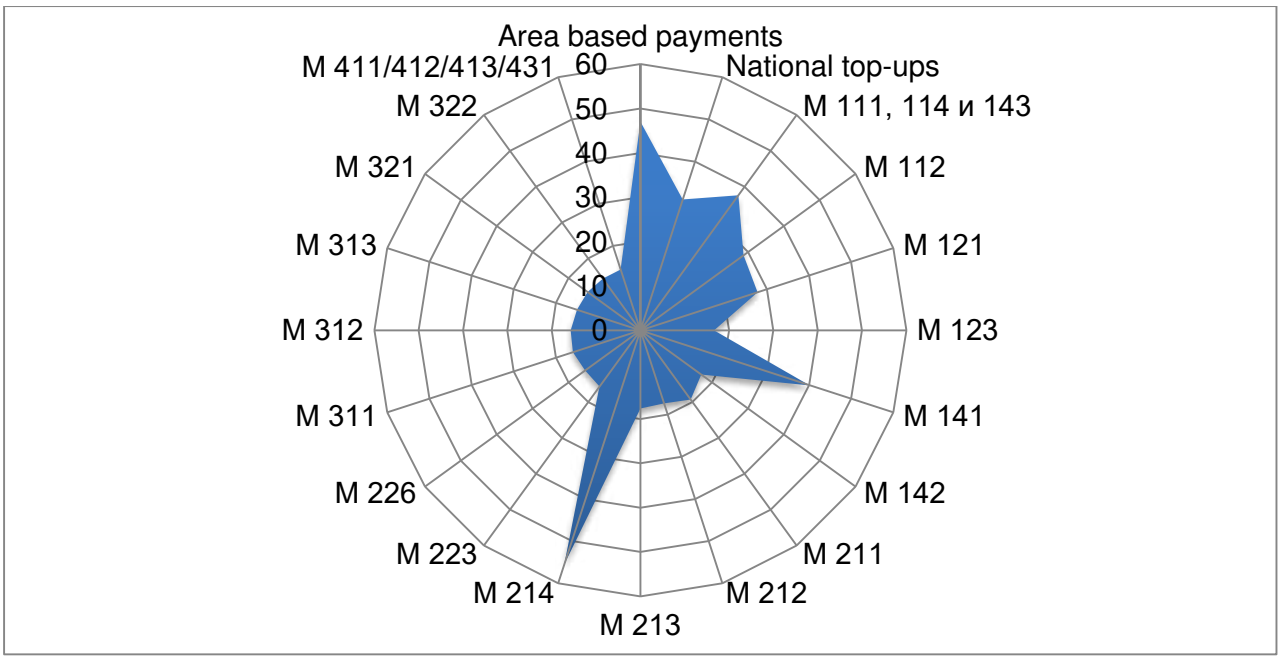
In particular, the public subsidies make “economically possible” the agricultural activity in “less-favored” regions and in protected zones and territories (national parks, reserves, NATURA 2000, etc.) supporting conservation of the soil fertility, natural biodiversity, services of (agro)eco-systems, etc.

The received public support by the surveyed farms (with “higher eco-activity”) is relatively higher than the average in the country for the farms of a similar type and location[39].

The most of the surveyed farms received in the past or are currently receiving support through Measure 214 “Agro-environmental payments” of the NPARD (55,6%), the Directs Area-based payments from the EU (46,7%), Measure 141 “Semi-subsistence farming” (40,2%) and Measures 111, 114 and 143 “Professional training and advise” (37,6%), the National tops-ups for products, livestock, etc. (31%), Measure 112 “Setting up of young farmers” (28,8%), and Measure 121 “Modernization of agricultural holdings” (27,8%) (Figure 41).

Figure 41. Share of farms supported with different instruments of EU CAP (percent)

[39] The assessment of the level and impact of the support of the agriculturl farms of different type in the country with individual instruments of the EU CAP is done Bachev *et al.* (2014).



Source: survey with agricultural producers, May 2014

For other Measures of the NPARD the shares of participating farms in the forms of direct public support in relatively small.

Nevertheless, comparing to the rest of the farms in the country, the "eco-active" farms take advantage to a greater extent from the "environmental measures" of the NPARD such as Measure 214 "Agro-environmental payments", Measure 211 "Natural handicap payments to farmers in mountain areas" (19,3%), Measure 212 "Payments to farmers in areas with handicaps, other than mountain areas" (17,3%), and Measure 213 "Payments for NATURA 2000 for farmlands" (17,6%).

The actual public support with the various mechanisms of the EU CAP to farms of different juridical type is quite different. For instance, a comparatively higher share of the Companies, Corporations, etc. have been taken advantage from the Area-based payments (70,6%), Agro-environmental payments (70,6%), and the National tops ups for products, livestock, etc. (47,1%) (Table 12).

On the other hand, the relative portions of the beneficiaries from the Measures 111, 114 и 143 "Professional training and advises" is higher for the

Sole Traders (40,9%) and the Physical Persons (39%), while of the Measure 141 “Semi-subsistence farming” for the Physical Persons (43,6%).

The surveyed Cooperatives are leaders only for the Measure 121 “Modernization of agricultural holdings” (37,5%), while their relative share is lower for the “area-based payments” and the “national tops ups” (12,5%), and Measures 112 “Setting up of young farmers” (12,5%), 213 “Payments for NATURA 2000 for farmlands” (12,5%) и 214 “Agri-environmental payments” (25%), and without beneficent for all other measures from the NPARD.

There is also a great differentiation in the support through various measures for the farms with different specialization, size and location.

For instance, to the biggest extent from the area-based payments have been taking advantage the farms specialized in mix crops-livestock (63,4%), in less favored regions different from the mountainous (63,6%), and those with lands in protected zones and territories (62,5%). Simultaneously, the relative portion of the beneficiaries from the direct area-based European subsidies for the farms specialized in mix livestock (24,1%), beekeeping (25%), vegetables na mushrooms (34,5%) is lower or zero (pigs, poultry and rabbits).

Table 12. Share of agricultural farms of different type and locations supported by individual instruments of EU CAP (percent)

Type of farms	Area based payments	Natio-nal tops ups	M 111, 114, 143	M 112	M 121	M 123	M 141	M 142	M 211
Physical Persons	46,3	30,9	39	30,5	26,2	17	43,6	17,8	20,5
Sole Traders	36,4	22,7	40,9	22,7	36,4	18,2	31,8	13,6	13,7

Cooperatives	12,5	12,5	0	12,5	37,5	0	0	0	0
Companies, Corporations, etc.	70,6	47,1	29,4	17,6	35,3	17,6	17,6	17,6	17,6
Field crops	50								18,1
Vegetables, mushrooms	34,5								27,6
Permanent crops	50								19,4
Grazing livestock	50								12,5
Pigs, poultries and rabbits	0								0
Mix crops	47,8								17,4
Mix livestock	24,1								17,2
Mix crop-livestock	63,4								22
Beekeeping	25								0
Mainly subsistence	52,5								37,5
Small for industry	49,3								16,9
Middle size	41,7								16,7
Big size for industry	46,								7,7
Mainly plain	46,2								14,5
Plain-mountainous	49,3								22,1
Mainly mountainous	51								36
With lands in protected zones and territories	62,5								56,2
Less-favored mountainous regions	40								40
Less-favored non-mountainous region	63,6								27,3
North-west region	56,5	34,8	39,1	39,1	34,8	26,1	52,2	30,4	30,4
North-central region	46,9	34,4	40,6	25	20,3	14,1	40,6	12,5	10,1
North-east region	53,1	30,6	36,7	18,4	24,5	10,2	46,9	10,2	10,2
South-west region	40	32	52	40	32	32	28	32	32
South-central region	52,6	42,1	47,4	34,2	34,2	18,4	36,8	18,4	21
South-east region	48,7	41	36	33,3	38,5	23,1	41	25,6	33,3

Table 12 (continues)

Type of farms	**M 212**	**M 213**	**M 214**	**M 223**	**M 226**	**M 311**	**M 312**	**M 313**	**M 321**	**M 322**	**M 411, 412, 413, 431**
Physical Person	17,8	18,1	56,4	16,2	15,8	16,2	16,2	15,4	15	15	15
Sole Traders	13,6	13,6	40,9	13,6	13,6	18,2	13,6	13,6	13,6	13,6	13,6

Cooperatives	0	12,5	25	0	0	0	0	0	0	0	0
Companies, Cor	23,5	17,6	70,6	17,6	17,6	17,6	17,6	17,6	17,6	11,8	11,8
Field crops			66,7								
Vegetables, mu			34,5								
Permanent crop			53,1								
Grazing livestoc			37,5								
Pigs, poultries			0								
Mix crops			47,8								
Mix livestock			62,1								
Mix crop-livesto			63,4								
Beekeeping			50								
Subsistence			57,5								
Small size			55,9								
Middle size			53,7								
Big size			61,5								
Mainly plain			53,8								
Plain-mountaino			61								
Mountainous			48								
Protected zones			75								
Less-favored mountainous			60								
Less-favored non-mountainou			63,6								
North-west regio	26,1	30,4	60,9	26,1	21,7	21,7	21,7	21,7	21,7	21,7	21,7
North-central	12,5	17,2	57,8	12,5	12,5	12,5	14,1	12,5	12,5	10,9	10,9
North-east regio	10,2	10,2	55,1	10,2	10,2	10,2	10,2	10,2	10,2	10,2	10,2
South-west regi	24	32	44	24	24	28	24	24	24	24	24
South-central region	23,7	21	52,6	18,4	18,4	15,8	18,4	15,8	15,8	15,8	15,8
South-east region	28,2	20,5	66,7	23,1	25,6	28,2	25,6	23,1	23,1	23,1	23,1

Source: survey with agricultural producers, May 2014

Likely wise, comparatively the biggest share of the beneficiaries of the "agro-environmental payments" are among the Physical Persons (56,4%), large-scale farms (61,5%) and those with lands in protected zones and territories (75%), and farms specialized in field crops (66,7%), mix crops-livestock production (63,4%), and mix livestock production (62,1%). At the

same time, a relatively smaller-share of farms specialized in vegetables and mushrooms (34,5%) and grazing livestock (37,5%), and none in these in pigs, poultry and rabbits have received this type of subsidy.

In another main eco-measure “Natural handicap payments to farmers in mountain areas” the greatest share of the beneficiaries are among the Physical Persons (20,5%), farms specialized in vegetables and mushrooms (27,6%), predominantly subsistence holdings (37,5%), farms with lands in protected zones and territories (56,2%) and located in less-favored mountainous regions (40%). Simultaneously none of the farms specialized in pigs, poultry and rabbits, and beekeeping, and relatively a smaller portion of the farms in grazing livestock (12,2%) and large size (7,7%) have got this type of payments.

There is also a great variation in the support by the individual measures in different regions of the country. For example, the relative share of the beneficiaries of the Area-base payments in the North-West and the North-East regions are higher that in the other regions of the country – accordingly 56,5% and 53,1% of the surveyed farms. On the other hand, the beneficiaries of the National tops ups from the South-Central and the South-East regions are relatively more than in the other regions of the country – accordingly 42,1% и 41% of the farms.

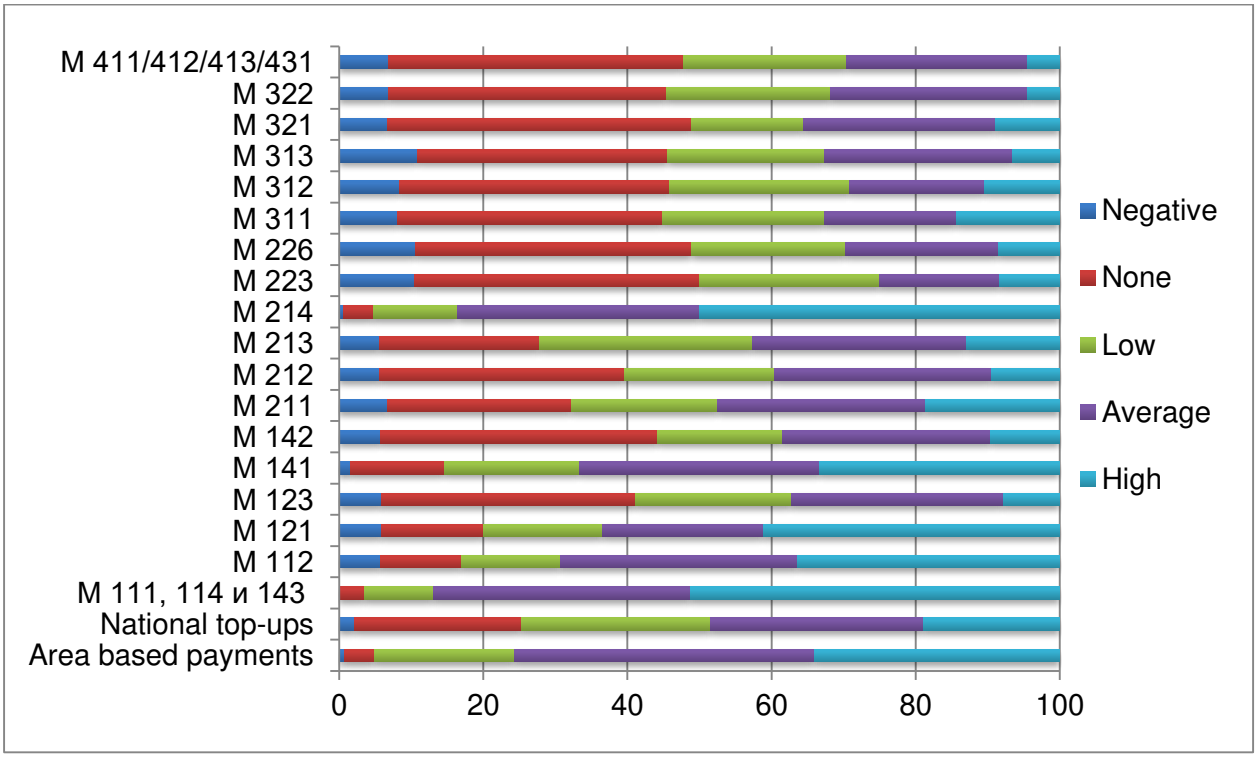
Likely wise, the North-West region, South-West region and South-East region are among the leaders regarding the numbers of supported farms by majority of the NPARD measures, including the special “eco-measures”. For instance, the biggest share of farms with “Agro-environmental payments” and “Natural handicap payments to farmers in mountain areas” are in the South-East (66,7% and 33,3% correspondingly) and the North-West (60,9% and 30,4% correspondingly) regions.

On the other hand, the North-East and the South-Central regions are among the leaders only for one of the measures (accordingly Measure 141

and Measures 111, 114 и 143), while the North-Central region for none of the public support instruments.

The individual mechanisms for support of the EU CAP impact unequally the agricultural farms, which received or are receiving public support (Figure 42).

Figure 42. Scale of impact on supported farms of different instruments of EU CAP (percent)



Source: survey with agricultural producers, May 2014

According to the majority of surveyed farms, the biggest ("average" or "strong") impact on their farms have been caused by the Measures 111, 114 и 143 "Professional training and advices" (86,9%), Measure 214 "Agro-environmental payments" (83,5%), "Direct Area-based subsidies by the EU" (75,7%), Measure 112 "Setting up of young farmers" (69,3%), Measure 141 "Semi-subsistence farming" (66,7%), Measure 121 "Modernization of agricultural holdings" (63,5%), "National tops ups for products, livestock, etc."

(48,4 %) and Measure 211 “Natural handicap payments to farmers in mountain areas” (47,4%).

The impact of the remaining instruments of the CAP on the greatest part of the surveyed beneficiaries is “low” or “none”.

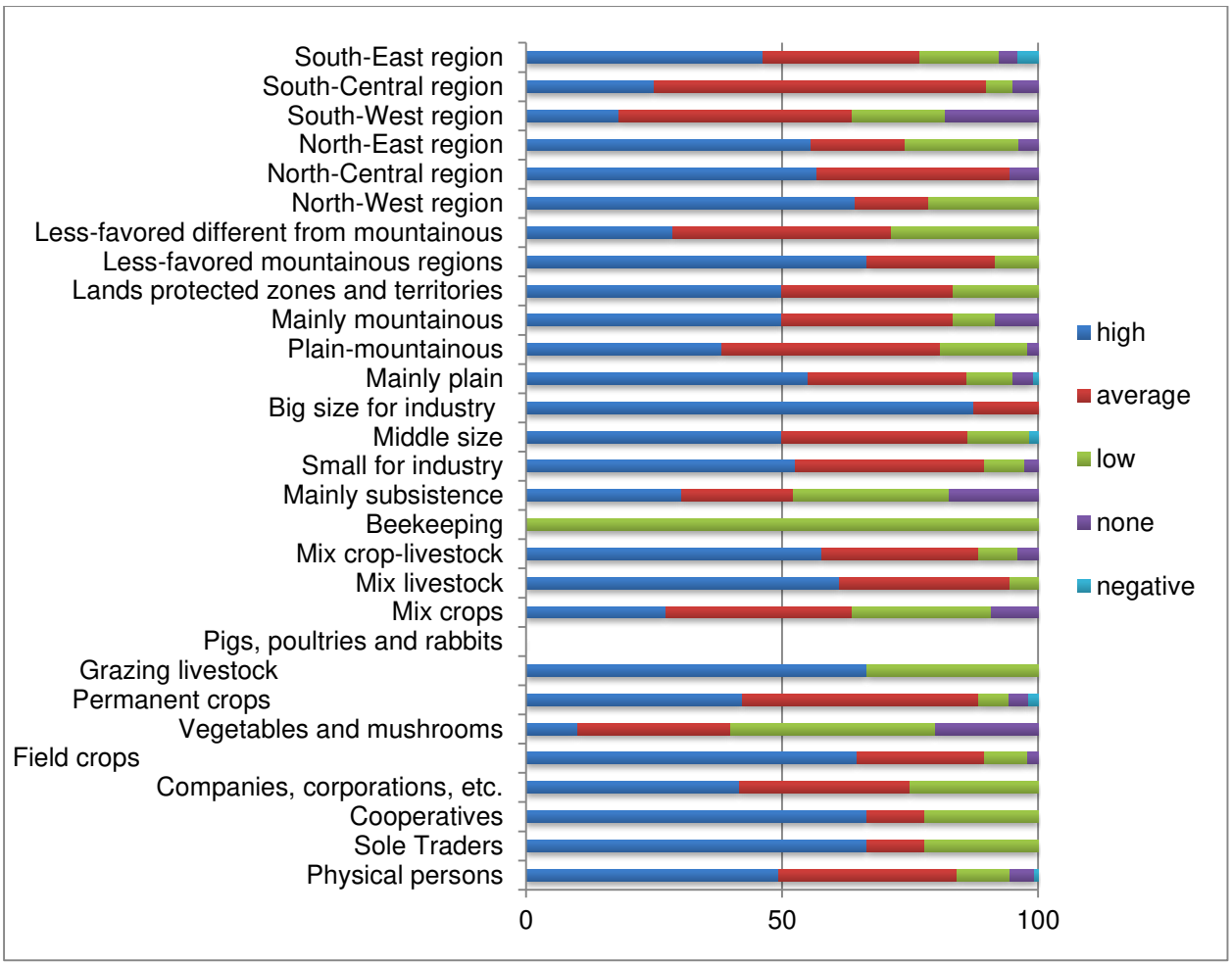
What is more, a part of the farms evaluate the impact of the public support instruments on their holdings as “negative”. The later concerns more than 10% of the beneficiaries from the Measure 223 “First afforestation of non-agricultural land”, Measure 226 “Restoring forestry potential and introducing prevention actions”, and Measure 313 “Encouragement of tourism activities”.

The impacts of the eco-measures of the NPARD on surveyed farms of different type and location is dissimilar.

For instance, for the two-third of the Sole Traders and the Cooperatives, supported in the past or currently with the Measure 214 “Agro-environmental payments”, the impact of that instrument on their farms is “strong” (Figure 43). Likewise, that measure effect is strong on the majority of farms specialized in the fields crops (64,6%), grazing livestock (66,7%), mix livestock production (61,1%), mix crop-livestock production (57,7%), the large scale farms (87,5%), and the farms located in less-favored mountainous regions (66,7%) and the North parts of the country (correspondingly for the North-West region - 64.3%, the North-Central region - 56.8%, and the North-East region - 55.6%).

For the remaining fractions of the farms the impact of the agro-environmental payments is with lower significance. Moreover, according to one fifth of the supported farms in vegetables and mushrooms, and a good portion of predominately subsistence farms (17,4%), as well as farms situated in the South-West region of the country (18,2%) these type of payments has got no impact at all.

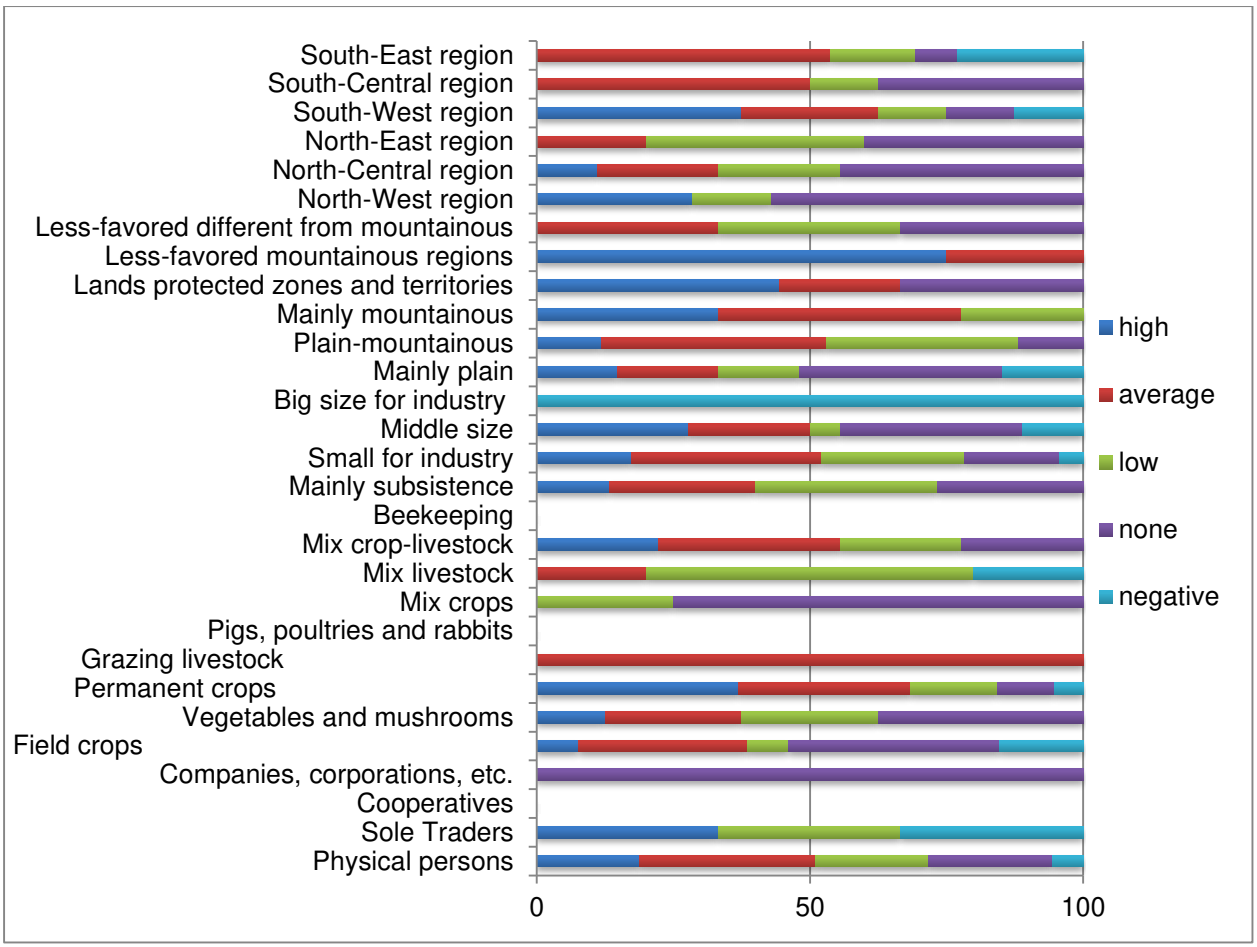
Figure 43. Impact of measure 212 “Agro-environmental payments” of NPARD on supported farms of different type and location (percent)



Source: survey with agricultural producers, May 2014

Similarly, according to the bulk of the supported farms in the less-favored mountainous regions (75%), those with lands in the protected zones and territories (44,4%), the Sole Traders (33,3%), the farms specialized in permanent crops (36,8%), and the holdings located in the South-West region of the country (37,5%), the impact of the Measure 211 “Natural handicap payments to farmers in mountain areas” on their farms in “strong” (Figure 44).

