Governing Agrarian Risks

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ABSTRACT

Risks management studies in the agri-food sector predominately focus on the technical methods and the capability to perceive, prevent, mitigate, and recover from diverse risks. In most economic publications the risks are usually studied as other commodity regulated by the market supply and demand, and the farmers "willingness to pay" for an insurance contract modeled. At the same time, the risk management analysis largely ignore a significant "human nature" based (bounded rationality, opportunism) risk, critical factors for the managerial choice such as the institutional environment and the transaction costs, and diversity of alternative (market, private, collective, public, hybrid) modes of risk management.

This paper incorporates the interdisciplinary New Institutional Economics and presents a comprehensive framework for analyzing the risk management in the agri-food sector. First, it specifies the diverse (natural, technical, behavioral, economic, policy etc.) type of agri-food risks, and the (market, private, public and hybrid) modes of their management. Second, it defines the efficiency of risk management and identifies (personal, institutional, dimensional, technological, natural) factors of governance choice. Third, it presents stages in the analysis of risk management and for the improvement of public intervention in the risk governance. Forth, it identifies the contemporary opportunities and challenges for the risk governance in the agri-food chain. Finally, it identifies, and assesses the efficiency and prospects of major modes for risk governance in the Bulgarian dairy sector.

Keywords: agri-food chain and risk management; market, private, and public governance; dairy risk management, Bulgaria

1. INTRODUCTION

Around the globe the issues of management of diverse (natural, technical, market, financial, criminal, policy etc.) risks in agrarian and food sectors are among the most topical in academic, business and policies debates [Babcock; CIPS; Deep and Dani; EU; OECD; Olsson and Skjöldebrand; Ramaswami; RPDRM; Schaffnit-Chatterjee; Shepherd et al.; Trench et al.; Weaver and Kim]. In the last decades, newly evolving uncertainty, risks and crisis associated with the progression of natural environment, products and technology safety, social demands, policies, economy, and globalization, all they have put additional challenges on existing system of risk management in agri-food sector.

Most risks management studies in agri-food sector predominately focus on technical methods and capability to perceive, prevent, mitigate, and recover from diverse threats and risks [Barker; DTRA & IIBR; Hefnawy; Jaffee et al.; Luning et al.]. In majority of economic

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publications a Neoclassical approach is applied, the risks is studied as other commodity regulated by market supply and demand, and farmers "willingness to pay" for an insurance contract in relations to agents risk aversion, risk probability and magnitude of damages modeled [Gerasymenko and Zhemoyda; OECD]. Nevertheless, market and private failures are acknowledged, and the needs for public intervention in risk management increasingly recognized. At the same time, risk management analyses largely ignore a significant "human nature" (bounded rationality, opportunism) based risks, the critical factors for the managerial choice such as the institutional environment and the transaction costs, and the diversity of alternative (market, private, collective, public, hybrid) modes of risk management. As a result, the efficiency and complementarities of diverse agri-food risk management modes can not be properly assessed [Bachev, 2012a].

Despite the significant advancement in the risk management technologies and the "menu" of risk reduction, mitigation and copping strategies, a great number of failures and challenges (production, supply chain, food and human safety, environmental etc.) continue to persist in agri-food sector [Dani and Deep; EU; Humphrey and Memedovic; OECD; Luning et al.]. Consequently, a greater attention is directed to the *system of governance* which eventually determines the exploration of technological opportunities and the state of agri-food security [Bachev, 2010a, 2011c].

This paper incorporates the interdisciplinary *New Institutional Economics* [Coase, 1939, 1960; Furuboth and Richter; North; Williamson, 1981, 1996] and presents a comprehensive framework for analyzing the risk management in agri-food sector.

First, it specifies the type of agri-food risks and the modes of their management.

Second, it defines the efficiency of risk management and identifies factors for the governance choice.

Third, it presents stages in the analysis of risk management and for the improvement of public intervention in the risk governance.