Figure 44. Impact of measure 211 “Natural handicap payments to farmers in mountain areas” of NPARD on supported farms (percent)



Source: survey with agricultural producers, May 2014

Nevertheless, for the greatest part of the farms, the impact of these type of payments is “neutral”, including for all of the supported Companies, Corporation, etc., a three-quarters of the specialized in mix crops production, 38,5% of the farms in field crops and 37,5% in vegetables and mushrooms, 37,4% of the holdings located in plain regions, a third of farms with middle sizes, with lands in protected zones and territories, and in less-favored regions different from the mountainous, 26,7% of the predominately subsistence farms, 22,6% of the Physical Persons, 22,2% of the mix crops-livestock holdings, and a considerable portion of the beneficiaries in the North-West (57%), North-Central (44,4%), North-East (40%) and South-Central (37,5%) regions of the country.

Furthermore, for a significant part of the beneficiaries the effect of that type of support on their farms is “negative”, including for all large-scale

holdings, one-third of the Sole Traders, 23,1% of the farms in the South-East region of the country, each fifth of the farms with mix livestock production, and 15,4% of the farms specialized in field crops.

Therefore, the accrual and likely effects of the different instruments of public support on the diverse type of agricultural holdings is to be taken into account in the process of the improvement and the design of support measures during the next programing period.

Efficiency and perspectives of eco-management in farms

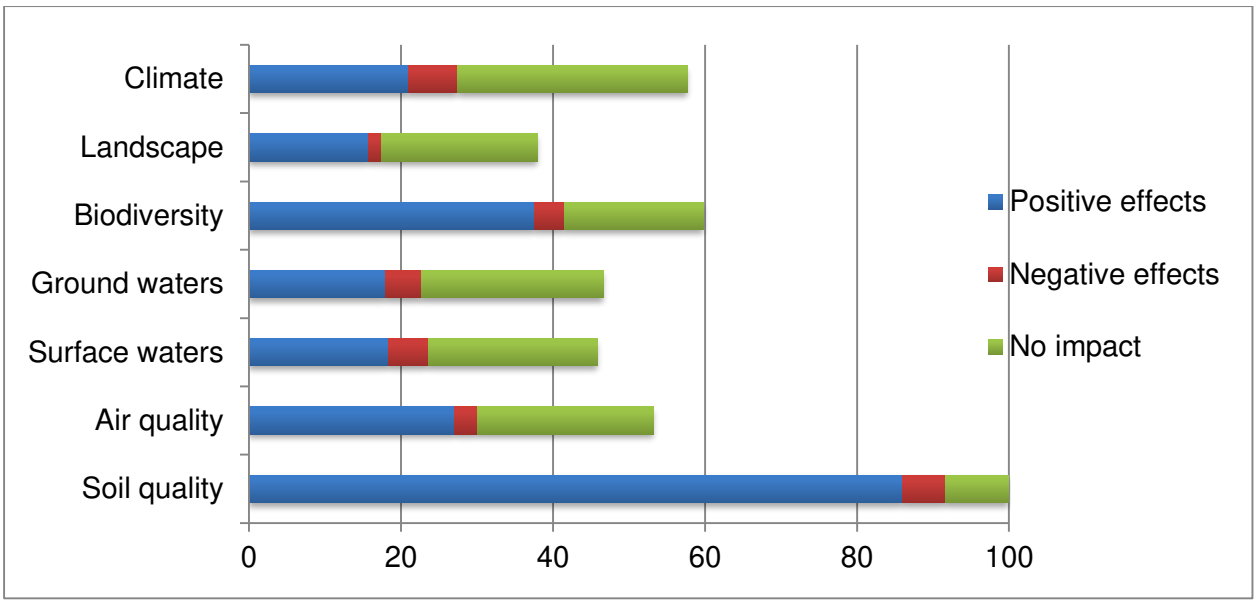
Specific impact on individual components of environment

Diverse activities of the agricultural farms is associated with positive, negative or neutral impacts on the different components of the natural environment (soils, waters, air, biodiversity, climate, etc.).

According to the majority of respondents to that question[40], the crop production activity of their farms is associated with “positive effects on soils quality” (86%) (Figure 45). A good part of the surveyed farms also believe that their crop production activity is associated with positive effects in terms of biodiversity (37,5%), air quality (27,1%), climate (21%), surface (18,3%) and ground (17,9%) waters, and landscape (15,7%).

Figure 45. Impact of the crop activity of agricultural farms on individual components of natural environment (percent)

[40] 74,8% of surveyed farms and 87,1% of the surveyed farms with crop specialisations.



Source: survey with agricultural producers, May 2014

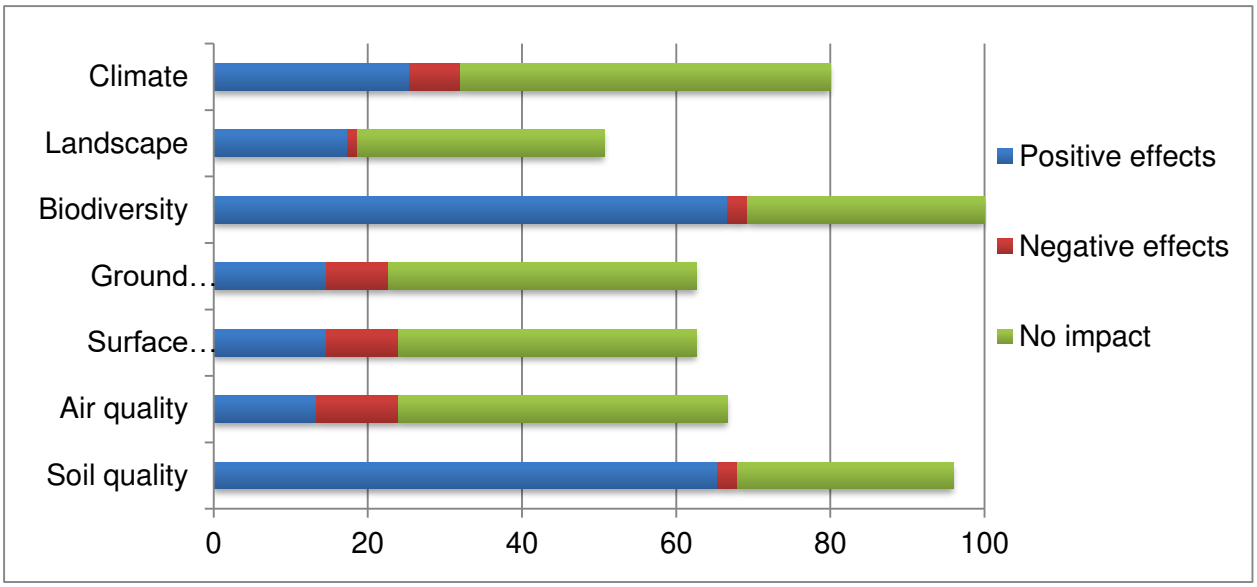
In addition, the majority of respondents believe that, their crop production activity does not affect the climate (30,1%), ground (24%) and surface (22,3%) waters, and landscape (20,5%).

Furthermore, a relatively small portion of the farms thinks that their crop production activity is associated with "negative effects" in relation to the different elements of the natural environment. The greatest is the share of the farms, which believe that their crop activity affects negatively the climate (6,5%), soils quality (5,7%), and surface waters (5,2%).

According to the most of the respondents[41], the livestock activity of their farms is associated with positive effects for biodiversity (66,7%) and soils quality (65,3%) (Figure 46). A good portion of the holdings also believe that this type of activity is associated with positive effects in relation to the climate (25,3%), landscape (17,3%), surface and ground waters (14,7%), and air quality (13,3%).

[41] 24,5% of surveyed farms and 88,2% of the surveyed farms with livestock specialisations.

Figure 46. Impact of the livestock activity of agricultural farms on individual components of natural environment (percent)



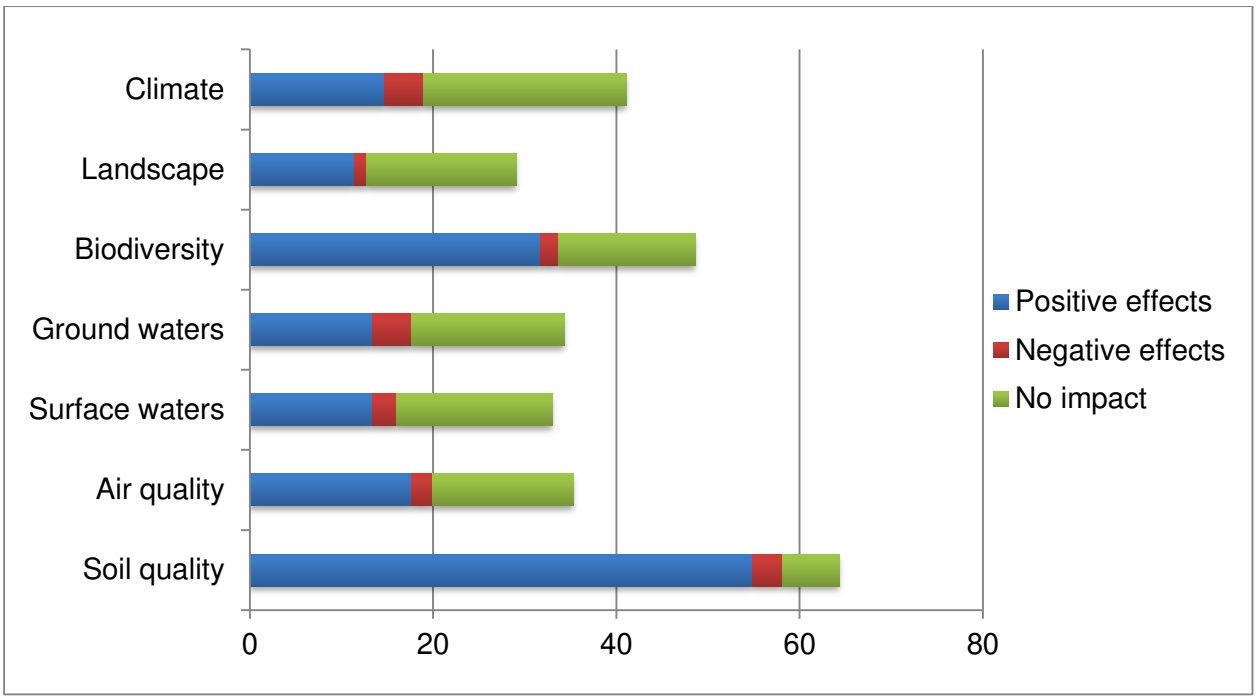
Source: survey with agricultural producers, May 2014

The majority of farms also suggest that their livestock activity does not affect the climate (48%), air quality (42,7%), ground (40%) and surface (38,7%) waters, and landscape (32%).

However, a relatively big share of the holdings believes that their livestock activity is associated with "negative effects" in terms of air quality (10,7%), surface waters (9,3%), ground waters (8%), and climate (6,7%).

According to a good part of surveyed farms, the overall activity of their farms is associated with positive effects in relation to soils quality (54,9%) and biodiversity (31,7%) (Figure 47). Also not so small fraction of the farmers believe that their activity has positive effects for the air quality (17,6%), climate (14,7%), surface and ground waters (13,4%), and landscape (11,4%).

Figure 47. Impact of the overall activity of agricultural farms on individual components of natural environment (percent)



Source: survey with agricultural producers, May 2014

Finally, the majority of the respondent farms to that question[42] also think that their overall activity does not affect the climate, surface and ground waters, landscape and air quality – accordingly 22,2%, 17%, 16,7, 16,3 and 15,4% of the surveyed holdings.

Only a small fraction of the surveyed farms believes that their overall activity is associated with negative effects related to the natural environment, and these is mostly true for the negative impact on climate and ground waters (4,2%).

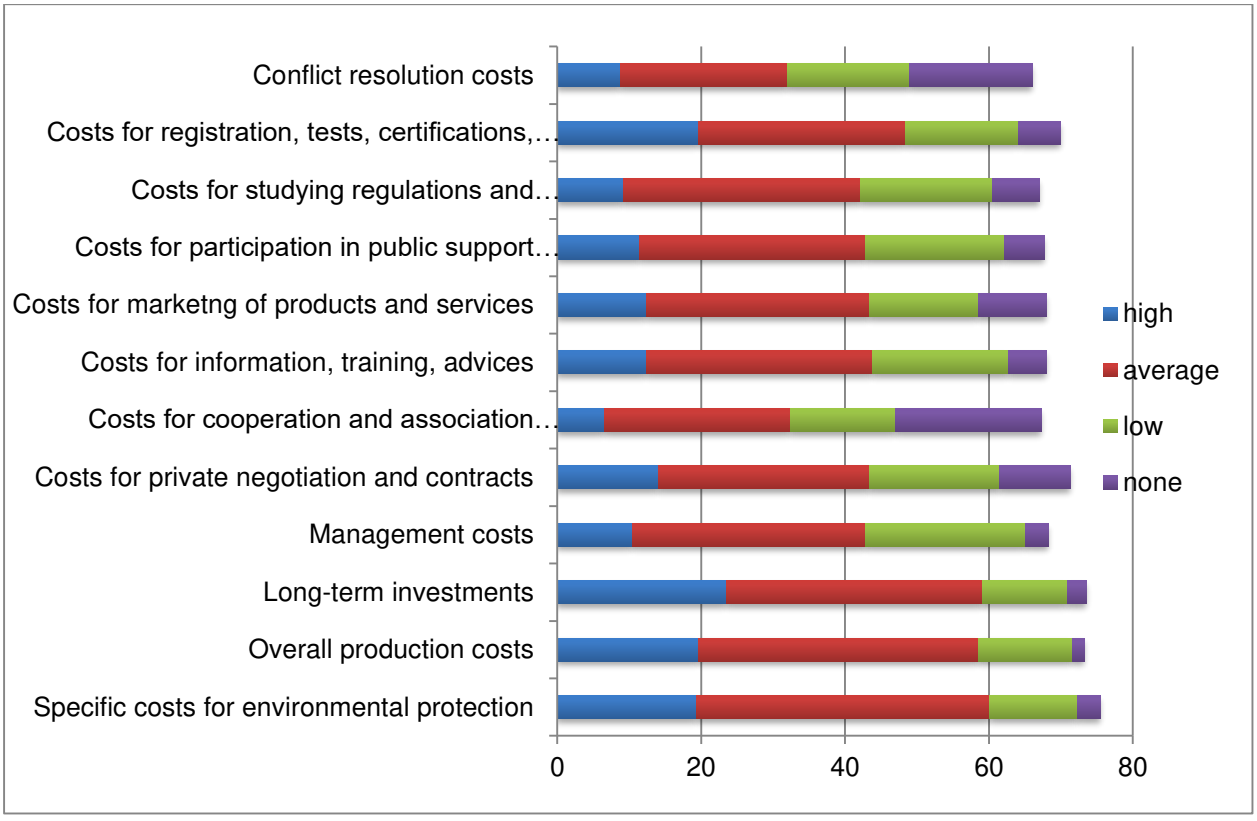
Costs and efficiency of environmental activity of farms

[42] 64,4% of all surveyed farms.

The eco-management in the agricultural farms is associated with inevitable augmentation of the production and the transaction costs of different type.

For a big part of the surveyed farms their natural environment protection activity is connected with a “high” augmentation of long-term investments (23,5%), overall production costs (19,6%), expenditures for registration, tests, certification, etc. (19,6%), and specialized costs for the conservation of natural environment (19,3%) (Figure 48).

Figure 48. Extent of augmentation of costs of agricultural farms associated with environmental protection activity (percent)



Source: survey with agricultural producers, May 2014

Also for the majority of farms, their eco-management is associated with “average” growth in the specialized costs for the protection of natural environment (40,8%), the overall production costs (38,9%), long-term

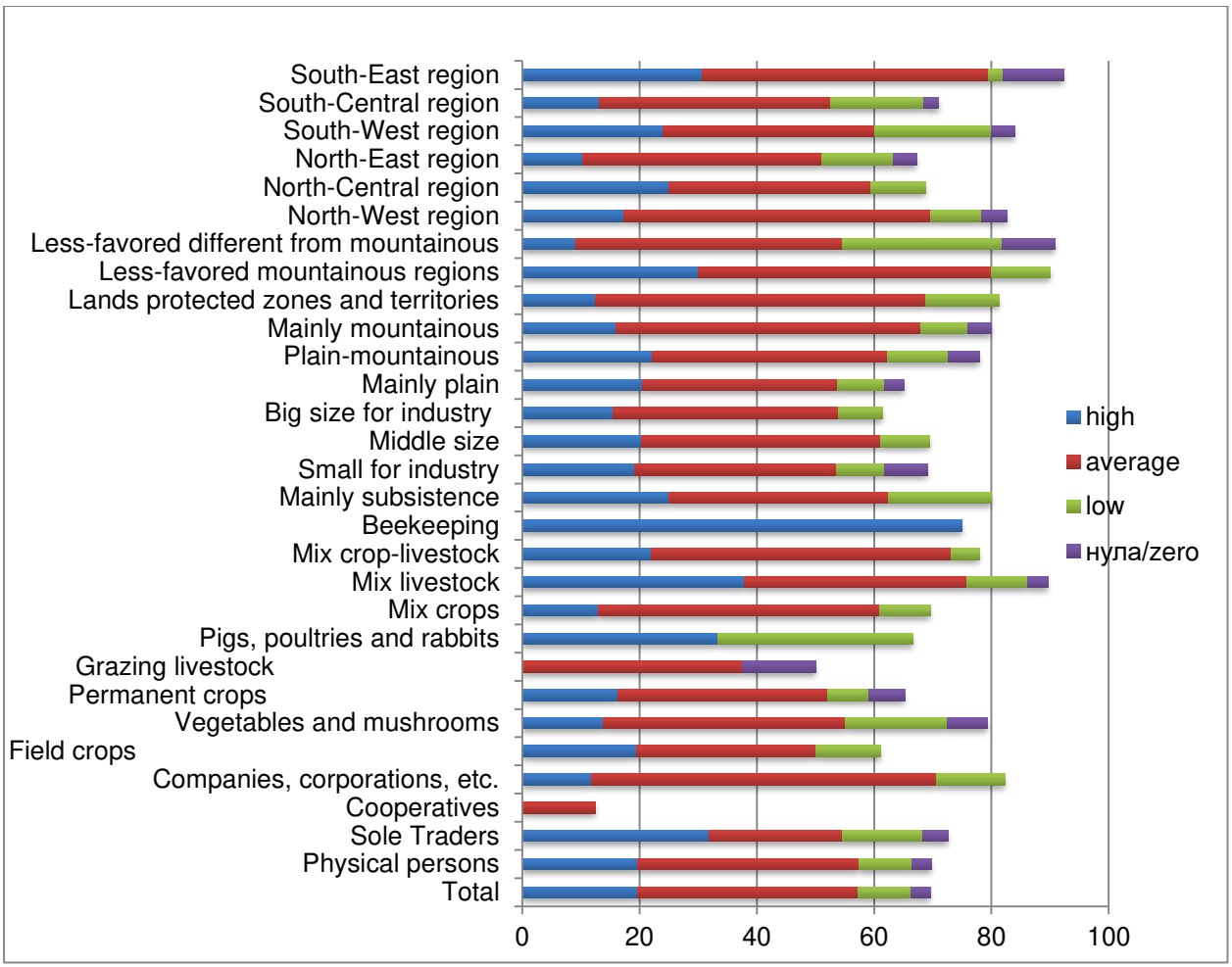
investments (35,6%), costs for studying the official regulations and standards (33%), the overall management costs (32,3%), costs for acquiring information, training, and consultations (31,37%), costs for marketing of products and services (31%), costs for participation in the programs for public support (31,4%), costs for private negotiations and contracts (29,8%), costs for registrations tests, certifications, etc. (28,8%), costs for cooperation with others (25,8%), and the costs for resolutions of disputes and conflicts (23,2%).

According to the predominate portion of the surveyed farms, their natural environment protection activity is also associated with the augmentation of farm economic efficiency, as for around one fifth of them that is to a “great” extent, for 37,8% in “average” extent, and for 9,1% of holdings in “insignificant” extent (Figure 49).

To the greatest extent the eco-activity of farms leads to increasing the economic efficiency for the Sole Traders (31,8%), the farms specialized in beekeeping (75%), mix livestock production (37,9%), and pigs, poultry and rabbits (33,3%), and the holdings located in less-favored mountainous regions (30%), and in the South-East (30,8%), North-Central (25%) and South-West (24%) regions of the country.

At the same time, for a relatively greater portion of the farms specialized in grazing livestock (12,5%) and permanent crops (6,1%), the holdings with smaller size for the industry (7,3%), and those located in less-favored regions different from the mountainous, and in the South-East region of the country (10,3%), the eco-activity is not connected with any positive change in the economic efficiency.