Forth, it specifies the contemporary opportunities and challenges for the risk governance in the agri-food chain.

Finally, it identifies, and assesses the efficiency and prospects of major modes for risk governance in the Bulgarian dairy sector.

The ultimate goal of this paper is to improve the analysis of risk management in agri-food sector, and to assist public policies and risk management strategies and collective actions of individual agents.

2. Framework for analyzing and improvement of risk management

Agri-food risks and modes of risk governance

Risk related to agri-food sector is *any current or future hazard (event) with a significant negative impact(s).* It is either an *idiosyncratic,* accidental, low probability, unpredictable event/threat, or it is *systematic* - a high probability, "predictable" event/threat.

The risk and threat could be of a *natural* origin - e.g. adverse weather, insect attract, catastrophic event etc. They may be of a *technological* origin - "pure" technical failures like tractor's flat tire, engine disorder etc. They are often of *human origin* - individual or collective actions/inactions, "human nature". Frequently, risks are a combination of previous three.

A great portion of risks in agri-food sector are caused or are consequences of a human actions or inactions. The *individual* behavior and actions causing risks may range from:

- *agent's ignorance* – "normal" human errors, lack of sufficient knowledge, information, and training;
- *risk-taking (retention) strategy of individuals* - accepting "higher than normal" risk;
- *mismanagement* - bad planning, prevention, recovery;
- deliberate *opportunistic behavior* - pre-contractual cheating and "adverse selection", post-contractual "moral hazard";
- *criminal acts* such as stealing property or yields, arson, invasion on individual safety;
- *terrorist attacks* – e.g. contamination of inputs and outputs aiming "mass terror" etc.

The *collective actions* which are source of risks are commonly related to:

- *economic dynamics and uncertainty* - changing industry and consumers demands, market price volatility, international competition, market "failures" and disbalances such as "lack" of labor, credit, certain inputs etc.;
- *collective orders* - "free riding" in big organizations, codes of behaviors, industry standards, strikes and trade restrictions, community rules and restrictions;
- *public order* - political instability and uncertainty, evolution in informal and forma social norms and standards, public "failures" such as bad, delayed, under/over intervention, law and contracts enforcements, mismanagement, "inefficiency by design", etc.

The agri-food sector risk could be *faced* by an agri-food sector component - e.g. risk *on* a dairy-farm, *on* a food processor, *on* a trader. The risk could also be *caused* by the agri-food sector - risk *from* farming, from food processing, *from* food-distribution etc.

The risk could be *internal* for the agri-food chain such as hazards cased by one element to another, and staying in or mitigating *within* the sector. It could also be *external* associated with hazard coming from outside factors (such as natural environment, government policy, international trade), and/or affecting external components (consumers, residents, industries, nature).

Finally, the risks could be *private,* when it is taken by individuals, collectives, economic entities (households, firms, cooperatives), industries. The risk is often *public* affecting large groups, communities, consumers, society, future generations.

The risk is big when there is *great likelihood* of a risky event to occur and that is combined with substantial possible *negative consequences.* The later may take a great variety of forms – e.g. damaged human and livestock health and property, inferior yields and income, lost market positions, food and environmental contamination etc.

When risk is considerable it would likely be associated with *significant costs* which sometimes are hardly expressed in monetary terms - e.g. human health hazards, degradared soils, lost biodiversity and eco-system services etc. Thus the "rational" agents maximizing own welfare will be interested to *invest in risk prevention and reduction*.

In a *narrow* ("technical") sense the ***risk management*** comprises the individual, collective and public *action(s)* for reducing or eliminating risk and its negative consequences. In a *broader* sense the *risk management* is the specific *system of social order* ***(governance)*** responsible for a particular *behavior(s) of agents* and determining the way(s) of assignment, protection, exchange, coordination, stimulation and disputing diverse risks, rights, resources, and activities [Bachev, 2011c]. In the particular socio-economic, technological and natural environment, the specific *system of risk governance* "put in place" is intimately responsible

for the efficiency of detection, prevention, mitigation, and reduction of diverse threats and risks and their negative consequences [Bachev, 2012a].