Figure 49. Share of farms in which environmental protection activity is associated with increasing of economic efficiency (percent)

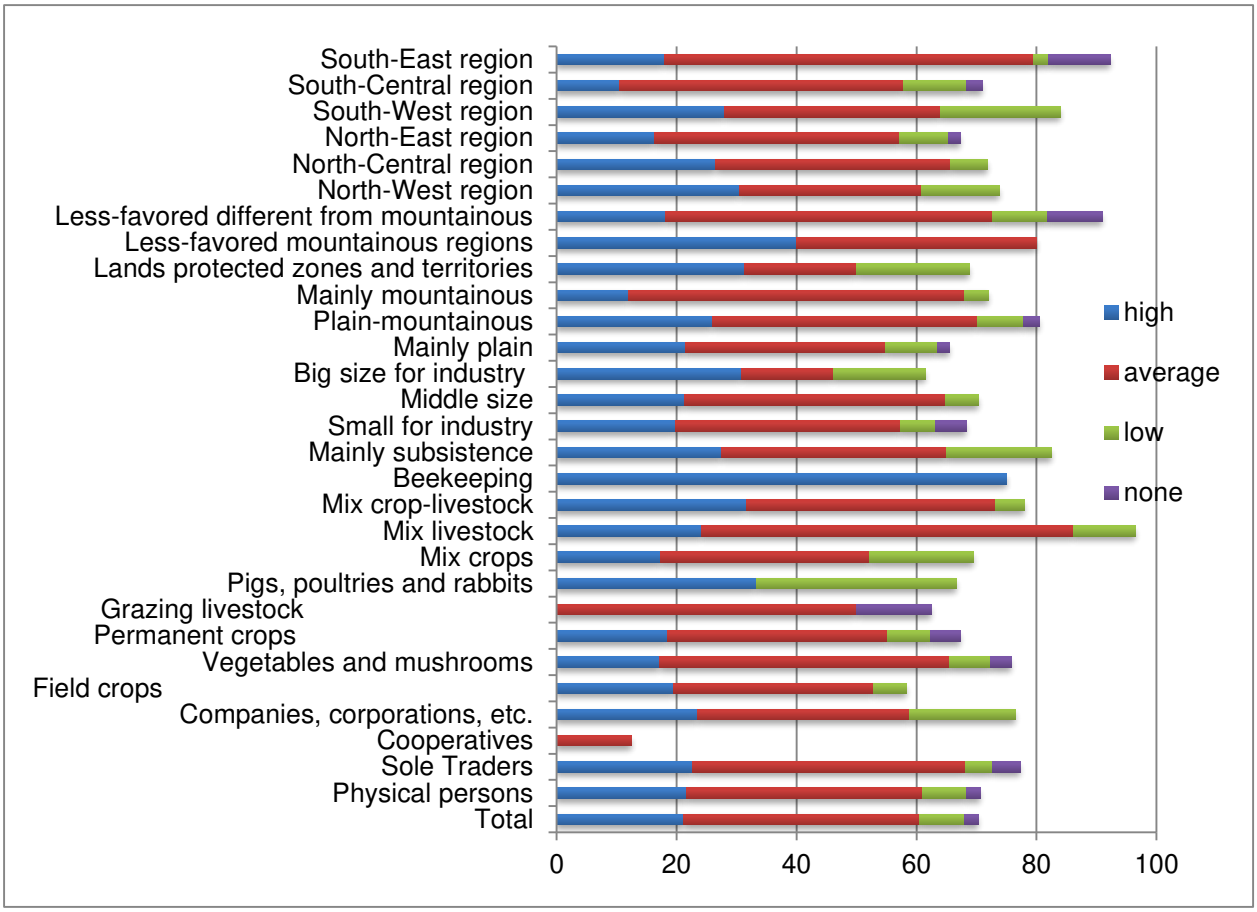


Source: survey with agricultural producers, May 2014

According to the majority of surveyed farms, their natural environment protection activity is also associated with the augmentation of ecological efficiency of the farm, as for 21,2% of them that is in a “high” extent, for 39,2% in “average” extent, and for 7,5% in “small” extent (Figure 50).

The eco-activity of farms leads to increasing in farm ecological efficiency for a relatively biggest portion of the farms specialized in beekeeping (75%), pigs, poultry and rabbits (33,3%), and mix crops-livestock production (31,7%), large-scale holdings (30,8%), and the farms located in less-favored mountainous regions (40%), those with lands in protected zones and territories (31,2%), and the farms in the North-East (30,4%) and the South-West (28%) regions of the country.

Figure 50. Share of farms, in which environmental protection activity is associated with increase in ecological efficiency (percent)



Source: survey with agricultural producers, May 2014

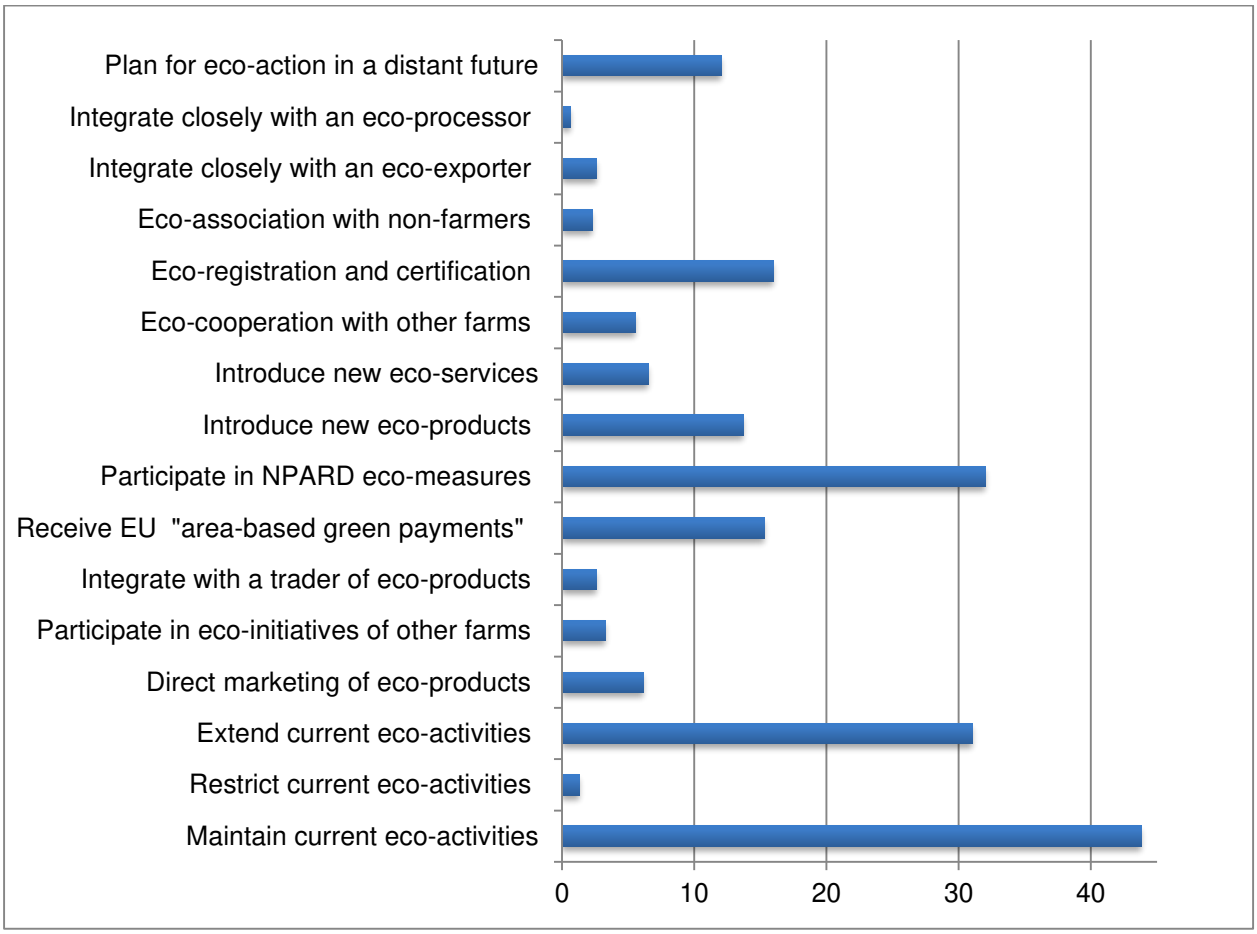
On the other hand, for a good fraction of the holdings specialized in grazing livestock (12,5%), those located in less-favored mountainous regions (9,1%) and with a small size for the industry (5,1%), the eco-activity is not connected with any change in the ecological efficiency.

Perspectives of eco-management in farms

The eco-active farms are with various plans (intentions) for the eco-management in near future.

The greatest part of the surveyed farms (43,8%) does not foresee any change in their eco-activity in the near future (Figure 51). However, a considerable fraction of them (31%) are having intentions to “expend the current eco-activities”. At the same time, the share of farms, which are planning to restrict their current eco-activity is insignificant (1,3%).

Figure 51. Share of farms with different intentions associated with natural environment protection in near future (percent)



Source: survey with agricultural producers, May 2014

In near future, a relatively great number of farmers are having intentions to “participate in the agro-environmental measures of the NPARD” (32%), for

“eco-registration and certification” (16%), for “receiving the “area-based green payments’ from the EU” (13,7%), and for “introduction of new eco-products” (13,7%).

Also a good portion of the farms are planning to “introduce new eco-services” (6,5%), “direct marketing of eco-products” (6,2%), and “participate in eco-cooperation with other farms” (5,5%).

Furthermore, a relatively smaller fraction of the surveyed farms intend to “participate in eco-initiatives of other farms” (3,3%), “integrate closely with a trader of eco-products” (2,6%), “integrate closely with an eco-exporter” (2,6%), “participate in eco-association with non-farmers” (2,3%), and “integrate closely with an eco-processor” (0,6%).

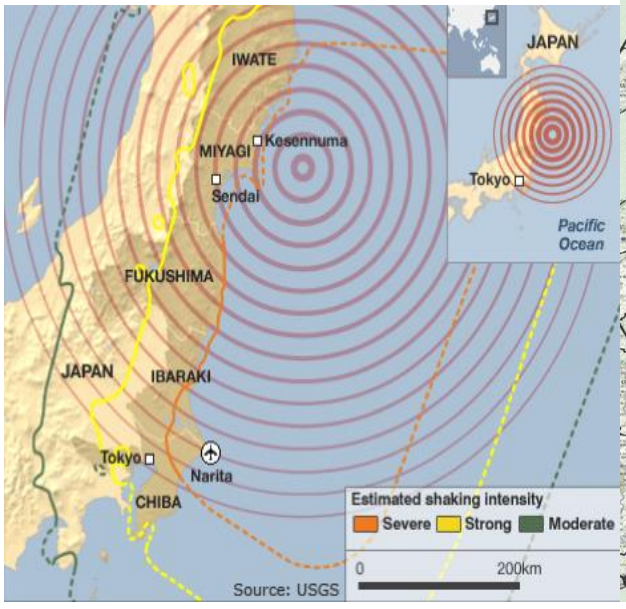
Besides, a considerable share of the farms (12,1%) indicates having a “plan for eco-actions in a more distant future”.

Part 4. Restoration and adaptation of Japanese agriculture after 2011 Great East Japan Earthquake

March 2011 triple disaster

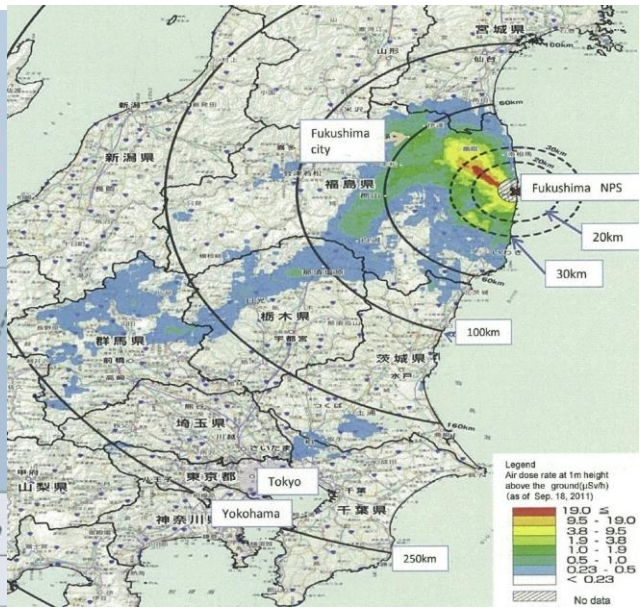
On March 11, 2011 the Great East Japan Earthquake occurred affecting a large areas of Northeastern parts of the country (Map 2). It was the strongest ever-recorded in Japan with a magnitude of 9.0 Mw [JMA]. It triggered a powerful tsunami [43] which cased huge destruction and inundated approximately 561 km^2 or 4.53% of the total territories of the six affected prefectures [GIAJ].

Map 2. Areas affected by March 11, 2011 earthquake in Japan



Source: U.S. Geological Survey

Map 3. Radioactive pollution caused by Fukushima accident (Sept. 2011)



Source: Ministry of Environment, 2014

[43] According to estimates an extensive coastal area surpassing 400 km was hit by tsunami higher than 10 m that submerged plane areas more than 5 km inland [Mori et al.].

What is more, the earthquake and tsunami caused a nuclear accident in one of the world's largest nuclear plant (Fukushima Daichi Nuclear Plant Station) where level 7 meltdowns occurred leading to releases of huge radioactivity into the environment[44] [NISA]. The radioactive contamination has spread in the region and beyond though air, rains, dust, water circulations, wildlife, garbage disposals, transportation, and affected soils, waters, plants, animals, agri-food products, infrastructure, and population (Map 3).

The triple disasters have caused huge destructions of soils, landscape, natural flora and fauna, and entire ecosystems, which all are hardly to be complete evaluated [Kontar et al.; ME; NASA; Urabe et al.; UNSCEAR; WWF]. Large land areas have been damaged by the seawaters, salinity, radiation and other pollutants, and become unsuitable for farming, living, and natural habitats. Unknown number of wildlife have been killed, injured or displaced and many farm households have been distracted, lost their livelihood, or displaced.

There have been numerous studies on diverse impacts of the 2011 disasters on the Japanese agriculture [Furutani et al.; JA-ZENCHU; Johnson; MAFF; Koyama; Pushpalal; Sekizawa; Murayama; MHLW; Nakanishi and Tanoi; Ujiie; Watanabe A.; Watanabe N.; WHO; Yonekura].

Nevertheless, due to the scale of the disasters and affected agents, effects' multiplicities, spillovers, and a long time horizon, the lack of "full" information and models of analysis, the overall impacts of the 2011 disasters on Japanese agriculture is far from being completely evaluated.

[44] According to the May 2012 nuclear power plant's estimates the cumulative radiation releases amounts 538.1 PBq of iodine-131, caesium-134 and caesium-137, out of which 520 PBq was released into the atmosphere between 12–31 March 2011 and 18.1 PBq into the ocean from 26 March – 30 September 2011 [TEPCO]. Since the accident there have been continued spills of contaminated water at the plant grounds and into the sea [TEPCO].

Impacts on farms, farm resources, and agricultural products

Damages to farms

The earthquake, tsunami and the nuclear accident have caused immense damages to agricultural sector. A great number of farmers and farm households has been injured, killed or displaced. Huge amount of farmlands were washed away or flooded by the tsunami as well as considerably salinated by the seawaters. Enormous agricultural and related properties, livestock, and infrastructure have been badly damaged or destroyed. In addition, large areas of farmland have been contaminated, and many livestock, crops and other products destroyed or devaluated due to the Fukushima nuclear disaster.

The total number of damaged Agricultural Management Entities of different type (private farms, corporate entities, cooperatives, local public bodies, etc.) reached 37,700 or around 16% of all Agricultural Management Entities in the affected eight prefectures (Table 13).

The greatest part of damaged farms (45.6%) was in Fukushima prefectures where more than a third of farms were hurt by the earthquake, tsunami, or nuclear accident. Tsunami affected adversely almost 5% of all farms of the six coastal prefectures. Tsunami damaged Agricultural Management Entities account for about 27% of the damaged by the disasters entities and the majority of the tsunami-damaged farms are located in Miyagi (59.4%) and Fukushima (26.9%) prefectures.

Table 13. Number of damaged Agricultural Management Entities by 2011 earthquake in Japan (March 11, 2012)

Prefectures	Total number of Agricultural management entities*	Damaged agricultural entities		Entities damaged by tsunami	
		Number	Share, %	Number	Share, %
Aomori	3,733	180	4.8	170	4.6
Iwate	35,321	7,700	21.8	480	1.4
Miyagi	47,574	7,290	15.3	6,060	12.7
Fukushima	50,945	17,200	33.8	2,850	5.6
Ibaraki	56,537	1,430	2.5	180	0.3
Tochigi	25,010	1,330	5.3	-	-
Chiba	17,224	1,220	7.1	430	2.5
Nigata	5,311	1,190	22.4	-	-
Nagano	312	210	67.3	-	-
Total	241,967	37,700	15.6	10,200	4.2

**subject to status confirmation*

Source: Ministry of Agriculture, Forestry and Fisheries

Reported area of agricultural land damaged by the 2011 disasters in the six coastal and six inland prefectures is around 24,500 ha (Table 14). The mostly hit farmlands were in Miyagi and Fukushima, where disaster affected almost to 11% and 4% of the total agricultural land in these prefectures.

More than 85% of the washed away or flooded by the tsunami farmlands were paddy fields [MAFF, 2013]. In most affected Miyagi and Fukushima prefectures the destroyed by the tsunami paddy fields accounted for 11.5% and 5.3% of all paddy fields in these prefectures.

Table 14. Area of damaged agricultural land by the 2011 earthquake in Japan (March 11, 2012)

Prefectures	Damaged agricultural land	Tsunami damaged agricultural land	Share of completely	Share of restored

	Area (ha)	% in total cultivated land	Area (ha)	% in damaged land	restored agricultural land (%)	tsunami damaged land (%)
Aomori	107	0.1	77	72	94.4	92.2
Iwate	1,209	0.8	725	60	22.2	3.9
Miyagi	14,558	10.7	14,341	98.5	33.3	32.5
Fukushima	5,927	3.9	5,462	92.1	9.3	4.1
Ibaraki	1,063	0.6	208	19.6	90.1	97.1
Chiba	1,162	0.9	663	57.1	100.0	100
Total coastal	24,026	2.7	21,476	89.4	32.9	27.3
Yamagata	1	0.0	-	0	100.0	-
Tochigi	198	0.1	-	0	98.0	-
Gunma	1	0.0	-	0	100.0	-
Saitama	39	0.0	-	0	100.0	-
Niigata	117	0.1	-	0	73.5	-
Nagano	95	0.1	-	0	69.5	-
Total inland	451	0.1	-	0	85.8	-
Total	24,477	1.6	21,476	87.7	33.8	27.3

Source: Ministry of Agriculture, Forestry and Fisheries

There has been also radioactive contamination of farmlands from the nuclear accident's fallout. Recent survey in the most affected regions shows that contamination with cesium of paddy fields ranges from 67 up to 41,400 Bq/kg and other lands (arable, meadows, permanent crops) from 16 to 56,600 Bq/kg (Table 15). Most heavily contaminated farmlands are in Fukushima prefecture where 3.6% of all samples (including 4% of the paddy fields and 2.9% of other lands) are above 5000 Bq/kg.

Table 15. Share of contaminated with Cs farmlands in Japan as of December 28, 2012 (percent)

	Paddy fields	Other farmlands

Prefec-tures	range Bq/kg	0-500	500-1000	1000-5000	>5000	range Bq/kg	0-500	500-1000	1000-5000	>5000
Miyagi	72-1,310	61.9	28.6	9.5	0	110-860	50	50	0	0
Fuku-shima	50-41,400	39	16.1	40.8	4	40-56,600	34.3	21.2	41.6	2.9
Ibaraki		0	0	0	0	230-560	50	50	0	0
Tochigi	110-1,040	50	41.7	8.3	0	62-2,630	66.7	11.1	22.22	0
Gunma	85-170	100	0	0	0	49-560	95	5	0	0
Chiba	67-120	100	0	0	0	< 16-190	100	0	0	0
Total	67-41,400	43.2	17.8	35.6	3.4	16-56,600	46.2	19.2	32.4	2.2

Source: Ministry of Agriculture, Forestry and Fisheries

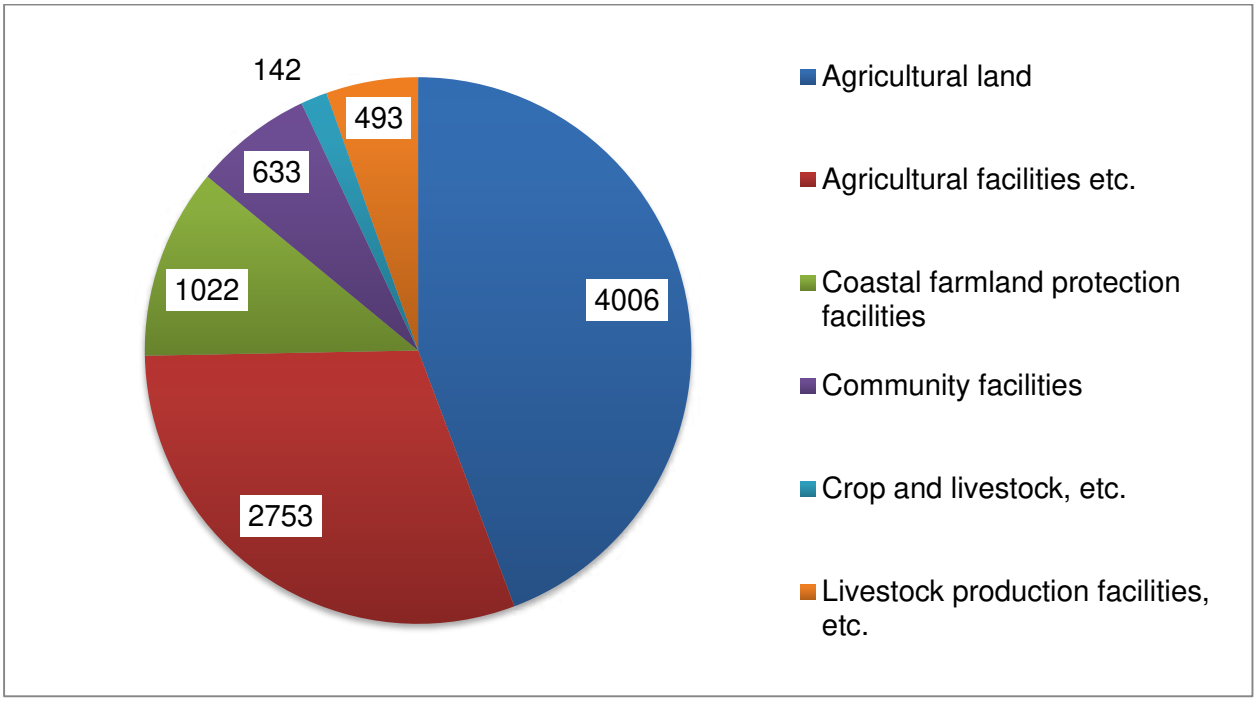
Damages on farms have been particularly big in areas around the Fukushima nuclear plant, where most agricultural land, livestock and crops were heavily contaminated and destructed [Koyama, 2012, 2013; Watanabe, 2013]. In the most affected “Evacuation areas” farming activity has been suspended or significantly reduced, and majority of livestock and crops destroyed.