The generic *forms* and *mechanisms* of risk governance are (Figure1):

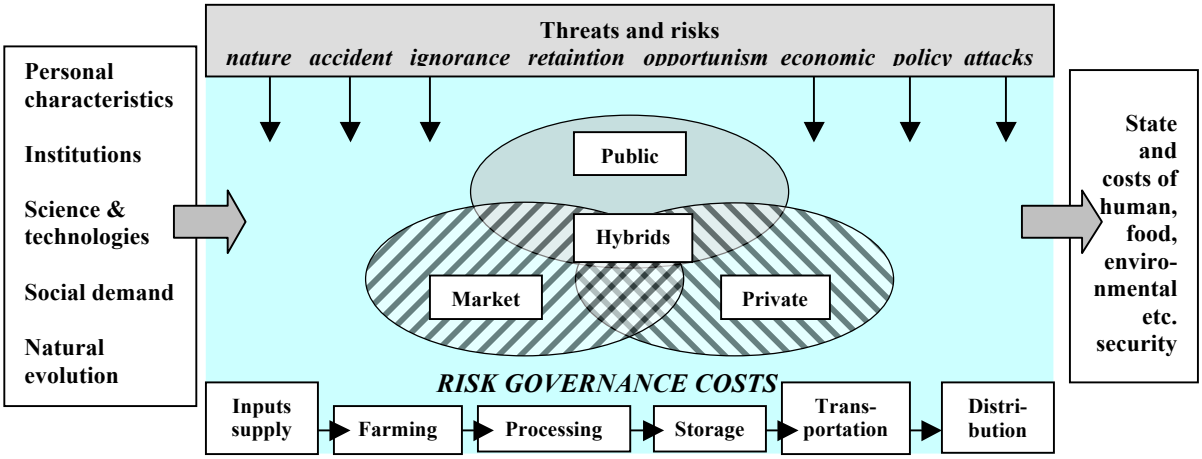

Figure 1. Generic risks, factors, stages and modes of risk governance in agri-food sector

- *private modes* ("private and collective order") - diverse private initiatives, and specially designed contractual and organizational arrangements tailored to particular features of risks and agents – e.g. private or collective codes of behavior, diverse (rational, security, future etc.) private contracts, cooperatives, associations, business ventures etc.

- *market modes* ("invisible hand of market") - various decentralized initiatives governed by the free market price movements and the market competition such as risk trading (selling and buying insurance), future contracts and options, production and trade of special (organic, fair-trade, origins) products etc.

- *public modes* ("public order") - various forms of a third-party public (Government, international) intervention in market and private sectors such as public information, public regulation, public ban, public assistance, public funding, public assurance, public taxation, public contract, pubic provision etc.

Sometimes, the risk management in agri-food sector could be effectively done though *"self-management"* – e.g. production management, adaptation to industry and formal standards, "self-insurance" though keeping stocks, financial reserves etc. For instance, primitive forms of *on farm* risk management through improving *production management* are widespread such as control and security enhancement, application of appropriate (pest, disease, weather resist) varieties, technology and production structure, product diversification, dislocation etc. Similarly, *off-farm* enterprise (and income) diversification is a major strategy for risk management in most of the European farms [Bachev and Tanic].

However, very often, the risk management requires an effective *governance of relations* with other agents – exchange and regulations of rights, alignment of conflicts, coalition of resources, collective or public actions at regional, national and transnational scales etc. Accordingly, a risk could be "managed" through a *market mode* (e.g. purchase of insurance, hedging with future price contingency contracts), a *private mode* (contractual or literal

integration, cooperation), a *public form* (state regulation, guarantee, compensation), or a *hybrid* combination of other forms.

Efficiency of risk management

The individual modes of risk governance are with *unequal* efficiency since they have dissimilar *potential* to reduce the likelihood and the (negative) impact of risk, and command different *costs* [Bachev, 2010a].

Principally, the market or the collective governance has bigger advantages over the internal mode ("own protection") since they allow the exploration of economies of scale and scope in risk prevention and bearing (sharing) negative consequences[2]. However, the risk trading and/or sharing is often associated with significant *transaction costs* - for finding best partners, prices, formulating and disputing terms of exchange, coalition, safeguarding against new risk from opportunistic behavior of counterparts or partners etc. Consequently, *market* and *private sector "fail"* to govern effectively the existing and likely risks in agri-food sector, and there is a need for a *"state intervention"* in risk management - assisting farmers cooperation, public costs-sharing or provision, mandatory insurance regulation etc.

Thus *"governance matters"* and applying a proper structure of risk management is an important part of the overall process of the optimization (effective allocation) of resources.

Following Coase's logic [Coase, 1960] if *property rights* were *well-defined* and *transaction costs* were *zero* then all risks would be managed in the most efficient (socially optimal) way independent of the specific mode of governance[3]. Then individual agents would either sell out their risk to a specialized market agent, or safeguard against the risk through terms of a private contract, or join a risk-sharing organization of interested parties. The risk-taking would be distributed between (exchanged, shared by) agents according to their will while the total costs for risk prevention, assurance, reduction, and recovery minimized. The rational choice for an individual agent would be to get rid of a significant risk altogether – to sell the risk out to a specialized market agent (a risk-taker). Such totally decentralized (market) governance would optimize the risk-taking and minimize the "technological costs" for risk assurance and recovery exploring the entire potential for economies of size and scope at national and/or transnational scales.

However, when property rights are not well-defined or enforced and transaction costs[4] are high then the *type of governance* is essential for the extent and costs of risk protection [Bachev, 2012a]. For instance, an internal (ownership) mode is often preferred because of the comparative protective and costs advantages for "standard" natural or behavioral risk management over the outside (market or contract) modes. What is more, frequently the enormous *transaction costs* could even *block the development of insurance market* or the emergence of *mutually beneficial (collective) risk-sharing organization*. It is well known that

[2] Most studies on risk management in agriculture focus on modeling farmers "willingness to pay" for a risk contract in relations to risk's probability and amount of likely damages [e.g. Gerasymenko and Zhemoyda].

[3] In such a world some kind of risks would not even exist or be of no importance - e.g. risks related to adverse human behavior (any opportunistic intention would be discovered at no costs and interests effectively safeguarded).

[4] Transaction costs are the *costs associated with the distribution, protection and the exchange of diverse rights and obligations of individual, groups, and generations* [Bachev, 2010a].

despite "common" interests and the huge potential for risk minimization the collective organization for risk-sharing are not or hardly developed by stallholders.

Furthermore, the formal and informal *institutional restrictions* could make some modes of risk governance impossible - e.g. risk assuring monopolies and/or cartel arrangements are illegal in many countries while most entrepreneurial risk-taking is endorsed (the "low risk - low profit" principle). Thus, not all modes of risk governance are constantly feasible in any socio-economic settings[5].

What is more, *individual agents differ* significantly in their *capacity to recognize, take, pay for prevention, and manage a risk.* For instance, a risk-taking farmer prefers risky but more productive forms (e.g. bank credit for a new profitable venture); the bigger enterprise can better perceive (hire expertise, collect information) and invest in protection of risks and/or take (absorb negative consequences) of a larger risk, etc. Besides, the individual agents have quite different interests for an effective management of a particular risk(s) since they get unlike benefits and costs from the risk management – e.g. effective environmental management often create costs for farmers while benefit the residents and other industries..