The number of farm households in the evacuation zones was 5400 and the farming area 11,000 ha, including 73.3% of paddy fields, 25.6% of uplands, and 1.1% permanent crops [Fukushima Prefectural Government, March 2012]. That comprises 8% of the total number of farmers and 9% of the farming area in Fukushima prefecture in 2010. The numbers of beef cattle in the evacuation areas was 10,836, of milk cows 1,980 and of pigs 40,740, accounting respectively for 15%, 12% and 22% of the overall numbers of livestock in 2011. The estimate figure for chickens was 1,589 or 30% of the total number in the prefecture in 2009.

The official estimate for the inflicted damage on agriculture by the 2011 earthquake is 904.9 billion yen (Figure 51). The biggest share of the damages

is for agricultural land (44.3%) and agricultural facilities (30.4%), followed by the coastal farmland protection facilities (11.3%), community facilities (7%), agricultural livestock etc. (mainly country elevators, agricultural warehouses, PVC greenhouses, livestock bams, compost depos) (5.4%), and agricultural crop and livestock etc. (1.6%).

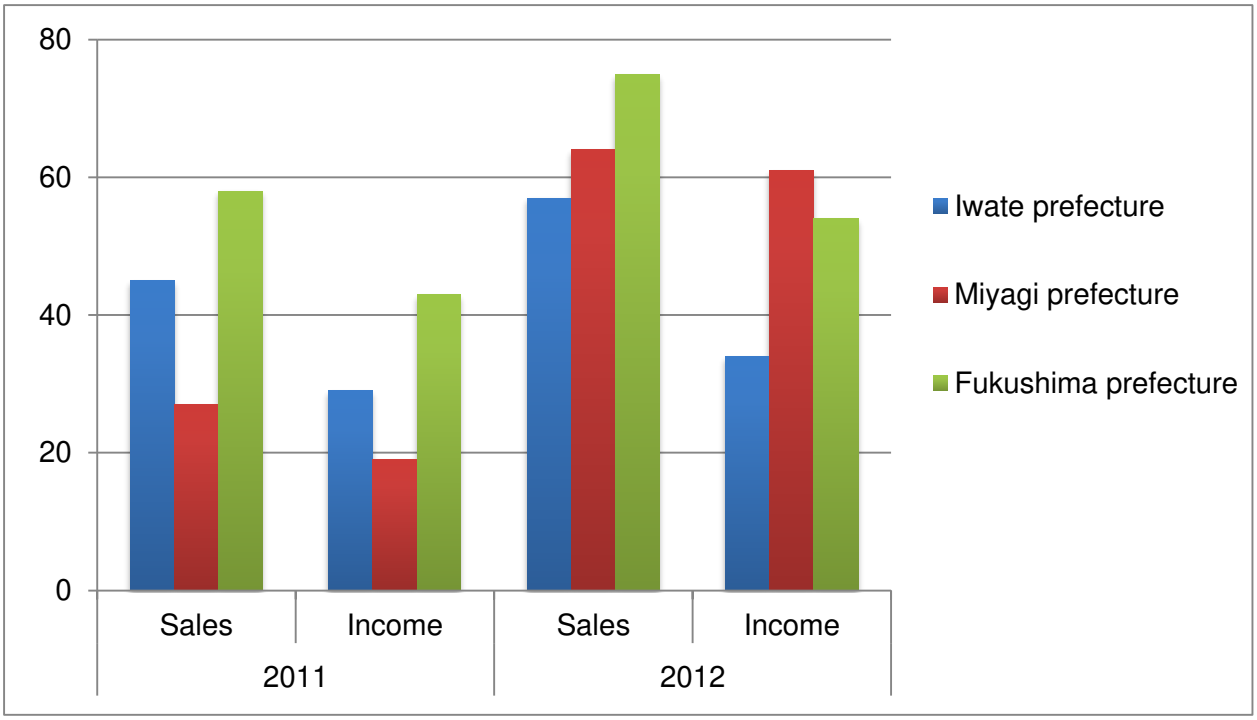
Figure 51. Damages to agriculture from 2011 earthquake as of July 5, 2012 (100 million yen)



Source: Ministry of Agriculture, Forestry and Fisheries

A survey on the economic situation of agricultural management entities in the tsunami damaged areas have found out that in 2011 the sales revenues from the agricultural products dropped by 68% comparing to 2010 and the agricultural income by 77% [MAFF, 2013]. The biggest decrease in sales and income experienced farmers in Miyagi prefecture, followed by the producers in Iwate and Fukushima prefectures (Figure 52).

Figure 52. Evolution of agricultural sale and income of agricultural management entities in tsunami-damaged areas (2010=100)



Source: Ministry of Agriculture, Forestry and Fisheries, 2013

There have been some improvements of sales and incomes in all areas but in 2012 they were still far bellow the 2010 level – 34% and 41% accordingly [MAFF, 2013]. In the first year after the disaster there was augmentation of the agricultural output value in 69.8% out of the 43 tsunami-damaged municipalities. In the rest of the affected municipalities there was no progress (11.6%) or even a reduction (18.6%) in the agricultural output, including in 58.3% of the damaged municipalities in Iwate prefecture, a half in Aomori prefecture, 26.7% in Miyagi prefecture, 16.7% in Ibaraki prefectures, and zero in Fukushima and Chiba prefectures [MAFF, 2013].

There are official estimates on some of the damages from the Fukushima nuclear disaster as well. For instance, the total product damages from the accident accounts for 2,568 billion yen in Fukushima prefecture, out of which 41.9% are in the evacuated and restricted areas (Table 16). These figures cover damage of products that cannot be sold, because of the

restrictions on planning and distribution, and loss of the value caused by rumors.

Table 16. Agricultural product damages in areas affected by nuclear disaster in 2012

	Vege-tables	Live-stock	Fruit	Rice	Evacuated/ restricted area total	Fukushima prefecture
Evacuated/restricted area (%)	42.4	68.0	48.9	35.9	-	100
Evacuated/restricted area (100 million yen)	225	346	135	371	1,077	2,568
Evacuated/restricted area ratio (%)	8.8	13.5	5.2	14.4	41.9	100

Source: Tohoku Department of Agriculture, MAFF Statistics

Nevertheless, above assessment does not include important “stock damage” (material funds, damage to production infrastructure, contamination of agricultural land, facilities for evacuation, and usage restrictions on machinery) as well as the loss of “society-related capital” (diverse tangible and intangible investments for creating production areas, brands, human resources, network structure, community, and cultural capital, ability to utilize resources and funds for many years). According to the experts the later losses are quite difficult to measure and “compensate” [Koyama, 2013].

Likely wise, much of the overall damages from the 2011 disasters on farmers livelihood and possessions, physical and mental health, environment, lost community relations etc. can hardly be expressed in quantitative (e.g. monetary) terms [Bachev and Ito]. Many farms livelihood and businesses have been severely destructed as a result of loss of life, injuries and displacement, and considerable damages on property (farmland, crops,

livestock, homes, material assets, intangibles such as brands, good reputation, etc.), related infrastructure, and community and business relations.

What is more, thousands of farmers in Fukushima and neighboring regions have been continuing to suffer enormously from the radioactive contamination of farmlands and agricultural products, the official and/or voluntary restrictions on production and shipments, and the declined markets and prices for their products [JA ZENCHU, 2012; Koyama 2013a, 2013b; Ujiie 2011 and 2012; Watanabe, 2011; Wataname 2013].

Radioactive contamination of agri-food products

During the year after the nuclear accident officials tested 137,037 agri-food samples across the country and detected 1,204 cases (0.88%) exceeding the provisional safety limit in 14 prefectures [MAFF, 2012]. Most of the contaminated food samples were in Fukushima prefecture (59.63%), followed by Saitama (10.55%), Ibaraki (7.14%), Tochigi (6.23%) and Miyagi prefectures (5.32%). The share of contaminated items in all inspected samples was highest in Saitama (3.64%), Fukushima (3.33%) and Kanagawa (1.98%) prefectures, and in Tokyo (1.42%).

The majority of highly contaminated items In Fukushima prefecture were vegetables, fishery products and meats, in Ibaraki and Chiba prefectures vegetables, in Miyagi prefecture beef, in Tochigi prefecture vegetables and meats, in Saitama prefecture and Tokyo tea leafs.

The mandatory and voluntary restrictions on shipment covered a number of products from designated areas of affected regions. In addition, there was a ban on rice planting on 8000 ha of paddies in evacuation (95%) and other contaminated areas [MAFF, 2012]. What is more, several municipalities called for voluntary restraints on planting of paddy rice on total area of 5,600 ha.

In the last two years the number of (official, collective, private) food inspections has multiplied in the 17 most vulnerable prefectures and around

the country. The official inspections results indicate that for all agricultural food products, but mushrooms and wild edible plants, the number of samples with radioactive cesium above safety limits is none or insignificant (Table 17).

Currently there are still a number of products from certain areas of 17 prefectures, which are subject to mandatory or voluntary shipment restrains[45]. In Fukushima prefecture mandatory and voluntary restrictions cover a wide range of vegetables, fruits, livestock and fish products grown in heavily contaminated areas. In addition, there is still a ban on rice planting on 2,100 ha (almost 3 times lass than in 2013) and the overall production management restrictions on 4,200 ha paddies in the evacuation area (Table 18).

In other prefectures mandatory and voluntary shipment restrictions mostly concern mushrooms, wild plants, and fish.

Table 17. Results of inspections on radioactivity levels in agricultural products in Japan*

Products	March, 2011 - March 31, 2012			April 1, 2012 - March 31, 2013		April 1, 2013 - March 31, 2014	
	Number samples	Above provisional limit	Above new limit	Number samples	Above maxi-mum limit	Number samples	Above maxi-mum limit

[45] updates on requests for shipment restrains and other measures are available at: http://www.maff.go.jp/e/quake/press_since_130327.html

Rice	26,464	39	592	10.4 million	84	11 million	28
Wheat and burley	557	1	27	1,818	0	592	0
Vegetables	12,671	139	385	18,570	5	19,657	0
Fruits	2,732	28	210	4,478	13	4,243	0
Pulse	698	0	16	4,398	25	6,727	59
Other plants	498	1	16	3,094	14	1,613	0
Mushrooms and wild edible plants	3,856	228	779	6,588	605	7,583	194
Tea/Tea infusion**	2,233	192	1,562	867**	13**	446**	0**
Raw milk	1,937	1	7	2,453	0	2,052	0
Beef	91,973	157	1096	187,176	6	208,477	0
Pork	538	0	6	984	1	693	0
Chicken	240	0	0	472	0	385	0
Egg	443	0	0	565	0	418	0
Honey	11	0	1	124	0	66	0
Other livestock	23	0	0	99	1	118	0

** for crops in 17 northeastern and eastern prefectures, for livestock products all prefectures*

Source: Ministry of Agriculture, Forestry and Fisheries

Table 18. Target areas of rice planting restrictions in Japan (ha)

Type	2013	2014
Planting restrictions	6,000	2,100
Farmland preservation and cultivation test*	-	700
Planting resume preparation	6,200	5,100
Total volume production delivery management	5,200	4,200

** set in the new "Policy on the planting of the 2014 annual rice"*

Source: Ministry of Agriculture, Forestry and Fisheries

Effects on agricultural markets

Due to a genuine or perceived health risk many Japanese consumers stop buying agricultural and food products originated from the affected by the nuclear accident regions. Even in cases when it was proven that food is safe some wholesale traders, processors and consumers restrain buying products from the contaminated areas Koyama, 2013; MAFF, 2012; Watanabe 2011, 2013].

That has been a result of lack of sufficient capabilities in the inspection system, inappropriate restrictions (initially covering all shipments in a prefecture rather than from contaminated localities), revealed rare incidences of contamination in generally safe origins, low confidence in the official “safety” limits and inspections, lack of good communication, harmful rumors (“Fu-hyo”), and in certain cases not authentic character of traded products [Bachev and Ito, 2013]. The “reputation damage” has been particularly important factor for the big agri-food producing regions like Fukushima, Ibaraki etc. which products have been widely rejected by the consumers [MAFF; Koyama, 2013; Watanabe, 2013].

Consequently, the demand for many traditional farm produces from the affected by nuclear disaster regions (such as rice, fruits, vegetables, mushrooms, milk, butter, beef etc.) significantly declined while prices considerably decreased.

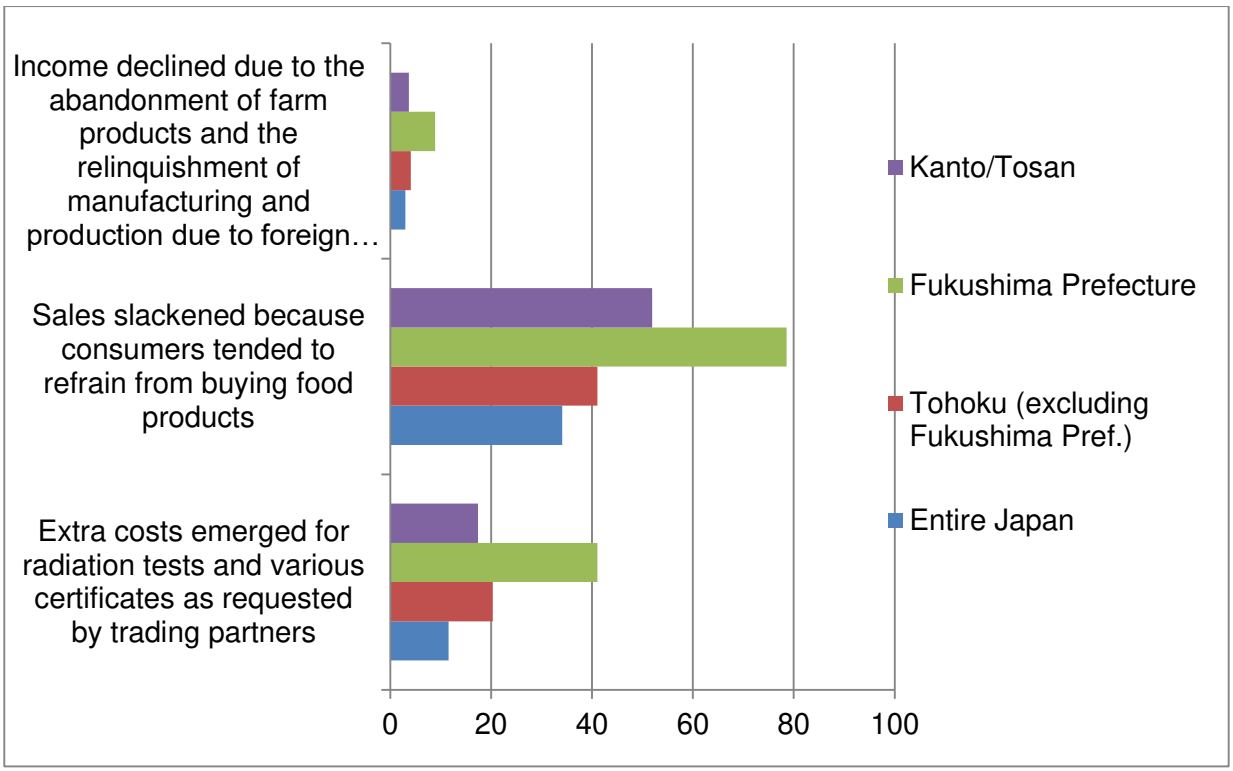
Since autumn 2011 and 2012 radiation measurement tests for radiation level in all beef and package of rice have been carried out in Fukushima prefecture. Until April 30, 2013 more than 10.3 million bags of rice were checked by JA Fukushima, and detected radiation in 99.78% of them were less than 25 Bq/kg while in only 71 bags (0.0007% of the total) it was above 100 Bq/kg [JA Fukushima Prefecture, 2013]. Intensive safety checks have

been also carried out on a great range of agri-food products by the authority, farmers, agricultural organizations, processors, retailers etc.

Despite all safety checks many consumers in the big cities and in the region alike continue to avoid Fukushima products [Koyama 2013]. In the end of March 2013 the rice sales from Fukushima was almost half of what it had been before the disaster while rice prices considerably lower. Similarly, sales of vegetables as ingredients for school lunch in Fukushima have decreased; only 3 out of 16 JA farmers market recovered the sales, most have their sales decreased by 30%, some still struggle at 40% of the pre-disaster level, and one was closed; sales of meat started to recover but it is still bellow the pre-disaster level etc. [Nagashima, 2013].

Countrywide survey of the MAFF found out that more than a third of surveyed Japanese farmers indicate that “Sales slackened because consumers tended to refrain from buying food products” (Figure 53). The later figures are much higher for the most affected by the disaster regions. Moreover, a substantial number of food industry companies point out that they “switched from agriculture products in areas with radioactive contamination fears to those in other areas for our purchasing” and that amounts for more than 57% in Fukushima prefecture.

Figure 53. Effects of Fukushima nuclear plant accident on Japanese farmers (%, multiple answers)



Source: Ministry of Agriculture, Forestry and Fisheries, 2013

Furthermore, after the nuclear accident, there was a considerable decline in the absolute and the relative prices of affected farm products and products from the contaminated regions. Fukushima prefecture has lost its comparative advantage to other farming regions. For instance, in 2011 the price of peaches from Fukushima dropped 100 to 200 Yen, and asparagus around 300 Yen compared to the same products from other regions (Murayama, 2012). Wholesale market shipment prices of vegetables grown in Fukushima prefecture in summer-fall 2012 were 20-30% lower in absolute terms than for 2011 (Watanabe, 2013). At the same time, new rice in 2011 was 10-20% more expensive than 2010 crop due to the efforts of wholesalers to purchase rice free of radioactive substances (MAFF, 2012).

For instance, there was a considerable decline in the wholesale prices of beef cattle in Fukushima prefecture and in Japan after the accident [MAFF]. The prices in the country have been recovered and there has been gradual recovery of beef prices in Fukushima prefecture as well. Nevertheless, prices

for different categories of beef are still 12-13% lower in Fukushima comparing to Japan [Watanabe, 2013].

In order to facilitate communication with consumers, promote and recover Fukushima agricultural products numerous initiatives have been undertaken by farmers, agricultural organizations, NGOs, authorities, business, retailers etc. such as: direct sells by farmers, on spot radiation tests, recovery markets, Farmers' Document and Farmers Café events, government "Eating for support" initiative, joint ventures with shops, promotion complains with participation of top officials, celebrities, journalists, and farmers in big cities, international fairs etc. [Koyama, 2013; NHK World, May 17, 2014; MAFF, 2014].

For instance, the fast-food chain Yoshinoya has set up a joint venture to produce and market food from the Fukushima prefecture to help region's recovery [Thompson and Matsutani, 2013]. Company provides funds (investment of Y10m or $102,000) through a joint venture (Yoshinoya Farm Fukushima Co) held with local farmers who will grow rice, onions and cabbages in the region, produce which could then make it on to the tables of the 1,175 restaurants the chain operates in Japan.

Fight against "harmful rumors" that led to plummeting prices and sales of farm products have been also a high priority for local and national authorities. For instance, Fukushima prefecture is spending about 1.7 billion yen ($16.6 million) this fiscal year to fight rumors about radiation - fourfold budget increase over the previous year [Inoue, 2014].

The central government also plans to do more to help revive industries suffering from groundless rumors following the nuclear accident. The Reconstruction Agency compiled new guidelines for helping local businesses which say that: the government will continue releasing the results of radioactivity tests on agricultural products from Fukushima prefecture; officials will continue to urge foreign countries to ease or abolish import restrictions on farm and fisheries products; they call on member companies of the Japan

Business Federation to use farm products from Fukushima prefecture as gifts and offer them at in-house sales events; officials will work to attract tourists, including students on school trips, from inside and outside Japan; and urged the related agencies to lead the way to help give the industries a boost [NHK, June 23, 2014].

Recent data suggest that demands for Fukushima, Ibaraki and Northern Honshu agricultural products (e.g. rice, beef, vegetables) have been recovering fast while the farm-gate and wholesale prices in the most affected regions (Fukushima, Ibaraki) are still lower than in other part of the country.

That is consequences of a number of factors: reduction of radioactive contaminations, improving consumer confidence on inspection and safety, “forgetting” the contamination issue by some part of population, preferences to lower prices regardless the quality by some segment of consumers, changing marketing strategies of processors and smaller shops (not promoting/labeling anymore some farming and processed products as “Fukushima origin”), increasing procurement by restaurants and processors of safe and cheap produces from the region etc. Consequently, despite negative impact on local producers in affected region some actors in the food chain (restaurants, food stores, middleman) have been profiting enormously getting a higher margin.

The 2011 disasters also affected considerably the international trade with agricultural products. Due to the foreign countries’ import restrictions and the experienced damages, the value of Japan’s farm and livestock product exports declined substantially - in April-December 2011 the export plunged by 40.9 billion yen (11%) from the year before [MAFF, 2012]. Furthermore, in January-March, 2012 the value of country’s export of agricultural products was 89 million (12.77%) lower than for the same period before the disaster.

At the same time, there was a significant increase in the import of agricultural, forestry and fishery products as imports of farm products jumped 16% to 5.58 trillion yen in 2011

In April-December 2012 it was registered a 5.98% growth in the export of agricultural products of the country. Moreover, a slight augmentation of the annual exports of agricultural and field crops products were reported but the export value was still bellow 2010 level. The overall import of agricultural and crop products decreased but it was still above the pre-disaster levels.

Farms compensation claims

Until May 2013 the amount of compensation demands reached 109.2 billion yen with a greatest portion of claims being for the untilled land (compensation for suspension of work) horticulture and livestock damages (Table 19).

Progress in the compensation payments by TEPCO has been slow and uneven due to the delays in the review process and the demands for further documentation, the lack of sufficient funds for satisfying all claims, multiple disputes, etc. [Watanabe, 2013].

Meanwhile, farmers have been facing cash-flow difficulties as they struggle to pay production and household expenses. In order to alleviate cash-flow difficulties certain agricultural cooperatives in Fukushima Prefecture started offering interest-free loans by subsidizing the interest and some established own substitute payment programs [Watanabe, 2013].

Table 19. Breakdown of Fukushima Prefecture Union Compensation Claims (100 million yen)

Claims	On May 1, 2012		On May 1, 2013	
	Value	Share in total (%)	Value	Share in total (%)
Rice	11	1.8	32	2.9

Horticulture	130	20.8	264	24.2
Fruit	62	9.9	75	6.8
Milk	18	2.9	20	1.8
Livestock disposal	99	15.8	100	9.2
Other livestock damages	85	13.6	162	14.8
Pasture	27	4.3	50	4.6
Untitled land (for work suspension)	163	26.1	325	29.8
Business damages	30	4.8	64	5.8
Total	625	100	1,092	100

Source : Central JA Union for Fukushima Prefecture

What is more, TEPCO continues to receive claims for damages of farmers and agri-food business from around the country. However, up to date the total amount of claims received by and paid to the different affected agents is not easy to find.

There have been many problems related to the compensation of damages from TEPCO. For farmers and agriculture cooperatives in Fukushima prefecture the major issues can be summarized as: three month to almost a year delays in payments; not paying the full amount that was claimed; disputing nuclear accident origin of damages; denying claims when people restrain production and distribution voluntarily; claims related to farmland and farming property damage; compensation for discontinuation of business; the closing date issue is not decided yet (how long the compensation will last); insufficient amount of compensation to restart farming; additional (inspection, administrative, radiation map preparation, etc.) costs and damages of organizations such as JA are not compensated yet; support for damages not clearly specified in the Dispute Reconciliation Committee for the Nuclear Damage Compensation guidelines [Koyama, 2013; Nagashima, 2013].