Last but not least important, there is no singe *universal* form for the management of divers type of risks and according to the *specific feature of each risk* (origin, probability, likely damages) there will be different most effective form of governance. For instance, while a low probable "standard" (natural, criminal) risk could be effectively governed by a classical market contract (e.g. purchase of insurance), most behavioral risks require special private modes (branding, long-term or interlink contracts, vertical integration), a high damaging risk from a terrorist attract necessities specialized public forms (intelligence, security enforcement) etc.

Hence, depending on the *kind and severity of risk*, and the *interests and personal characteristics of individuals*, and the *specific natural, economic and institutional environment*, there will be *different (most) efficient* forms of governing a particular kind of risk. Consequently, some *governance mix* will always exist to deal with divers risks associated with the agri-food sector [Bachev and Nanseki].

In many cases, an *effective* risk management leads to a considerable *reduction* or *removal* of a particular type of risk. However, often complete risk elimination is either very costly ("unaffordable" by individuals, communities, society) or practically impossible (when uncertainty associated with the future events is enormous, the transaction costs are very high etc.). For instance, certain natural risk will always exist despite the available system of risk management. Besides, it is practically impossible to write a "compete" contract (e.g. for insurance supply and trading risk) including all probable future contingencies, and the subsequent rights and obligations of each party. Consequently, some transacting risk will always retain. Therefore, an effective risk management is usually connected with the needs for some *trade-off* between the benefits from reducing a particular risk (saved costs, minimized negative impacts) and the related *costs for the risk governance*[6].

Furthermore, an individual mode of governance could offer an effective protection from different *(multiple)* risks. Besides, an effective management of one type of risk might be associated with exposure to a new type of risk/costs – e.g. the vertical integration eliminates

[5] Nevertheless, if costs associated with the illegitimate forms is not high (possibility for disclosure low, enforcement and punishment insignificant) while benefits are considerable, then the more effective governance prevail – large gray or black economies are widespread around the globe.

[6] Thus some "uncovered" risk would normally remain.

the "market risk" but creates a risk from opportunisms of partners. Moreover, the level of the (overall) risk exposure is typically determined by the *"critical"* (most important) riskand the integral risk is rarely a sum of the individual risks. For instance, if there is a very high risk/threat for stealing the harvest, otherwise important risk for crop pest protection would not be added to the overall risk of the farm[7].

Frequently, there are a number of possible *(alternative)* forms of governance of a particular type of risk – e.g. "risk to the environment" could be managed as voluntary actions of individual farmers, environmental cooperation, private contracts with interested parties, assisted by a third party organization, public eco-contact, public regulation, hybrid forms etc. [Bachev, 2010a].

In certain cases, some forms of the risk management are practically impossible or socially unacceptable – e.g. insurance markets do not develop for many kind of agro-food risks and the *private management* is the only option; the management of many environmental risks and challenges require *collective actions* at local, eco-system, regional or transnational levels etc. In modern societies many type of risks management are *publicly imposed* – e.g. food safety risk is under *public management* and harmonized in the EU, there are strict regulations on GMC, "precaution principle" is mandatory for the environmental related projects and carried out by the state authority, "safety nets" are organized as public projects etc.

Therefore, a *comparative analysis* is to be employed to select among (technically, economically, socially) *feasible alternatives* the most efficient one – that which would reduce the overall risk to "*acceptable"* level, and which would require minimum *total* (risk assurance *and* risk governance) costs [Bachev, 2012a]. The later must include all current and future costs associated with the risk management – the *current* technological and management costs (for adaptation, compliance, information, certification), risk insurance premium, contracting and coalition costs as well as the (current and future) *long-term* costs for adaptation and recovering damages including associated *transaction costs* (disputes, expertise, low suits etc.) for claiming experienced losses[8].