Difficulties experiencing by some older age farmers associated with the paper works in compensation procedures is also pointed out as a problem

[Ishii, 2013]. According to experts the efforts of farmers who did not market their products through cooperatives are particularly big. We have also found that some of the “safety tests” costs currently incurring by farmers (e.g. for voluntary and self inspections) and consumer associations (e.g. Consumer cooperatives) and due to be compensated in unclear future, are also a problem.

The important issue how certain claims will be compensated is still disputed by the parties and unspecified. For instance, JA Union, Fukushima prefecture, and Central Federation of Societies of Commerce and Industry have established a zero interest fund (Farmers Management Stability Funds) to support farmers with immediate needs. There are also funds for compensating beef distribution restrictions to help projects support emergency management of national companies raising cattle for consumption, support measures for emergency rice straw provisions, and measures to allow undisturbed distribution of cattle and programs sponsoring free rice straw in Fukushima prefecture.

In areas where restrictions are placed on planting, a standard compensation “per 10 are” is guaranteed. However, there are problems with uniform compensation, including differences in the amount of products per 10 are, discrepancies in farming method (e.g. organic, conventional farming), unlike value added of produce etc.

Furthermore, compensation claims negotiations are conducted individually and it is quite difficult for an individual farmer to negotiate effectively with the giant TEPCO. For example, compensation for areas with new planting restrictions in 2012 was 59,000 yen per 10 are while there were cases of people purchasing rice for own consumption and falling into a deficit [Koyama, 2013]. The later amount is not recognized for compensation as well as the value of left property in evacuation areas.

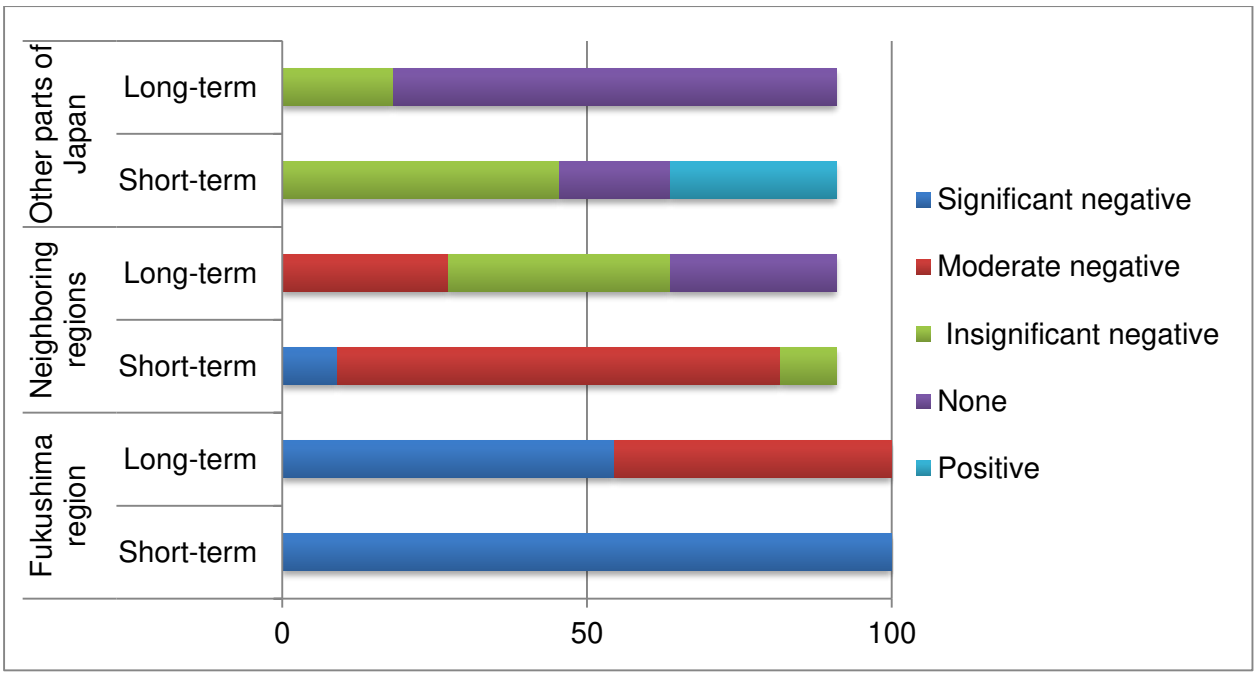
According to the assessment by leading experts[46] the Fukushima nuclear accident has had a significant negative overall short-term impact on agriculture in Fukushima region (Figure 54). Furthermore, most experts agree that the overall impact from the disaster varies considerably according to the specific location of farms since living and working environment, contamination of farmlands and assets, restrictions on entry, production, shipping of produces etc. have been quite different in evacuation areas and in other parts of the prefecture. The common view is that “in the areas of restriction to entry, stay and residence, recovery of agriculture remains difficult while other areas are affected by bad reputation”.

A significant majority of experts evaluate the overall short-term impact of the nuclear disaster on agriculture in neighboring regions as moderate negative. The rest believe that there is a negative impact but some of them assess it as significant and others as insignificant.

As far as the impact of the Fukushima nuclear disaster on agriculture in other parts of Japan is concerned it is estimated as insignificant negative or none by the good part of the experts. What is more, more than 27% of experts assess as positive the overall impact of the disaster on agriculture in other parts of the country.

Figure 54. Overall impacts of Fukushima nuclear disaster on Japanese agriculture (percent)

[46] 11 including four researchers (Fukushima University, Tohoku University, and Tsukuba University), two representatives of the prefectural government in Fukushima, two farmers, two representative of farmers associations from Fukushima prefecture, and one representative of Fukushima food industry.



Source: assessment by panel of experts, June 2013

Progress in restoration and adaptation of agriculture

There has been a huge government budget for the recovery, reconstructions, compensations and development, and enormous efforts of individuals, private and public organizations toward reconstruction [Reconstruction Agency, 2014]. Subsequently, there has been a rapid recovery of infrastructure and economic activities in the country, including the most affected regions.

Nevertheless, there have been differences in the progress of recovery between Fukushima, Miyagi and Iwate prefectures. In Fukushima prefecture the overall progress has been lagging behind – e.g. merely 68% of debris and 44% of tsunami deposits outside the evacuation areas has been treated [NIRA, 2013].

The Government worked out a “Strategy for the Revitalization of the Agriculture, Forestry, and Fisheries” (2011) aiming to rapid restoration and resuming of farming in disaster affected regions. The strategy have been supported by a series of supplementary budgets including: subsidizing part of

the cost necessary to recover farm land, granting aid to resumption of farming, and providing interest-free loans for the afflicted farmers and businesses. It also considers projects for integrated development of residential zones, agricultural zones and other zones, including conversion from residential to agricultural zones.

In addition, there has been easing in approval standards under the Agricultural Land Act and other laws, and one-stop procedure for zoning, approval and project planning introduced in the affected areas. Further enlargement of the loans with a credit line of 100 billion yen and interest-free loan under the “Act on Temporary Measures on Financial Support of Farmers has been introduced. Subsequently, farms having 30% and more harvest reduction and over 10% of property damages can apply up to 2 million yen for persons and 20 million yen for companies with 3-6 years redemption period. What is more, for special cases individual loans have 2.5 million yen ceiling and extending period of redemption of 4-7 years under the “Special Financial Aid Act for Heavy Disaster” [MAFF].

The Government measures aimed both recovery and increased farm efficiency. Particularly, they have been contributing to accelerating farmland transactions and expanding farm operations. It encourages communities in the afflicted area to discuss and submit “master plans” for local farmland use.

Citizens have been faced with a task of discussing land use for public, commercial, residential, farming and other purposes from scratch in order to rebuild communities. This made it possible for agricultural commissions with the participation of other stakeholders and citizens to discuss farmland use and mark land zones clearly and effectively. The later gave opportunity to adjust land uses among the area and aggregate farmland while concentrating residence and commercial/communal facilities into uplands allowing improving farmland efficiency and building a disaster-resistant community.

Government decided to pay 30 thousand yen for every 0.1 hectares of farm land to retiring farmers, non-farmer inheritors, etc. if they lease their land

under certain conditions (e.g. period of lease is more than 6 years, land is to be blindly entrusted to government-approved agencies, which take part in farm land aggregation projects, and others). The later created incentives to increase farmland transactions within the afflicted area as well as opportunities for farm managers to expand production by borrowing consolidated land plots from farmland aggregation agencies.

Furthermore, there has been also a huge public support for all decontamination efforts – e.g. national budget for decontamination for the period of 2012-2013 comprises 1.1482 trillion yen [Koyama, 2013]. There has been also increased public (national, prefectural, local) support to farms and agri-business in the affected regions. The Government established the Nuclear Damage Liability Facilitation Fund to support nuclear damages payments.

The Government support to prefectures and farmers to recovery from disaster has been substantial. For instance, farmers that have conducted complete inspection of all cattle and feed lots are paid 50,000 yen per head of raised cattle. In places where shipping restrictions are imposed funds have been provided for the purchase and disposal of the beef facing delayed shipment or already in distribution chains. The similar measures applied to other farm products as well.

Last but not least important, there has been significant support from diverse agricultural (agricultural cooperatives), business, academic, non-governmental and international organizations. All they intensify their activities in the affected regions and multiply relations with individual farmers and agri-business companies. That has been associated with increased “outside” service supply and likely positive effects on activity, innovations, incomes, etc.

Consequently, a good progress in removal of debris, restoration of damaged agricultural lands, and resumption of farming has been achieved with concerted efforts of the government agencies, prefectural and local

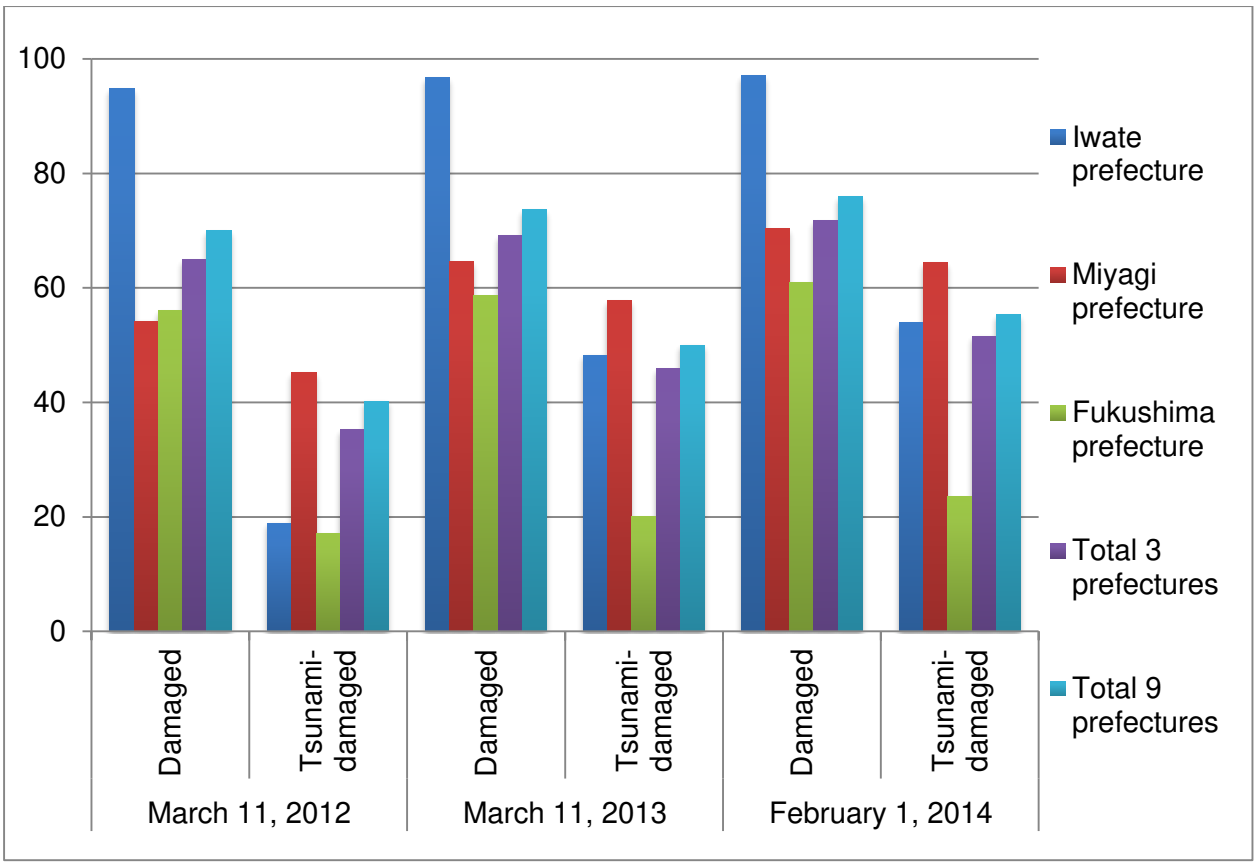
authorities, agricultural cooperatives, farmers, private companies, volunteers, etc.

In order to remove the salt following procedures have been applied – construction of temporary diversion canals or creasing cannels, pouring lime soil conditioner, mole draining, reverse plowing/soil crushing and flooding for removing salt [MAFF, 2011].

One year after the disasters around a third of damaged agricultural land was completely restored, including 27% of the tsunami damaged farmlands (Table 14). During the same period about 90% of the tsunami-afflicted farmland was cleaned of rubble, a large part of the agricultural infrastructure reconstructed (including 100% of major draining pumping stations and 7.3 km priority restoration zones of coastal farmlands, and 92% of the rural community sewages) [MAFF, 2012]. Consequently, 70% of all damaged farms in 9 prefectures and 40.2% of tsunami damaged farms in 6 prefectures and 40% of resumed farming (Figure 55).

By March 2013 restoration and salt removal on 38% of the tsunami-damaged farmland was completed and they were available for farming (with restoration on another 63% ongoing) [MAFF, 2013]. That was close to the target in the 3 years plan for complete restoration of tsunami-damaged farming set by the Basic Guidelines for Reconstruction of Agriculture and Rural Communities after the Great East Japan Earthquake. Consequently, a half of the affected by the tsunami farms resumed agricultural production or preparations for it (MAFF, 2013). The latest figures indicate that 63% of tsunami damaged agricultural land has been made again available for farming [Tani, 2014], and more than 55% of the affected farms resumed operation.

Figure 55. Share of agricultural management entities, which resumed farming (percent)



Source: Ministry of Agriculture, Forestry and Fisheries

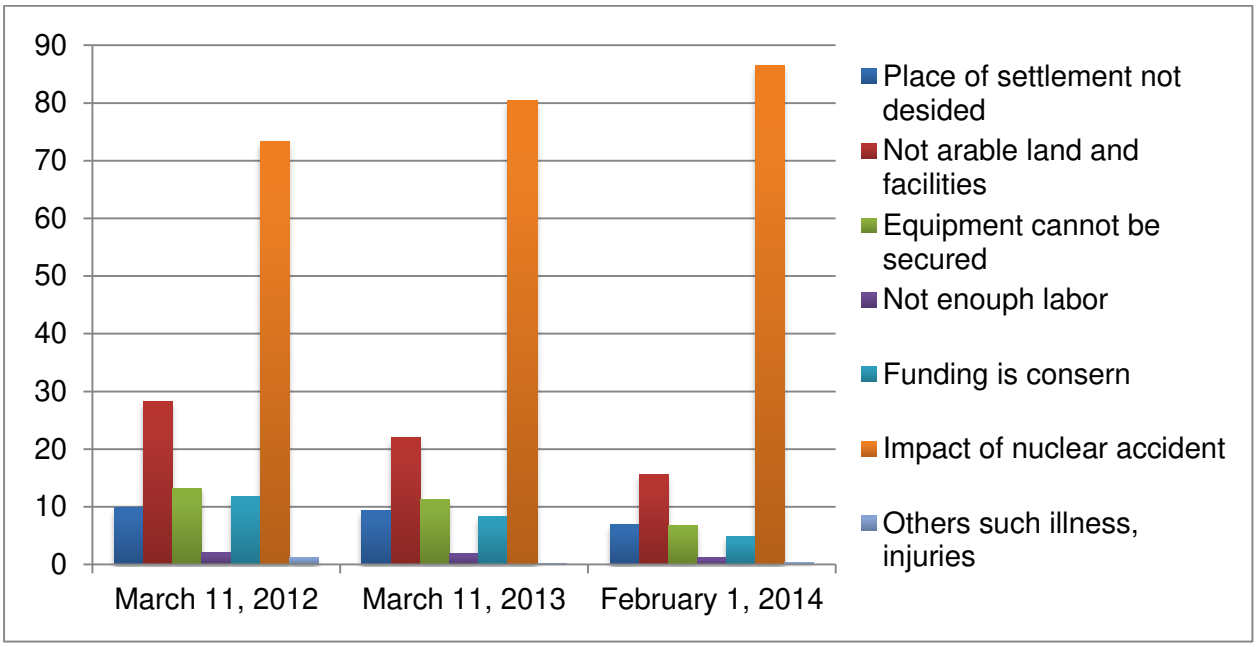
In the three most affected by the disasters prefectures approximately 72% of the damaged farms and 52% of the tsunami-damaged farms resumed operations [MAFF, 2014]. The biggest progress in restoration of the damaged farms has been achieved in Iwate prefecture and for the tsunami damaged farms in Miyagi prefecture.

On the other hand, in Fukushima prefectures restoration of operations in both damaged and tsunami-damaged farms has been progressing slowly. Moreover, some parts of heavily contaminated areas remain almost untouched and probably require a long time before farming can be resumed.

The major reasons for “not resuming farming” in the three most affected prefectures have been the impact of nuclear accident, unavailable arable land, facilities and equipment, undecided place of settlement, and funding problems (Figure 56). Moreover, the importance of most of these factors has been decreasing due to progression in reconstruction, returning of evacuees,

restoration of farmlands and public support measures. On the other hand, the significance the nuclear crisis as a reason deterring effective resumption of operations by majority of farms has been increasing.

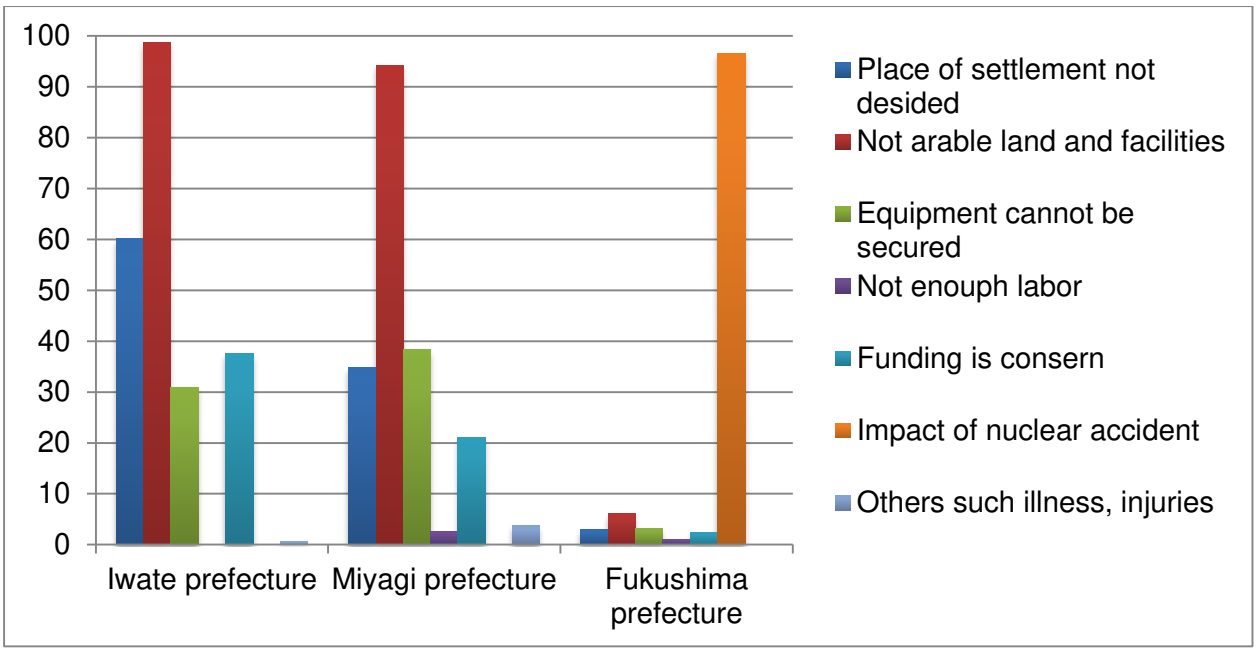
Figure 55. Reasons for not resuming farming in Iwate, Miyagi and Fukushima prefectures, multiple answers (% of farms)



Source: Ministry of Agriculture, Forestry and Fisheries, 2014

The most critical factors for “not resuming farming” for the majority of farms in Iwate and Miyagi prefectures have been unavailable arable land and facilities (Figure 57). Other important factors for a significant number of farms in these prefectures are that farmers have still not decided on the place of settlement (affecting 60% of damaged farms in Iwate prefecture), funding of farming activities is an issue, and equipment can not be secured.

Figure 57. Share of farms with diverse reasons for not resuming farming, multiple answers (%)



Source: Ministry of Agriculture, Forestry and Fisheries, 2014

On the other hand, the most important obstacle to restart operations for the most Fukushima farmers has been the “impact of nuclear accident”.

The aging of the farmers and the lack of successors in business has been a serious problem in the disaster areas as well a nationwide. For instance, presently a significant portion of the regular farm male workers in tsunami-damaged areas of Miyagi prefectures are part-time farmers and older than 65 [MAFF, 2014]. Therefore, any further delay in the reconstruction would put great challenges for the resumption of farming by the previous farm managers (older in age, lack of investment capability, short time span, lack of ability to put rebuilding efforts, lack of skills other than for rice paddy cultivation, unavailable successor, etc.).

The MAFF has also launched the National specific disaster restoration programs for the farmlands and the farming facilities in FY2011. In efforts to secure reconstruction after the restoration, it is implemented to enlarge partitions for farmlands to achieve the economies of scale and farming efficiency. In March 2013 the this program include 9,400 hectares in Iwate, Miyagi and Fukushima prefectures [MAFF, 2013]. In FY2012, MAFF further

kicked off its national specific restoration program of farming facilities in Minamisoma city of Fukushima Prefecture.