In any case an *individual, group, community, sectoral, chain, national and international* efficiency of the risk management have to be distinguished. It is often when elimination of a risk for one agent induce a (new) risk for another agent – e.g. the agri-food price fluctuation causes an income risk to the producers but benefits the speculators; the application of chemicals reduces risk for the farmers but produces significant negative effects (e.g. water, soil and air contamination) on the residents, consumers, affected industries etc.

Furthermore, the risk management is only a *part* of the overall governance of divers (production, consumption, and transaction) activities of agents[9]. That is why the total

[7] That was the case in transitional Bulgarian conditions where due to ineffective low and security enforcement, the entire sub-sectors of agriculture (vineyards, orchards) has been abandoned by smallholders in certain regions of the country because of the extremely high risk/treat of stealing the harvest by organized or individual thieves.

[8] Most analyses of the agri-food risk management usually ignore the current and likely long-term *transaction costs* associated with the risk management.

[9] E.g. most of the managerial innovations in farming and agri-food chain have been driven by the transaction costs economizing reason [Sporleder].

efficiency (benefits, disadvantages, costs saving and risk minimization potential) of the various modes for the individual agents and the public at large are to be taken into account[10].

According to the specific natural and socio-economic environment, the personal characteristics of individuals, and the social preferences, various *structure of risk governance* could evolve in different sub-sectors, industries, supply chains, and societies. In one extreme, the system of risk management would work well and only the "normal" (e.g. entrepreneurial) risk would be left "ungoverned". In some cases, *market* (free-market prices, competition) would fail to provide adequate risk governance but a variety of effective *private modes* would emerge to fill the gap - special contractual and organizational arrangements, vertical integration, cooperation. Often, both market and private governance may fail but an effective *public involvement* (regulation, assistance, support, partnerships) could cure the problem.

Nevertheless, there are situations when the specific institutional and risk management costs structure would lead to failures of market and private modes as well as of the needed public (Government, local authority etc.) intervention in risk governance[11]. Consequently, a whole range of risks would be left unmanaged which would have an adverse effect on the size and the sustainability of agri-food enterprises, the markets development, the evolution of production and consumption, the state of environment, and the social welfare [Bachev, 2010a].

Depending on the costs and the efficiency of the *specific* system of governance put in a particular (sub)sector, region, country, supply chain etc. there will be *unlike outcome* in terms of *"residual" risks*, and dissimilar *state* and *costs of human, food, environmental etc. security* in different regions and period of time (Figure 1). For instance, when there is inefficient public enforcement of food, labor, environmental etc. safety standards (lack of political willingness or administrative capability) then enormous "gray" agrarian and food sector develops with inferior, hazardous and counterfeit components.

Factors of governance choice

The forms of risk management in agri-food sector would depended on the risk type and features, the personal characteristics of agents, the institutional environment, the progress in science and technologies, culture, the social education and preferences, the evolution of natural environment etc. (Figure 1).

The risk features like origin, probability of occurrence, likely damages, scale etc. are important factor for the governance choice. For instance, local technical or behavioral risk could be effectively managed though a private mode while most of market and environmental risks require collective actions at regional, national or transnational level. For a high probability and harmful risks the agents will prefer more secure (and more expensive) mode – e.g. security investment, purchase of insurance, keeping reserves, taking hostages, interlinked organization. Nevertheless due to the lack of economic means many small size farmers can not afford related costs and practice no or primitive forms of risk management – cash and carry deals, product diversification etc. Here there is a need for a third party

[10] Frequently minimization of the risk related costs is associated with an increase in production and/or transaction costs, and vice versa. Often the risk elimination costs of one agent brings about a higher security for another agent in agri-food chain etc.

[11] Principally, when market and private modes fail there is a strong *need for a public* intervention in agriculture [Bachev, 2011b].

(Government, international assistance) intervention though insurance, support, safety net etc. schemes to decrease farmers vulnerability.