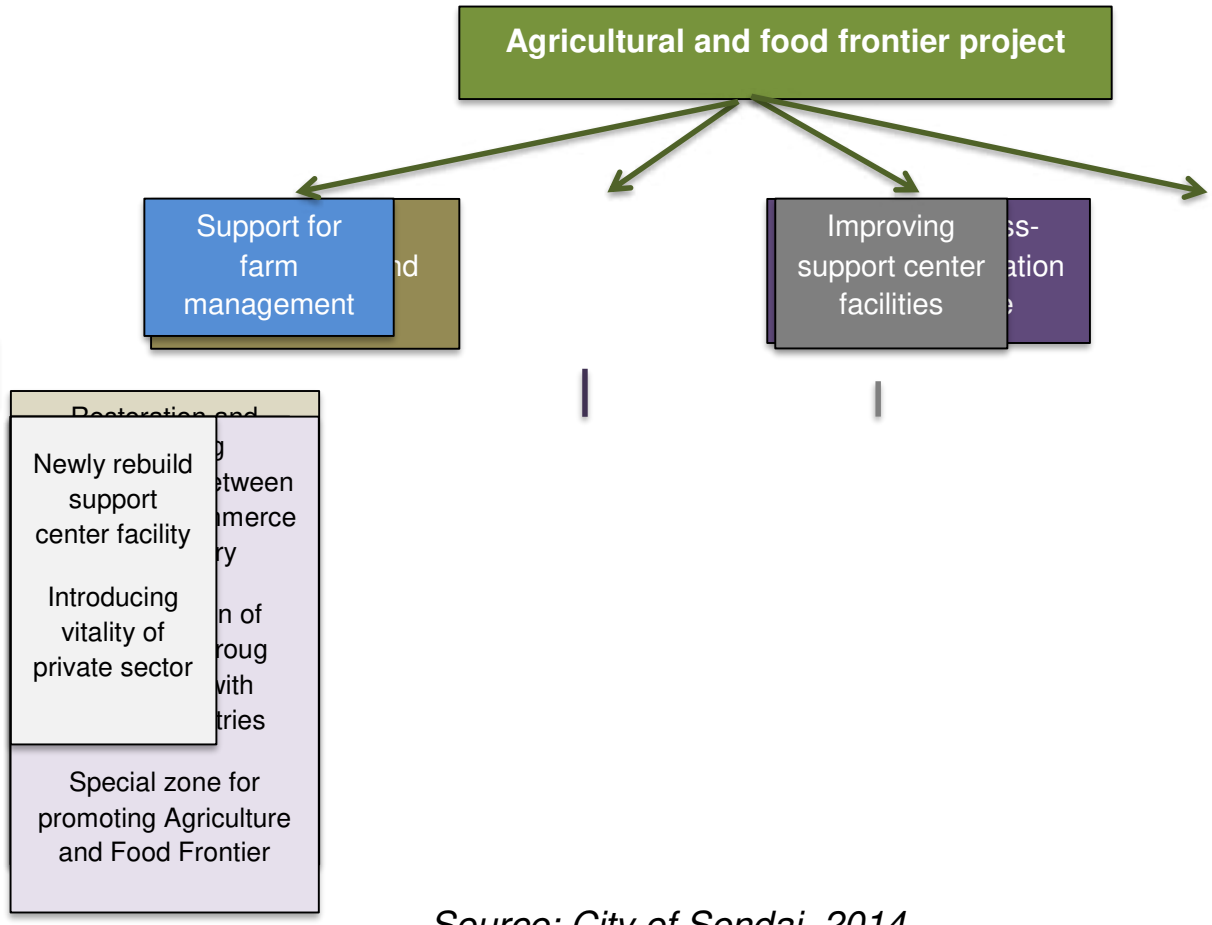
East Sendai case

The reconstruction process of devastated by the earthquake and tsunami East Sendai agriculture is a good example for the efficiency of implementing programs and revitalizing strategy. The strategy and the plan for reconstruction of agriculture is an essential part of the ten year “Sendai City Disaster Reconstruction Plan” for restoration, recovery and revitalizing of all aspects of social life and economies, and enhancing safety of residents and communities.

The Eastern Sendai agricultural zone includes four districts with total cultivated land of 2,300 ha, of which around 78% damaged by the 2011 tsunami, including 1600 ha rice paddies and 200 ha vegetable fields [City of Sendai, 2014]. The economic damage to agriculture is estimated at 72,1 billion yen, including 39,6 billion yen for damaged farmland, 10.6 billion yen for damaged machines and facilities used in agriculture, and 21.9 billion yen for damaged land improvement facilities [City of Sendai, 2014].

The Agricultural and Food Frontier Project has been undertaken to support recovery from the disaster and development of agriculture in East-Sendai. It is centered on four targets: farmland consolidation and improvement; supporting farmers in enhancement of management base; promoting “cross-industry diversification” (integrating farming with related industries such as food processing and sales), and improving support center facilities (Figure 58).

Figure 58. City of Sendai “Agricultural and Food Frontier Project” components



Source: City of Sendai, 2014

The Debris Removal Project was carried out between July 1 and December 28, 2011 on 1,800 ha flooded farmland [City of Sendai, 2014]. It included clean up of damaged buildings, woody debris and cars swept into farmland, farm roads and irrigational channels. The project employed 1,202 farmers who were victims of the disaster with additional 64 registered for employment.

The Soil Desalination Project was conducted from March 25, 2011 until April 30, 2014 on 1,860 ha. It was preceded by detailed surveys on the extent of soils salinations and designing of feasible countermeasures for land improvement. Until March 2013 around 80% of the damaged farmlands was restored and the majority of farms resumed operations. According to the officials the quality of harvested rice was at level equal to that before the disaster and land steadily returning to its former rural landscape.

Simultaneously, restoration of irrigation and drainage channels has been conducted. Temporary Restoration Drainage Pumping Stations was carried out from May 2011 until June 2012, and all 11 of them timely restored as the pre-disaster capacity reached. The full-scale restoration continues taking into account the degree of ground subsistence (50 sm).

The Farmland Consolidation Project has been currently promoted and involves readjusting small traditional plots to form new larger ones. The process is guided by a Council including representatives of different stakeholders – authority, farmers, JA, Land districts, etc.

Before the aggregation farms plots were small and farm roads narrow which was obstacle for the efficient agricultural practices. What is more, poor draining made it difficult to plant wheat, soybeans and other crops. Consolidation raises the farm efficiency, expends crop possibility, and allows farmland borrowing and lending to progress smoothly.

The East Sendai District Farmland Consolidation Project covers 1,979 ha out of the 2,244 ha of the total District area including farmlands, roads and irrigation/drained channels [City of Sendai, 2014]. The ratio of consent by the landlords for farmland consolidation is 94.6%.

The Natori District (Shiromaru area) Farmland Consolidation Projects covers 708 ha out of the 809 ha of the District area. There 98.8% of consent by the landlords for farmland consolidation, including 100% in Shiromari area.

New Approaches for Accumulating Farmlands have been also reviewed. The goal is to promote land accumulation by leasing farmlands to current or future farm operators. The traditional approaches for accumulating farmlands include: transfer of ownership (buying and selling farmlands), reploting by exchanging farmlands (constructing the right of farmland use through implementing land consolidation), lease contract (establishing the right of farmland use though a contract to commissioning farming between a lender farmer and borrower farmer), and commissioning farm work (borrower farmer

is commissioned to cultivate rice in paddy fields from plowing dry soils, tilling irrigated soils and transplanting rice seedlings to harvesting rice).

Since April 2013 the Sendai city in collaboration with the JA Sendai introduced a new approach to “bulk management of farmland”. Sendai city and JA Sendai act as intermediary by implementing bulk lease management practices of farmlands in the relevant areas so that borrower farmer are able to cultivate land that have been consolidated in a single place according to the scale of their farming and the status of operations.

In addition, city authority has created “Sendai city Agriculture Enhancement Plan” based on the discussions held in communities and areas in the 14 districts of Sendai. Among other things the Future Vision of the Regional Agriculture incorporate:

- recognizing regional agriculture so that farmers who operate large farmland plots can play a central role;
- encouraging associations for rice-crop diversion practice to form group-farming organizations based on integrated cultivation of rice and other crops;
- fostering community-based incorporated farming bodies as a model by establishing the right to bulk use and re-allotting farmlands to farm operators.

Ido and Arahama Districts have been selected as model districts, and measures to establish the rights of bulk use and re-allotment of farmland to farm operators started in 2013.

Furthermore, a variety of support measures have been provided to lender and borrower farmers in order to put the plan into action. Support funding for 2013 include Farm Accumulation Support Fund (Central Government) and Project to Promote Accumulation of Farmlands for Use (Sendai city government). The former provides support funds to farmland owners who are listed in the “Sendai City Agricultural Infrastructure

Enhancement Plan" when they newly commission JA Sendai to lease their land "giving full authority" (a contract without designating a borrower).

Concerning the tsunami-affected farmlands recovered for farming on or after April 1, 2012, subsidies are offered to both "farm lender disaster-victims" and "borrowing farmers" when they made a new contract for leasing farmland or commissioning farming that extend over a period of three years or longer.

The Comprehensive Support Project for Agricultural Restoration in Disater-stricken Areas (Leasing) give opportunities through the Reconstruction Grant Project for community farming organizations to lease free-of charge large machines (such as tractors, rice planters, combines, etc.) and facilities (as plastic greenhouses for raising seedlings, machinery store houses, etc.) in the disaster-stricken farmlands making possible for farmers to resume operations.

The Great East Japan Subsidy for Agricultural Production Measures include financial support by the national, prefectural and municipal governments to groups which are organized by farmers, agricultural producers cooperative corporations etc., so that they can install common facilities, do repair and renovations, and lease agricultural machines and materials.

Measures for Project Subsidy/aid includes: Emerging Installation of Plastic Greenhouses for Vegetables and Flowers, and the Project to Support Disater-stricken Farmers to Resume Farming. The first one comprises city government subsidies of the part of expenses of the disaster-stricken farmers (farming groups, certifies farmers, ecofarmers, etc.) for installing plastic greenhouses to resume farming. The second project provides subsidies to farmers who jointly establish a recovery association to remove fine debris, weeding or clearing so that farming can be resumed.

Another major aspect of the Agricultural and Food Frontier Project is the Promoting Diversification of Agriculture by integrating it with Related

Industries such as Food Processing, Distribution and Sales. It includes three measures:

a/ The Promoting Collaboration between Agriculture, Commerce and Industry - it aims to encourage regional industries based on agriculture by arranging business “matching” opportunities and supporting activities to develop high value-added products and services (in addition to efforts to boost demand). The idea is that the later can be done with the collaboration of agriculture, commerce and industry, and mutual utilization of their resources, technologies and networks.

b/ Diversification of Agriculture through Integration with Related Industries such as Food Processing, Distribution and Sales. Measures are carried out to promote “cross-industry diversification of agriculture” – e.g. farmers independently enter the businesses of food processing, distribution and sales, and collaborate with the secondary and tertiary industries to produce and develop new and market-competitive products and provides new services. It also fosters young farmers who will play a major role in management in the cross-industry diversification of agriculture.

c/ Special Zone for Promoting Agriculture and Food Frontier Project – set up in East Sendai as a part of the central government special reconstruction zone program. It allows farm operators in the area to receive special tax provisions so that they can acquire machinery and facilities, start new incorporated businesses and other projects without difficulties.

The target area covers approximately 3,000 ha and target businesses includes incorporated entities or small independent companies that contribute to creating employment opportunities and promote agriculture or operate businesses that correspond to cluster industries in the approved area. Twenty different businesses are designated including: agriculture, food processing, distributing and sales-related industries, renewable energy-related industry, research and testing-related industry. The preferential measures include: special tax provisions, tax credit or special depreciation against taxes (income

tax and corporate tax), exemption from prefectural tax (corporate tax and real property acquisition tax), exemption from municipal tax (fixed assets tax).

Finally, the Renovation and Remodeling of the Support Center Facility has been under way. The goal is to rebuild and modernize the Sendai Agriculture and Horticulture Center as a support center to promote Agriculture and Food Frontier Project. The Center facilities include vegetables greenhouses, food-processing facilities, and allotment garden for “amateur farmer” city residents, direct sales shop, multipurpose open areas, and restaurant.

In December 2011 Sendai city carried out a questionnaire survey in order to figure out farmers’ intentions on: resuming farming, participating in the re-development scheme, selling or leasing the land if they would want to give up or cut back on farming, etc. The majority of the respondents wanted the new paddy field to be plotted by blocks of 0.3 or 0.5 ha while merely 22% preferred 1.0 ha. Therefore, the authority should try to persuade farmers into large-scale operation by explaining the merits clearly and supporting farmers’ moves toward corporate or community farming [Hori, 2012].

Furthermore, the survey showed that a quarter of farmers wanted to retire or cut back on farming (most likely because they do not have a business successor) while 11% wanted to expand or start out from the scratch. Thus authority is to find an efficient means to aggregate retiring farmers’ land persuading them to sell or lease out land as well as encourage ambitious farmers to take up as much land as possible, so that restored farmland would not be left uncultivated.

Preventing farmland from being left uncultivated is a task common for all tsunami-afflicted areas and country as a whole [Hori, 2012]. While the government has already come up with incentives for retiring farmers, it should also consider providing incentives to farmers who would expand operations in the afflicted areas, expected to play a major role in agricultural recovery.

Challenges in farming recovery

There is no official statistics on whether farmers have been able or not to harvest any produce on officially restored land in the affected prefectures. However, there are reports that some of already desalinated and restored tsunami-damaged farmland is still unproductive.

For instance, farmers have been unable to harvest any soybeans in a 30-hectare area out of planted nearly 45-hectare field in Rokugo, Eastern Sendai [Ishikawa and Ishikawa, 2014]. According to farmers remained high salt concentration in the farmland soils might have been reason for that. Similar complaints have also been heard from farmers in Iwate Prefecture who have seen seawater flowing back to five kilometers in the upper stream of some rivers due to land subsidence [Ishikawa and Ishikawa, 2014]. Even after restoration work is done, people in Ofunato have been unable to harvest crops on some farmland because of the lack of freshwater.

What is more, not all farmers could joint the government projects, including many medium and small-scale operators, and recover in lines with the government priorities[47]. For instance, in the tsunami-damaged areas of Miyagi prefecture most farmers are elderly (over 65), small-scale (under 1 ha), part-time and single crop (paddy only) farmers.

The process of reconstruction and rebuilding communities progress differently in individual places. For instance, Iwanuma was among the first municipality that initiated a collective relocation project[48] [Pushpalal, 2013]. The plan is to relocate 348 coastal homes and build 156 public housing unit in 20ha Tamaura Nishi District by April 2014. Agriculture was the largest industry in Tamaura but most workers were aging part-time farmers in

[47] e.g. to integrate with downstream industries.

[48] cost of purchasing land is born by the government while most residents bear construction costs as in some cases partial subsidies are also available. Those who can not buy own land and house can rent distaste recovery public housing.

predominately rice production. Enormous losses of houses, workshops, machineries etc. have made it difficult to restart farming, 90% of farmers left the industry, and citizen group decided to focus on large-scale agriculture revitalization. On the other hand, in Natori relocation plans have been delayed due to the conflicts of residents who want to return to previous neighborhood and who are against it

One of the important issue affecting new land development is the disaster areas is that more than 40% of residents in three Tohoku prefectures hope to sell their land or move away from areas subject to land-use reallocation projects, instead of returning to live there after the ground in designated areas is raised to rebuild new tsunami resistant towns [The Japan News, March 9, 2014]. Residents hoping to rebuild their lives are concerned that this widespread reluctance could leave the redeveloped areas with a host of vacant towns. Also, many municipalities involved are worried over revisions to the project plan plans, and say that more residents will leave if town rebuilding continues to be delayed due to plan revisions.

Land development in residential areas due to the March 2011 disaster is planned on 1,315 hectares in 40 areas across 16 municipalities in Iwate, Miyagi and Fukushima prefectures [The Japan News, March 9, 2014]. In surveyed 15 of the designated municipalities 43% of the respondents said they want to sell the land or move away from the areas. Meanwhile, a half of respondents answered they “want to continue living there,” or “want to keep the land.” 9% are still “undecided” which indicates that the number of people who could choose to sell their land or move out of the areas will rise.

Major problems associated with the planning and implementation of relocation has been: opposition of part of affected population, financial burden to individuals[49], different treatment and splitting of communities due to demarcation rule, unequal capability of local government for additional

[49] e.g. huge (6 times) differences in the land price in disaster (10,500-17,800 yen per m^2) and new settlement (60,000-81,500 yen per m^2) areas .

assistance for covering replacement costs, delays in land procurement, deficiency of traditional land registration and related disputes, inadequate manpower in authority [50], mortgage status of some lands [51], different regulations for alternative resettlements, complicated procedures and higher costs for individuals, etc. [Yonekura, 2013].

Another major problem has been that a significant portion of land plots is the "property of unknown persons" since information in the real estate registrations is out of date due to inheritors not properly changing registration[52], known owners are dead or moved to urban areas abandoning land, population decline, etc. [The Japan News, August 5, 2014]. Consequently, authorities have been hindered in conducting reconstruction work from disasters or public works projects, as they cannot obtain approval from landowners.

Some experts suggest that government should learn from the experience in farming modernization in the afflicted areas and apply the suggested measures nationwide to prevent further decline of Japanese agriculture [Hori, 2012]. That would require a fundamental modernization of agricultural policies allowing consolidation of farm management in bigger more competitive structures, removal of restrictions on farmland transactions, new entrants and corporative management, easing approval of farmland diversion to other uses, reforming agricultural cooperatives, further liberalization of internal and international trade, etc.

Namely, the agricultural reform incorporating some of above measures have been an essential part of the growth strategy of the new Abe administration [Government of Japan]. What is more, more and more people

[50] to complete land ownership investigation, land surveys and registration.
[51] E.g. in Sendai a quarter of land was under a mortgage and cannot be sold to government as par of group relocation arrangement. By end 2012 most banking institutions accepted request by the Financial Service Agency to release mortgages on the land [Yonekura, 2013].
[52] Due to hight costs or other reasons (multiple owners, disputes, etc.).

support the major new agricultural policies of the Government (The Japan News, July 15, 2014). Recent nationwide survey has found out that the policy of large-scale farming is supported by 73% of respondents, while only 17% were opposed. Moreover, most people support drastic reforms in the agriculture sector, as 79% of respondents backed the abolition of the rice paddy reduction program. Likely wise, 64% support the easing of regulations on buying and selling farmland to make it easier for corporations to own farmland for investment purposes, and 23% were against it. Furthermore, 76% agree with the policy of abolishing a system that the Central Union of Agricultural Cooperatives direct and control regional agricultural cooperatives, while 11% were opposed.

In addition, the policy of encouraging farmers to change from mainly cultivating rice to producing other products such as vegetables and fruits was supported by 78% of respondents and only 11% opposed it. Finally, the gap in the opinions was narrower regarding participation in the Trans-Pacific Partnership multilateral free trade agreement with nations in the Asia-Pacific region, with 43% in support and 35% opposing. Many people also called for improved food self-sufficiency, as 60% responded that the percentage of domestic agricultural products consumed in Japan should be raised.

The process of decontamination has been posing particular great challenges.

Decontamination of lands, houses, roads etc. in the affected areas has been a complex and slow process. Inevitably, priority has been given to decontamination of residences, public facilities and their surroundings, rather than farmlands [Watanabe, 2013].

Appropriate radioactive decontamination technologies have been applied according to the radioactive cesium density levels in farmland soil: up to 5,000 Bq/kg - inventing plowing, radiation transfer reduction cultivation, topsoil removal (unplowed land); 5,000-10,000 Bq/kg - top soil removal, inverting plowing, padding with water; 10,000-25,000 Bq/kg - topsoil removal;

more than 25,000 Bq/kg - using soil hardener for topsoil removal [MAFF, 2012].

The results of farmland decontamination demonstration projects show that the topsoil removal reduced the radioactive cesium levels in plow layers by about 80-90% and air dose rates at a height of 1 meter above surface about 60-80% [MAFF, 2013]. Similarly, inverting plowing reduced the radioactive cesium in plow layers by about 60% and air dose rates at 1 meter above surface about 30%. Moreover, all results of test cropping on the farmlands decontaminated under these projects have been below the minimum detection limit.

Various trials have been also made at grass-root level and some new plant introduced such as rape blossom seeds, sunflower etc. which reduce contamination of soils and air [JFS, 2011; NHK World, December 9, 2013, March 10, 2014]. For instance, recovery group “Resurrection of Fukushima” was established three months after the accident. Now there are 250 members in the group, including researchers in the fields of physics, IT, and agriculture, as well as volunteers from all over the country [NHK World, December 9, 2013].

Likewise, a number of measures were used to reduce radioactive materials in farm trees and crops such as: removal of rough bark in apple, pear and other fruit trees with rough bark; high-pressure washing for peach and other fruit trees having no rough bark; and for tea - pruning (deep skiffing and medium level cutting) covering leave layers, and at non-pruned tea fields puning branches to increase leaves for cutting [MAFF, 2011].

Besides, diverse measures to reduce the transfer of radionuclides from the soil to crops have been recommended such as: changing crop structure; application of potassium-based fertilizers (such as potassium silicate) and zeolite (natural mineral effective in improving soil quality); using combines for harvesting in order to reduce adhesion of soil; abating the impact of ambient radiation by avoiding the practice of drying harvested rice plants naturally in

the sun; transition to organic farming; bioremediation of farmlands, etc. [NHK World, March 10, 2014; Moqsud and Omine, 2013; Watanabe, 2013].

In relation to the livestock and livestock products, different measures have been promoted by the MAFF for preventing grass from absorbing radioactive cesium. Until the end of FY2012 such measures were completed for 17,000 ha (44.73%) out of the 38,000 ha in grassland subjected to these measures [MAFF, 2013]. Consequently, the frequency of exceeding the maximum limit of radionuclides in farm and livestock products has declined substantially.

Similarly, new crops, products and technologies have been introduced such as plant factory, IT and smart innovations, biodiesel fuel made from sunflower and camellia seeds, land-sharing for crop and solar energy productions, etc.

Decontamination of farmlands outside the evacuation zone has been completed and farming resumed in most places. According to the officials appropriate reduction of radiation was achieved to allow the safe production. The later has been also confirmed by the multiple safety checks up and the removal of restrictions on production and shipments of major farm produce. However, according to experts still there are many hot spot with excessive contamination. Experimental rice production on some farmlands in the evacuation zone started in 2012 and it has been gradually expending [Kageyama, 2012].

Insufficient decontamination of farmland and irrigation canals, decreased motivation among farmers, and local anxiety over rumors about contaminated harvests are major reasons for the low resumption rate of farming in former evacuation zone [NHK World, June 11, 2014]. Furthermore, it has been difficult to farm efficiently (e.g. water control in paddy fields) since farmers were not allowed to stay permanently, there has been uncertainty associated with marketing of output (high contamination, unwillingness of buy the region), and in some case radioactive water runoff from mountains to

reservoirs for irrigation and/or paddy fields. The later has been an issue for farmers beyond the evacuation areas as well [HNK World, March 10, 2014].

Furthermore, the process of decommissioning the nuclear reactors is at the beginning stare and is expected to last 30-40 years and associated with many challenges such as lack of experiences, available technologies, uncertainties and risks, public concerns, lack of disposal cite, etc. (NHK World, August 2, 2014).

What is more, un to date, it has been difficult to secure cites for long-term and permanent disposal of radioactive waste and contaminated soil, leaves, and mud removed during decontamination work, and other radioactive waste have been stored at temporary sites across Fukushima prefecture.

According to expert there are 3 million tons of tainted biomass in Fukushima and its disposal is a big challenge (The Japan Times March 23, 2014). In addition, there have been collected a huge amount of contaminated soils, debris, incinerated ash, mud from sewage, straw, etc. located in Tokyo and 11 other prefectures. In the end of March 2014 there are a total of 143,689 tons of materials defined by the Government as “designated waste”[53] (The Japan News, July 9, 2014). There is a government plan to build interim storage facilities in 2 cities (Okuma and Futaba) to store contaminated soil, waste and ash from burned contaminated materials. These sites are to operate for up to 30 years but residents of candidate places continue to oppose the plan (NHK World, June 8, 2014).

Technological and organizational adaptation

Reconstruction and recovery challenges have also had positive effects on the technological and organizational development and innovation in agriculture and related industries. The enormous public funding as well as the

[53] containing radioactive substances measuring more than 8,000 Bq/kg,

novel business possibilities (and restrictions) have created new opportunities for revitalization and expansion of farming and agri-business in the most affected regions and beyond trough technological and organizational modernization.

There have been huge incentives for investment in soil decontamination, emergency aid, agri-food safety, production recovery and modernization, product and technologies innovations and diversification, agri-food marketing, reconstructing of business and infrastructure, other public and private research and development projects. All they have been opening up more entrepreneurial, employment and income opportunities for agricultural and general population, and diverse form of business and non for profit ventures.

Furthermore, according to the experts there are many companies (especially from he outside affected areas) wanting to lease in the abandoned farmland and a start large-scale corporate farming. That will let consolidate and enlarge farm size, introduces large-scale machineries and innovations, explore economies of scale and scope, increase investment and efficiency, diversify and improve competitiveness of farming enterprises.

For instance, rice paddies and farming equipment in the Nobiru district, Miyagi prefecture was ravaged by the tsunami and a large number of rice growers given up farming leasing out paddies to a local farming corporation [NHK World, June 12, 2012)] Before the disaster, the corporation managed 55 ha of 49 farmers but area increased to 81 ha of 46 more farmers after the disaster. The government has backed that move toward “mass farming” as well.

The plant “no-soil” factories have been developing in Japan for many years and now about 130 on them grow lettuce, herbs, tomatoes, strawberries, etc. [JFC, 2012]. Expansion of this new technology has been perceived as an efficient way to overcome some of major challenges associated with the post-disaster recovery in the affected regions such as – degradated (salinated or radioactive) soils, destructed farms and equipment, lack of employment and

income opportunities, aging farm population, insufficient integration in supply chain, etc.

For instance, a large futuristic vegetable plant has been recently opened led by Fujitsu Ltd. Aizuwakamatsu Akisai Vegetable Factory uses renovated 2,000 m^2 idle semiconductor-manufacturing clean (free of environmental contaminants and pests) room facility of the company in Aizuwakamatsu, Fukushima Prefecture [Fukushima Minpo News, 26 January 2014] Production technology is chemical-free and completely controlled to maintain optimal growing and atmospheric conditions.

The factory produces low-potassium leaf lettuce on a demonstration basis handling the whole process of production ranging from seed sowing to shipment. Initial daily output of 1,800 heads of leaf lettuce is to be boosted to a maximum 3,500. Production space will be also expanded (by 1,000 $m^{2)}$ in the future. About 30 people are employed as staff is expected to increase as output grows. The product, containing 86% less potassium on average, is intended for people suffering from chronic kidney disease requiring dialysis. It is also kid-friendly since a low nitrate level makes it less bitter and more appealing to children.

Produced in a clean-room environment, output features few bacteria and a longer shelf life. Main customers include hospitals and department stores in and outside Fukushima. Annual sales are targeted at about 150 million yen in the initial fiscal 2014 year and 400 million yen in the third year (fiscal 2016). The plant's production is more expensive than the common varieties, but they have medical value, grow year around, they are organic and most importantly radiation-free [Lisa, 2014].

Similar factory has been built in Natori, Miyagi prefecture where the tsunami inundated more than half of the farmland. A 5,900 m^2 plant factory producing 1.4 million bulbs of lettuce in a year and costing 4.3-million dollar was built on tsunami-hit area by 3 farmers after their farms were devastated by the disaster [NHK World, June 12, 2012]. Soil salt contamination has not

been not a problem because the crops are grown in water while water temperature is controlled to enable year round production. Output is sold to a nationwide restaurant chain operator. The biggest challenge was the high construction cost since the Government subsidies covered 80% and farm group had to borrow one million dollars. Farmers expect to pay back the borrowed money in 7 years.

A newly formed agricultural corporation Michisaki built indoor hydroponic “plant factories” on a just under seven acres rented land where tomatoes, spinach, and other vegetables grow under precisely regulated conditions from April 2013. It hires 10 full-time and 50 part-time workers, and market the produce to convenience stores and chain supermarkets. Using recycled heat from a nearby sewage treatment plant and fish byproducts from the port as fertilizer is also planed [Bird, 2013].

Another example is the state-of-the-art “Domed” Indoor Farms in Rikuzentakata, Iwate prefecture that harnesses solar energy and water to grow lettuce [Reconstruction Agency, 2014]. The facility was built on 1.8 ha of land that was devastated by tsunami and transformed into a sustainable agriculture project with eight 5-by-30-meter domed indoor farms that utilize a number of innovative energy efficient features to reduce costs and improve production. This public-private-partnership project was developed through a joint venture between Granpa Co. Ltd and Tobishima Corporation with the support of a JPY300 million subsidy from the Ministry of Economy, Trade and Industry in January 2012.

The facility was established in July 2012 and immediately began shipping produce. Each dome produces about 450 heads of lettuce per day, which is supplied to supermarkets, major sales retailers and sandwich chains. In addition to the solar power capabilities, the facility's innovative features include air conditioning system that uses an exhaust opening in the ceiling to improve energy efficiency during the summer and winter months.

The facility also incorporates a unique layered seedling planting design, which maximizes efficiency of the space, increase production capacity and reduce the labor and energy costs. Since lettuce produced at the facility is natural and guaranteed to be free from any forms of pollution, the local governments regard it as a promising new agricultural model that can appeal to customers while contributing to the local revitalization. The project contributes to local economy by creating 20 new jobs and establishing sustainable business model of partnership with major food-chain actors.

Due to the project's success the same model has already been adopted in Minamisoma in Fukushima Prefecture where municipality plans to build 7 plant factories over the 3 years in the hope that local farmers can make a fresh start. For instance, a Kawauchi farmer and a local government official leads a group that farm in a sealed-off hydroponics factory with a technique where plants are grown using minerals and nutrients dissolved in water without using soil [The Japan Daily Press, May 12, 2013]. Aluminum-clad, soccer field-sized building was completed in April 2013 and produce 8,000 heads of lettuce for every farming cycle. The lettuce factory use filtered ground water, which is proven to be free of contaminants. Operations started with 25 employees providing jobs to unemployed idle farmers who were by the nuclear leak disaster. The produce is sold in Fukushima's supermarkets labeled “Kawauchi”.

Another example is the innovative Luxury Strawberry Farms in Yamamoto, Miyagi prefecture where March 2011 disaster wiped out nearly all strawberry farm greenhouses [Reconstruction Agency, 2014]. The project has been realized by IT specialist, who combined technology expertise with passion for reviving hometown agriculture. He established the General Reconstruction Association (July 2011) and has been able to rebuild the strawberry industry using advanced IT systems and creating something new and innovative. The business uses technology to optimize the climate for growing strawberries by automating windows and sprinkler systems.

Local strawberry farmers, who lost their jobs as a result of the tsunami, have been hired and their expertise used to enhance product quality and secure knowledge digitally for future generations. The business led to the stabilization of the strawberry industry in Yamamoto and helped building a high-quality luxury brand image. The unit price has more than tripled from about ¥980 per kg before the tsunami to ¥3,000 per kg with the luxury "migaki-ichigo" strawberries selling for ¥1,000 per piece.

The plant factory technology has a number of advantages: capacity for stable year-round production; possibility to be installed on non-farmland areas (industrial parks, vacant stores etc.) in shopping districts; safe and high-quality agricultural produce with no or minimal pesticide use; employ novice farmers due to the light workload and the ease of standardizing procedures; comfortable work environment in which the elderly and people with disabilities can work with ease.

Comparative survey also shows that the consumers' awareness of plant factory has increased in recent years (from 69% in 2009 to 76% in 2012) while the purchase experience also raised (from 9% to 17% accordingly) [JFC, 2012]. Furthermore, consumers find superiority in the plant factory vegetables over the conventional farming in terms of safety, looks, ecology, etc.

What is more, the financial institutions (e.g. JFC) provide long-term financing with fixed, low-interest rates, taking into account unique business characteristics such as long investment recovery periods and unstable incomes influenced by the weather risk [JFC, 2012]. Besides, JFC also serves as a safety net for the agriculture, providing quick and flexible finance for disasters, etc.

Furthermore, in response to March 11 disaster the JFC established an interest-free Special Earthquake Loan for those who suffer from direct or indirect damages by the earthquake or tsunami. The Agricultural Improvement Loan is an interest-free financing program that supports farmers' challenges such as when they adopt a new crop or technology. Moreover, for the Eco

farmers the maximum repayment periods can be extended from 10 years to 12 years and the maximum loan amount from 80% to 100% of total project costs.

In order to support further challenging projects the JFC also provides Capital Subordinated Loan [JFC, 2012]. The later is not recognized as debt but as capital in borrowers' financial statement because there is no need to repay principal for the first 8 years and interest rates are reviewed regularly according to the financial performances.

Nevertheless, there a number of challenges associated with that new technology such as: high building and running costs, difficulties in establishment of cultivation technique, and securing of human resource development, difficulties to use existing food certification system (because fertilizers for nutriculture are used to the water prepared for breeding and cultivation)[54], etc. Under the new technology plant factory produce is a little more expensive (less competitive) than products grown outdoors or in greenhouses. Therefore, the key to success is to secure stable outlets for marketing the output through close vertical integration. Since food and food service industries need a stable supply of good quality produce it is extremely important to build business ties with vertical counterparts to secure outlets for the produce at the initial stage.

Another prospective technology applied in the disaster-hit area is "solar sharing" - a process in which farmers generate solar power on the same land where they grow crops.

Farmers in Fukushima prefecture have been testing that new technology and hope to sell power to help improve farmland or cover losses in income caused by radiation fears [Asiaone News, June 26, 2013]. In Minami-Soma, the prefectural government has begun a model project and a 2,000 square-metre piece of farmland in the city's Odaka district is an example

[54] Since March 2012, a new third-party certification system evaluating the safety of vegetables produced in plant factories has been introduced.

of solar sharing. On the farmland, 500 solar panels, each 70 centimetres by 1.6 metres, are installed atop 1.9-metre poles. Below the rows of panels, eggplants, chili peppers and produce are grown on an experimental basis.

The prefectural government set up the project to determine how the use of the panels affects plants. An increasing number of farmers affected by the nuclear plant crisis want to convert their land into mega solar power plants while continuing to grow crops on the same land. Farmers can sell the electric power to the utilities because since July 2012 there is a system that obliges electric power companies to buy power generated by renewable energy sources at fixed prices. However, MAFF set some conditions for farmers wanting to use their land for solar sharing – e.g. they must continue to cultivate the land, and annual crop volume cannot fall 20% or more compared with the regional averages after introducing solar sharing.

In addition, Eko Ene Minami-Soma Kenkyu Kiko, an incorporated foundation, plans a solar sharing project on about 600 m^2 of farmland. According to the foundation about 1 million yen of annual revenue is expected from selling the electric power generated in the project [Asiaone News, June 26, 2013]. Rapeseed has been already planted because its oil is free of contaminants even though the plants themselves take in some radioisotopes such as those of cesium.

In the end of 2013 the community run project Renewable Energy Village (REV) boasts 120 photovoltaic panels, generating 30 kilowatts of power, which is sold to a local utility [Gilhooly, 2013]. Plans are afoot to put wind turbines on some of the land. Recreational and educational facilities as well as an astronomical observatory will also be built if further funding can be secured.

Generous feed-in tariffs (renewable energy payments) set by the government also support the project. While the proceeds from the crops and energy will be ploughed back into the project, the REV's creators hope the

model will be mimicked by farmers whose livelihoods were decimated by the nuclear disaster.

Other large-scale solar projects[55] treat farming traditions since if farmers sell up land entire communities will be wiped off. The REV model offers a way around this issue – it protects farmland and communities, and with two parallel revenues creates increased prosperity compared with before the disasters.

Minamisoma's Solar Agripark opened in spring 2013 and combines a 500KW solar power facility with indoor plant farms [Reconstruction Agency, 2014]. A new children's park is being created, where youth affected by the disaster can receive hands-on learning experience featuring renewable energy and advanced agriculture, helping to educate the future leaders of the region on the importance of sustainability and energy efficiency. This project is supported by a JPY115 million investment from Toshiba and subsidies from the MAFF totaling JPY90 million. Energy generated from the solar facility is used to power the indoor farms, while surplus energy will be sold back to the grid through the feed-in-tariff system.

Other innovations have been also experimented. For instance, Dutch bio-farming company Waterland International and a Japanese federation of farmers made an agreement in March 2012 to plant and grow camellia on 2000 to 3000 ha [The Mainichi Shimbun, Aril 4, 2012]. The seeds will be used to produce bio-diesel, which could be used to produce electricity. The affected region has a big potential for production of clean energy since some 800,000 ha could not be used to produce food anymore. Experiments have been carried out to find out whether camellia was capable of extracting cesium from the soil since experiment with sunflowers had no success.

[55] Since the feed-in tariff was introduced (mid-2012), several other large-scale solar parks around Japan have been announced or are already in operation – but none uses solar sharing. Most solar parks have solar panels resting on the ground itself (including country's largest also in Minamisoma), which makes growing crops impossible.

Various areas in Tohoku have been also considering rapeseed as a source of bioenergy for the future [NHK World, July 29, 2013]. The recovery project called Nanohana, or Rapeseed Project is run by a company. The oil extracted from the rapeseed is processed into motor fuel. For one litre about 30 kilograms is needed. Concerned about environmental problems, this company started manufacturing biodiesel several years ago from used cooking oil that was collected through their cleaning services. Now they apply the same technology, for processing rapeseed oil into biodiesel fuel. Since the rapeseed is being grown on a very small scale the process is far from turning a profit.

Test runs on diesel vehicles have been completed. They hope to eventually produce and sell the biodiesel for use in ordinary vehicles. The main problem is the lack of farmland to grow rape. Members of the Rapeseed Project are focusing on farmland contaminated by saltwater. It is believed that if salt-resistant rapeseed could be grown there, the businesses could take off, which would also bring considerable relief to the farmers who lost their fields.

Meanwhile Tohoku University scientists have been conducting research on rapeseeds, their resistance to salt, application and improvement. The leafy part of the rape plant called nabana, is edible so it can be sold as food. Farmers can earn income from this plant by extracting the oil or selling it as food. The oil can be used to make soap, candles or biodiesel fuel so the plant can be used according to the needs of each farm. Nevertheless, the project is expected to take a minimum 10 years before achieving practical results.

Furthermore, Nonprofit body Koriyama Area Technopolis Promotion Organization (KATPO) has been set to begin a demonstration test of a hybrid renewable energy system combining geothermal and solar power generation for the heating of an agricultural greenhouse at the Iwase Ranch in Kagamiishi, Fukushima prefecture. [Fukushima Minpo News, January 21, 2014]. Two greenhouses are built for flower and vegetable plantation starting March 2014, with one of the facilities set aside for the hybrid energy system.

The experiment is implemented under the Fukushima prefectural government's project for the development of next generation technology for renewable energy. KATPO is the coordinator and study is done by Nihon University, Naito-Kogyosho Co. of Koriyama, Suzuki Seisakusyo Co. of Tanagura, Rhizome of Koriyama, and SK Electronics Industry Co. of Sukagawa. The period of demonstration is expected to be around three years, and the expertise and comparative data (on energy efficiency and cost of heating) obtained from the project will be made available to farmers after cost effectiveness has been confirmed.

Increasing applications of ICT in agriculture have been also reported leading to precision technologies, higher farming productivity, efficient use of resources, enhanced food safety, and improved relations with counterparts and consumers [NHK World, July 15, 2013].

The demand for proper measurements have induced numerous smart innovations for agriculture and related industries. For instance, a team of researchers from Fukushima University, PerkinElmer Japan Co. (a Japanese subsidiary of U.S. technology firm PerkinElmer Inc.), Japan Atomic Energy Agency, and Japan Agency for Marine-Earth Science and Technology has developed a new system that can quickly analyze the density of strontium 90 in soil (Fukushima Minpo News, September 19, 2013). The new system cuts the time of analysis to only 20 minutes from the existing one of two weeks to one month. The smallest amount of strontium detectable in soil is about 5 Bq/kg a figure that is sufficient to be deemed a risk to humans.

Similarly, a teach of scientists developed a car-borne radiation measurement method for the farmland and roads in the Minamisoma Ota area of Fukushima, and a community led radiation measurement framework was established and implemented [Furutani et al. 2012]. As a result, radiation measurements and visualization for farmlands, paddies, and forests, which had been conventionally unachievable, has been made possible. Furthermore, effective verification of the effect of decontamination also became possible by

feeding back the radiation measurement results before and after decontamination to the residents.

Improvement of agri-food regulation and inspection system

Up to the Fukushima nuclear plant accident there had been no adequate system for the agri-food radiation regulation and inspection to deal with such a big disaster [MAFF, 2011].

On the wake of the accident a number of measures were taken by the government to guarantee the food safety in the country. Widespread inspections on radiation contamination were introduced and numerous shipment and consumption restrictions on agri-food products imposed. Within a week from the nuclear accident the Ministry of Health, Labor and Welfare (MHLW) introduced Provisional regulatory limits for radionuclides in agri-food products (Table 19).

Table 19. Provisional regulatory limits for radionuclides in agri-food products (Bq/kg)

Products	I-131	Cs-134 + Cs-137
Drinking water	300 (100)*	200**
Milk/Milk Products	300 (100)*	200**
Vegetables/Fish	2000	500**
Cereals/Meat/Eggs	-	500**

**for infants ** values take into account contribution of radioactive strontium*

Source: Ministry of Health, Labor and Welfare

In order to meet growing public safety concerns since April 1, 2012 new[56] official limits on radioactive cesium in food items have been enforced in the country (Table 20). Four categories of Drinking water, Infant foods and Milk, and General foods are distinguished while the new safety standards are more stringent than in international ones.

Table 20. New Standard limits for radionuclides in food in Japan (Bq/kg)

Food item	Cs-134 + Cs-137
Drinking water	*10**
Milk	*50**
General Foods	*100**
Infant-food	*50**

** limit takes into account contribution of radioactive strontium, pultonium etc.*

Source: Ministry of Health, Labor and Welfare

For some raw materials and processed food (like rice, beef, soybean) were set transitional measures and longer periods (until December 31, 2012 or "the best before date") for complete enforcement of the novel safety standards. The reason is that producers of such commodities need more time for preparation to prevent any confusion in distribution at the time of shift to new limits for radionuclides in food

In addition, MAFF undertook a number of measures to improve food safety: provided advice on creation of food inspection plans and supporting inspection equipment installations in affected prefectures; commissioned laboratories to analyze agri-food contamination; implemented technical guidance regarding feeding and management of livestock (March 19, 2011); set up provisional tolerable levels for forage for producing milk and beef below

[56] annual maximum permissible dose from radioactive cesium in foods reduced from 5mSv to 1mSv - the same level as Codex GLs [MHLW, 2012].

the provisional regulation value for food (April 14, 2011); set up provisional tolerable levels for fertilizers and feed for preventing radioactive contamination of farmland soil from expanding and for producing agricultural and animal products below the provisional regulation value for food (August 1, 2011); released a farmland soil radiation level map (August 30, 2011) and updated it covering a wider scope and more details (March 23, 2012); supported emergency radiation inspections for rice in Fukushima prefecture and conducted analysis of factors for radioactive contamination over the regulation level (November 2011); implemented restrictions on rice planting (April 22, 2011; February 28, 2012; March 25, 2013; March 7, 2014); revised provisional tolerable levels for producing animal and fishery products below the standards limits for radionuclides in foods (February 3 and March 23, 2012); published farmland decontamination technical book (August 2012), publish list of registered administrative and private laboratories for radionuclide inspections (April 1, 2013), etc.

Since June 2011 regular radiation tests have been carried out on great number of agi-food products[57] in 17 prefectures in Northeastern and Eastern Japan. In addition, since 2012 all rice bags (30kg) produced in Fukushima prefecture have been checked in the Agricultural Cooperative inspection cites to assure safety.

Furthermore, there have emerged many private and collective inspections systems introduced by farmers and rural associations, food processors, retailers, local authorities, consumer organizations, independent agents etc.

For instance, in Nihonmatsu-shi, Towa town, there was a sharp decline in well developed before the nuclear accident tourism and agricultural sells. The local Rural Development Association introduced radiation measurement of farm products in June 2011. It has been done in own laboratory by

[57] In late March 2014 the number of items was reduced from 98 to 65 because of low detection rate.

equipment supplied by a private company and costs 500 yen per test for farmers. Our interview with the Chairman found out that due to the timely introduction of safety inspection and proper product safety reporting (labeling) the number of costumers visiting that farmer market recovered almost fully as well as 80% of the sells on not restricted items. Municipality has also introduced 60 points for inspection of food for self-consumption, which is done free for producers.

Similarly, the group Rebuilding a Beautiful Country from Radiation launched an inspection service soon after the nuclear accident through a non-governmental fund and currently supports more than 90,000 farming households who pay a nominal fee to have their produce inspected for contamination and declared safe for consumers [Kakuschi, 2013].

Agricultural Cooperatives in Fukushima prefecture also conduct their own testing using analytical equipment (such as NaI scintillation spectrometer) either purchased or borrowed from a government agency [Watanabe 2013]. Before shipping produce, member farmers bring crop samples to testing sites where measurement is done (about 30 minutes per crop) for free. What is more, many agricultural cooperatives in the prefecture have in place systematic testing regimes covering every farm and item, and all members are required to have their produce tested by the cooperative before shipping.

The Fukushima Consumer Cooperatives Union has also 30 machines around prefecture for food inspection and training of members. In addition, it introduced 35 machines for radiation body check providing free mobile service including in neighboring prefectures.

Many farmers groups and organizations from heavily contaminated areas have been organizing own tests on soils (detailed maps) and other inputs (water, livestock feeds) as well as screen output to secure safety. For instance,

a large scale tests to collect data[58] and find a solution on fighting rice contamination has been carried by a group in Nihonmatsu no comparable with all experiments done by national or local governments [NHK World, March 10, 2014]. Another producer group from Nihonmatsu developed a way to put all information about their products (contamination, betacarotene and sugar content sugar) as well as details about who grew what, into a QR code, a kind of bar code that people can scan with their cellphones [The Japan News, March 7, 2012].

Recovery, Sunday, evening, promotion etc. markets, Farmers' Document and Farmers' Café events etc. organized by farmers, authorities, NGOs, food chain partners etc. have been regularly held in Fukushima and around the country, where farmers sell directly their products confirmed as safe through voluntary screening [Koyama, 2013].

On the top of that, various voluntary restrictions on sale have been introduced by farmers, farmers' organizations, food industry, and local communities.

According to some farmers the biggest hurdle they face is the lack of a clear radiation risk standard that can be accepted by all [Kakuchi, 2013]. In order to address consumer concerns on food safety some producers, processors and retailers started to use lower than the official norms for radiation. Simultaneously, there has been a progress in efficiency of radiation testing devices for farm and food products.

Nevertheless, many concern consumers continue to disbelieve in the existing inspection system and employ other ways to procure safe food (direct sales contracts, origins, imports, etc.) [Kakuchi, 2013; Ujiie, 2012].

There have been a number of challenges with the present system of safety inspection. Due to the lack of personnel, expertise, and high-precision

[58] e.g. they proved that crops at organic farms were free of contamination becouse well-mainatined fertile soil helps immobilize cesium.

equipment, the water, food and soil tests have not always been accurate, consistent and comprehensive. For instance, quite expensive high-precision instruments are not available everywhere to measure lower radiation levels set up by the new regulation – e.g. for drinking water capable of detecting a single-digit level of becquerels.

Food safety inspections are basically carried out at distribution stage (output for shipment or export)[59], and do not (completely) cover produces for farmers markets, direct sells, food exchanges and self-consumption. Nevertheless, Fukushima prefecture and municipalities have been strengthening their inspections for self-consumed agricultural products since 2013.

Furthermore, capability for radiation safety control in Fukushima prefecture is significantly higher than in other affected regions, while radiation contamination has “no administrative borders”. In fact most food is regularly inspected in Fukushima prefecture and it is much safer than in other prefectures where such strict tests have not been not carried out at all.

What is more, many of the privately and collective employed testing equipment are not with high precision, and/or samples are properly prepared for analysis (e.g. by inexperienced farmers). Consequently, some of the sold and consumed products are labeled as “Not detected” despite existing contamination. Some tested agricultural products are further cooked or dried reaching higher levels of radiation at consumption stage. Uptake of radioactive materials with food by the local residents increases especially during summer season when most of the fresh vegetables and fruits are consumed.

Moreover, there are untested wild plants and/or produced food, which are widely consumed by local populations. For instance, radioactive

[59] Cropping itself has not been restricted and inspection carried at ex-post production- shipping stage.

contamination in forestry trees leaves has been found far away in Nagano prefecture.

Furthermore, there are considerable discrepancies in measurements of radiation levels in air and food done in a specific location. For instance, in Nihontatsu-shi laboratories of the NGO and the Government are located across the street (50 m of each other) but they often register different radiation in environment and food.

Agri-food inspections, regulations and countermeasures are conducted in vertically segmented administration with “own” policies and not well-coordinated procedures. For instance, soil contamination surveys and inspection of agricultural produce is conducted by MAFF, monitoring of air radiation levels by MEXT, regulations on food safety standards and value determination by MHLW, decontamination and waste disposal by the Ministry of the Environment, training associated with food safety by Consumer Affairs Agency, and promotion of restoration plans and decontamination programs under the Reconstruction

Similarly, there are no common procedures and standards, nor effective coordination between monitoring carried out at different levels and by different organizations (national, prefectural, municipal, farmers, business, research etc.). Neither there is common framework for centralizing and sharing all related information and database, and making it immediately available to interested parties and public at large.

Officially applied area based system for shipment restrictions have been harming many farmers producing safe commodities. Consequently basis instead of a municipal area wide blanket lifting and permit mushroom shipments by selected farmers has been recently introduced.

Last but not least important, there have been on-going discussions among experts about the “safety limits” and that lack of agreement additionally confuses producers and consumers alike.

Nevertheless, there has been attempt to improve coordination and cooperation between different agencies. For instance, analysis on contamination of agri-food products is one of the major working areas of the Fukushima Future Center for Regional Revitalization. When unsafe food items are found the FATC is informed and the later take decision for ceasing shipments. Similarly, Soil screening project in Fukushima is coordinated by FCCU with participation of number of regional agencies and volunteers from the entire country.

Experts suggest existing system to be further improved by creating uniform inspection manuals and standards, enhancing coordination and avoiding duplication between different organizations, establishing inspection framework that cross prefectural borders, and a new management system that extend random sampling tests of circulating produce (shipment level) with management/control at production “planning” stage [Koyama, 2013].

The later is to be based on detailed contamination maps of each agricultural field based on soil analysis, farmland certification system (similar to the local certification system based on “Guideline to indicate specially cultivated agricultural products”) targeting to establish production practices (crop selection, land decontamination, inputs control) preventing contamination of agri-food products. Consequently, depending on the degree of radiation dose effective decision could be made whether to restrict cropping (high level), decontaminate (medium level), or encourage certain type of crops combined with further reduction measures (low level).

Another challenge associated with current inspection system is the costs. Fukushima prefecture costs for food testing, including sample purchases, amount to about 150 million yen each year [Fukushima Minpo News, May 11, 2014]. Local government uses money withdrawn from its fund for residents' health management for food monitoring. When it began conducting tests (June 2011), the money in the fund that could be used for the screening process totaled about 2 billion yen while now (May 2014) they are about 600

million yen. Money is also used for projects and it is expected to be depleted in several years unless central government extends support. The prefectural government plans to maintain the number of tested items but it is unclear how much support it will get from the health ministry, which is moving toward decreasing the number of items subject to screening.

Producers have also expressed dissatisfaction over the MHLW's guidelines to reduce testing underlying that government perception is very different from that in the field [Fukushima Minpo News, May 11, 2014].

What is more, some farmers started to be nervous about the efficiency of the applied methods. In some places they discuss to cease inspections, which are associated with significant costs (time for preparation of samples, shipment, payments for tests) with no adequate compensation received or recovery of farming progressing.

Last but not least important, the public food safety policies have been also positively affected. For instance, the Great East Japan Earthquake and following nuclear disaster considerably impacted citizens' consciousness on food security in Japan. This disaster has prompted more 34.3% of the consumers to "become conscious of need of food storage" on the top of another 34.5% who "remained conscious with that need" [MAFF, 2012]. A great part of the surveyed consumers have also strongly recognized the importance of different food supply arrangements

There have been a number of challenges in public support response as well. Most important among them are: delay in establishing Reconstruction Agency (February 2012) for coordinating multiple recovery efforts in affected areas; lack of clear government guidelines for the nuclear disaster recovery, lack of detailed contamination map for all affected agricultural lands, using extension officers for obtaining samples for monitoring tests while suppressing their ability of management consulting, introducing technology, and forming areas of production badly needed by farmers in affected areas, etc. [Koyama, 2013].

Long-term impacts of Fukushima nuclear disaster

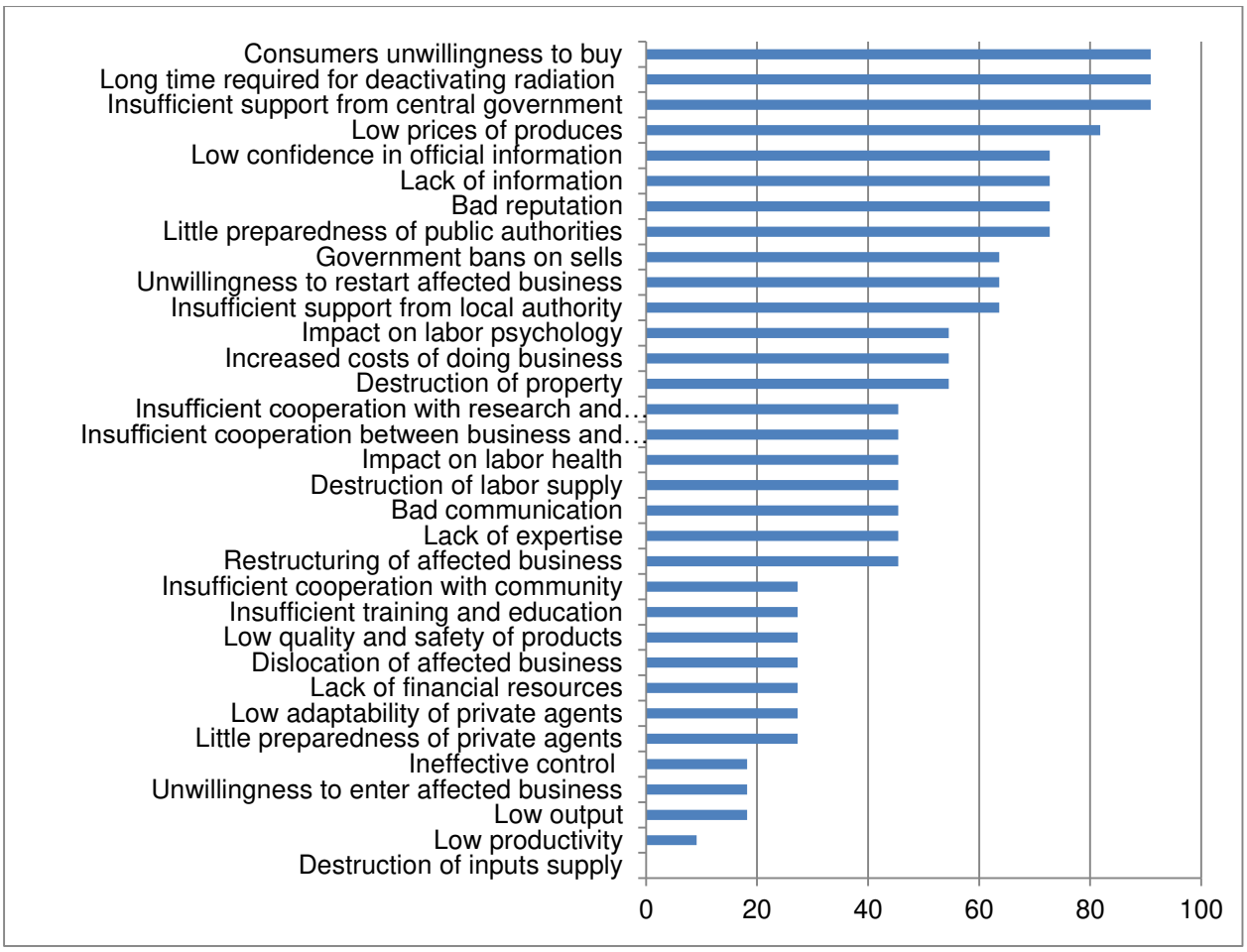
Furthermore, all experts think that the overall long-term impact of the Fukushima nuclear disaster on agriculture in Fukushima region will be negative. What is more, the biggest part of them assesses this impact as significant while the rest evaluate it as moderate (Figure 54).

Most experts evaluate the overall long-term impact on agriculture in neighboring regions as insignificant or none. Nevertheless, some good part of the experts believes that there will be moderate negative impact of the nuclear disaster on agriculture in these regions.

The overall long-term impact of the Fukushima nuclear disaster on agriculture in the other parts on Japan is estimated as none by the majority of experts.

According to the expertise the most important factor for persistence of the negative impacts on agriculture are: “consumers unwillingness to buy”, “long time required for deactivating radiation”, “insufficient support from the central government”, and “low prices of produces” (Figure 59). The “low confidence in official information”, “lack of information”, “bad reputation”, and “little preparedness of public authorities” are also identified as a significant factors for sustaining the negative consequences from the disaster in agriculture.

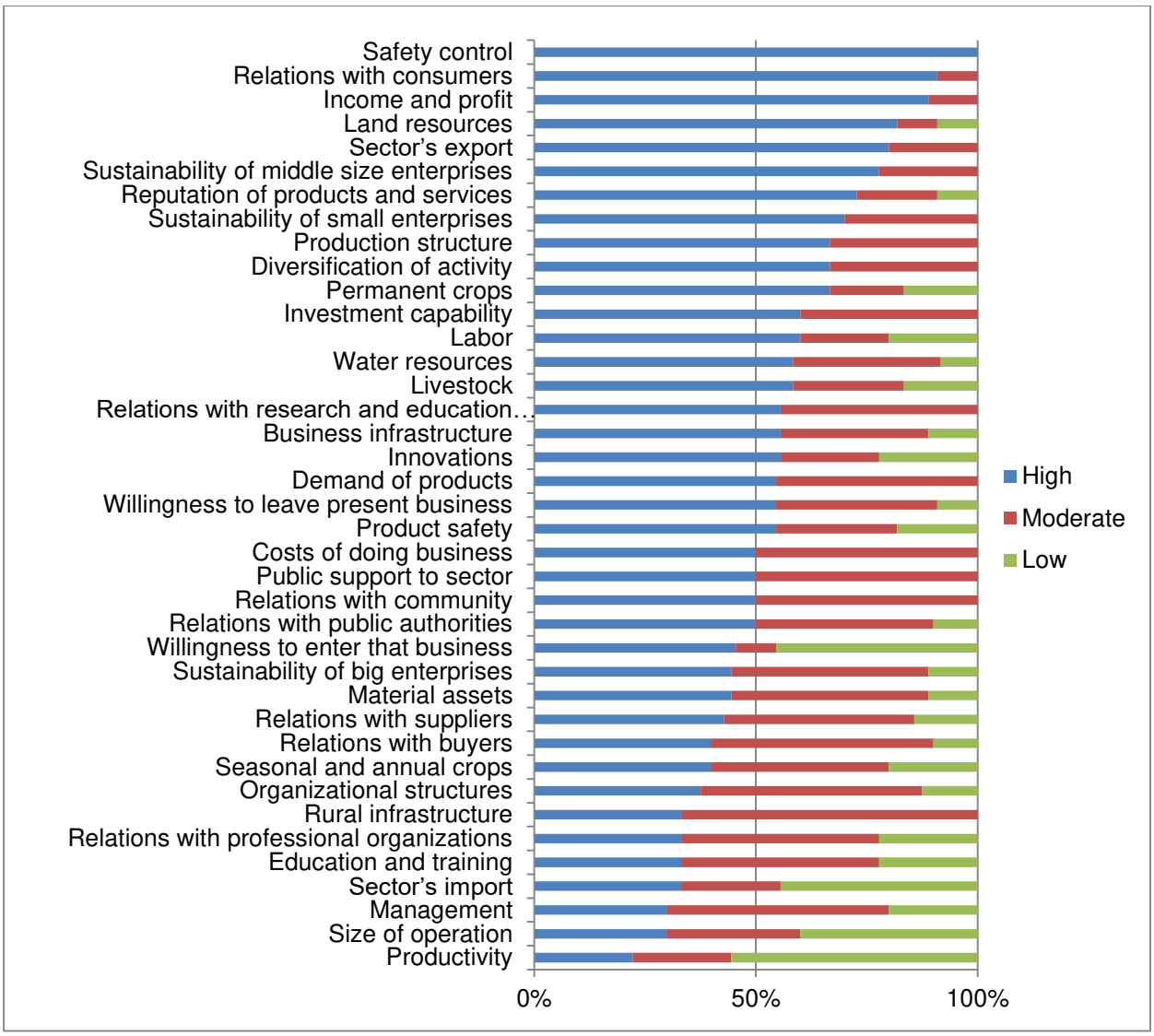
Figure 59. Factors for persistence of negative impacts of Fukushima nuclear disaster on agriculture (percent)



Source: assessment by panel of experts, June 2013

Furthermore, experts are unanimous that there will be a high long-term effect on food safety in agriculture (Figure 60). They also believe there will be significant effect on “relations with consumers”, “income and profit”, and “land resources” in this sector.

Figure 60. Long-term effects of Fukushima nuclear disaster on Japanese agriculture



Source: assessment by panel of experts, June 2013

Moreover, according to experts there will be high or moderate effects on "sector's export", "sustainability of small and middle size enterprises", "reputation of products and services", "diversification of activity", "permanent crops", "investment capability", "labor", "water resources", "livestock", "relations with research and education institutions", "demand of products", "willingness to leave present business", "product safety", "costs of doing business", "public support to sector", and "relations with community".

On the other hand, the long-term effect on "rural infrastructure", "relations with buyers", "organizational structures" and "management" in that sector is mostly estimated as moderate. Finally, according to experts the

nuclear disaster will have only low effect on the “productivity” and “willingness to enter that business”.

Conclusion

Suggested holistic framework let better understand, assess and improve eco-management in the specific market, institutional and natural environment of individual farms, ecosystems, regions, sub-sectors and countries. However, its application requires new type of data for the formal and informal rights distribution, system and efficiency of enforcements, personal characteristics of agents related to eco-management in agriculture, type of eco-problems and challenges, formal and informal forms of farming organization and contractual arrangements, critical dimensions of agrarian and eco-activities and transactions, etc.

We have also showed that the post-communist transition and the EU integration have brought about significant changes in the environmental management in the Bulgarian agriculture. The newly evolved market, private and public governance has led to a significant improvement of the eco-management and the eco-impacts of agriculture introducing modern eco-standards and public support, enhancing environmental stewardship, disintensifying production, recovering landscape and traditional productions, and diversifying quality, eco-products and services.

The agrarian transition and integration has been also associated with some new challenges such as unsustainable exploitation of the natural resources, lost biodiversity, land degradation, water and air contamination etc.

Furthermore, the implementation of the “common” EU policies has been having unlike results in the specific “Bulgarian” conditions. Up to date it enlarges the income, technological, and eco-discrepancy between different types of farms, sub-sectors of agriculture, and regions of the country. In a

longer-term the eco-hazard(s) caused by agriculture will likely expand unless effective public and private measures are taken to mitigate the existing eco-problems and risks. Moreover, the specific structures for the management of farming activity (small commercial, semi-market, and subsistence farms, production cooperatives, large business firms, etc.) will continue to dominate in years to come and have to incorporate the eco-management needs.

Therefore, a significant improvement of the public (Government, EU, etc.) interventions in the agrarian and eco-management is needed to enhance the sustainability of prospective farms, and the sustainable agrarian and rural development. The further implementation of the EU common (agricultural, environmental, regional, etc.) policies would have no desired impacts on the environmental conservation and improvement unless special measures are taken to improve the eco-information and assessments; modernize the system of property rights, public regulations and enforcement; perfect the management of public organizations, programs and services; and extend the public support to and partnerships with the dominating farming (including small-scale and subsistence) structures, etc.

Furthermore, the first large-scale study on the forms, factors and the efficiency of eco-management in the “eco-active” farms in Bulgaria have found out that the structure of these holdings is similar to the country’s with more massive presence of farms specialized in the permanent crops. Besides, the biggest part of the eco-active farmers are with a small “farming experiences” proving that the specific issue of the “eco-management” is new for most of the Bulgarian farms.

The majority of eco-active farms knows and implements well the principles of eco-friendly agriculture. With the greatest internal knowledge capability are Cooperative farms, while for some Physical Persons the implementation of eco-principles is associated with certain conditions such as economic rationality, importance of the eco-actions, existing

environmental problem in the farm, a public contract, or a collection action with others.

A good portion of the eco-active farms are certified or in a process of certification for the organic production, while others are with a plan for a bio-certification. Other market, private, and collective forms of eco-management (such as own or collective eco-label, protected origin, supply of eco and related services, establish good reputation, participation in diverse private, collective and public initiatives) are less frequently employed by the Bulgarian farms.

To the greatest extent the eco-activity of the eco-farms farms is stimulated by the personal conviction and satisfaction of the farmers from eco-activity, the participation in the public support programs, the received direct public subsidies, the professional eco-training of the farmer and the hired labor, the market competition, the access to the farm and eco-advices, the possibilities to increase profit, the co-benefits for your farm in the longer-term, and the European Union policies.

On the other hand, the factors mostly restricting the eco-activities of farms are the amount of the direct costs for eco-friendly activity, the state control and sanctions, the state policies, the financial capability of the farm, the market demand and prices, the market competition, and the amount of costs for eco-cooperation.

The public support to the eco-active farms is higher than the average in the country for the farms of the similar type and location. The greatest fraction of these farms have been supported through the Measure 214 “Agro-environmental payments” of the NPARD, the Directs Area-based payments from the EU, the Measure 141 “Semi-subsistence farming”, and the Measures 111, 114 and 143 “Professional training and advise”, the National tops-ups for products, livestock, etc., the Measure “Setting up of young farmers”, and the Measure 121 “Modernization of agricultural holdings”.

For most beneficiaries the biggest impact on their farms have been caused by the Measures 111, 114 и 143 “Professional training and advices”, the Measure 214 “Agro-environmental payments”, the “Direct Area-based subsidies by the EU”, the Measure 112 “Setting up of young farmers”, the Measure 141 “Semi-subsistence farming”, the Measure 121 “Modernization of agricultural holdings”, the “National tops ups for products, livestock, etc.”, and the Measure 211 “Natural handicap payments to farmers in mountain areas”.

According to the good part of the eco-active farms, the overall activity of their farms is associated with positive effects to the soils quality and biodiversity. The majority of them also believe that their overall activity does not affect the climate, surface and ground waters, landscape and air quality. Only a tiny amount of the farms suggest that the overall activity is associated with negative effects to the nature, and that mostly concerns the negative impact on climate and ground waters.

For a big part of the eco-farms their environment protection activity is connected with a “high” augmentation of the long-term investments, the overall production costs, the expenditures for registration, tests, certification, etc., and the specialized costs for the conservation of natural environment. Furthermore, for the majority of farms, their eco-management is associated with “average” growth in the specialized costs for the protection of natural environment, the overall production costs, the long-term investments, the costs for studying official regulations and standards, the overall management costs, the costs for acquiring information, training, and consultations, the costs for marketing of products and services, the costs for participation in the programs for public support, the costs for private negotiations and contracts, the costs for registrations tests, certifications, etc., the costs for cooperation with others, and the costs for resolutions of disputes and conflicts.

According to the greatest fraction of the eco-active farms, their environment protection activity is also associated with the augmentation of the economic and ecological efficiency of their holdings.

We have concluded that giving a special public support (training, information, funding, partnership, preferences, etc.) to the “eco-active” farms having a higher knowledge and applying greatly the principles of environmentally friendly agriculture, which would induce (implement, demonstrate advantages, inspire and involve others, etc.) the overall improvement of the agro-eco-management in the country.

Our in-depth analysis of the impacts of the 2011 triple environmental disaster in Japan has demonstrated that it has caused significant impacts on the agricultural development and the environmental management in the most affected regions, in neighboring regions, and nationwide.

It has been associated with considerable environmental, human, economic, market, etc. damages to the sector, destructions of market balances and demands for affected regions’ products, changes in the farming and institutional structures, enormous public interventions, intensive cooperation between diverse actors, etc.

Moreover, the post-disaster recovery has been connected with new modes for environment restoration, adaptation and improvement, and new technological, products and organizational innovations in the farming and agro-food supply chains alike.

Further studies on the system of agro-environmental management in the conditions of rapidly evolving market, institutional and natural environment (like in Bulgaria) as well as post-disaster recoveries and adaptations (like in the Japanese case) is necessary in order to deepen our understanding on factors, forms and efficiency of agro-eco-management, learn lessons from the good experiences and failure, and transfer acquired knowledge on eco-management and disaster-prevention and recovery to other regions and countries with similar conditions and challenges.

Therefore, it is crucial to give more public support to multidisciplinary and interdisciplinary research on all aspects and impacts of the eco-management, including factors and forms of eco-management, and their impact on individual and collective eco-behavior and environmental preservation.

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