The personal and behavioral characteristics of agents (such as specific interests, preferences, knowledge, capability, risk-aversion, reputation, trust, "contractual" power, opportunisms) are important factor for the choice of management form. For instance, some risks are not perceived (unknown) by private and public agents and therefore no risk management is put at all; in some cultures, the cooperative is the preferred mode of agrarian organization; experienced and trained farmer could design and manage a bigger organization (based on hired labor) and more outside (credit, insurance, inputs supply etc.) contracts adapted to his specific needs; a risk-taking entrepreneur prefers riskier but more productive (specialized, high margin) ventures etc.

The *behavioral* factors such as individuals' bounded rationality and opportunisms have been identified as responsible for the transaction costs, and thus for the choice of organizational mode [Williamson, 1996]. They are widely studied in the insurance theory as a source for cheating by both sides of contract [Derrig].

The agents do not possess full information about the economic system (risks, price ranges and dynamics, trade opportunities, policy development) since collection and processing of such information is very expensive or impossible (multiple markets, future events, partners intention for cheating etc.). In order to optimize decision-making they have to spent on "increasing their imperfect rationality" (on data collection, analysis, forecasting, training, consultation) and selecting forms minimizing related risks/costs (internal organization, "selling out" risk etc.).

The agents are also given to opportunism and if there is an opportunity for some of the transacting sides to get non-punishably extra benefit/rent from the exchange he will likely to take an advantage of that[12]. A *pre-contractual* opportunism ("adverse selection") occurs when some of the partners use the "information asymmetry" to negotiate better contract terms. A *post-contractual opportunism* ("moral hazard") occurs when some counterpart takes advantage of impossibility for full observation on his activities (by another partner, a third-party) or when he takes "legal advantages" of unpredicted changes in exchange conditions (costs, prices, formal regulations etc.). The third form of opportunism ("free ride") occurs in development of large organizations where individual benefits are not-proportional to the individual efforts (costs) and everyone tend to expect others to invest in organizational development and benefit from the new organization in case of a success [Olson].

It is often costly or impossible to distinguish the opportunistic from the non-opportunistic behavior because of the bounded rationality - e.g. a farmer finds out that purchased seeds are not of high quality only during the harvesting time. Therefore, the agents have to protect their rights, investments, and transactions from the hazard (risk) of opportunism through: ex-ante efforts to find reliable counterpart and design efficient mode for partners credible commitments; and ex-post investments for overcoming (through monitoring, controlling, stimulating cooperation) of possible opportunism during the contract execution stage [Williamson, 1996].

In the agri-food sector the opportunism is widespread before signing an insurance contract (not disclosing the real information for possible risks) or during the contract

[12] If there was no opportunism only risks related to the bounded rationality would remain (natural, technical) and consequences easily recovered with the cooperation and in a mutual benefit (risk sharing) of all parties.

execution period (not taking actions for reducing damages when risky event occurs; consciously provoking damages in order to get insurance premium etc.). That augments considerably the insurance prices and restricts the utilization of insurance contracts by small enterprises. On the other hand, insuree often "discover" the pre-contractual opportunism of the insurers only after the occurrence of harmful event finding out that not all assurance terms (protected risks, extend of coverage of damages, ways of assessing damages, extra hidden costs) had been well explained and/or adapted to farmers needs [Bachev, 2010b].

For many kinds of farm related risks the markets evolve very slowly and/or the insurance services are practically inaccessible by the majority of small operators. What is more, for many important risks an insurance is not available "for purchase at all" – e.g. the risk of lack of market demand for farm products, the fluctuation of prices, possible opportunism of the counterparts etc. That is why farmers have to develop other (private, collective) modes to safeguard their investments and rights or lobby for a public intervention in the assurance supply.

The institutional environment ("rules of the game")[13] is important factor for the management choice. For instance, in many countries some forms of risk governance are fundamental rights (on food, labor, environmental security and safety) and guaranteed by the state; a public income support to farmers is "institutionalized"; environment and food safety standards could differ even between different regions in the same state etc. Furthermore, the (external) institutional environment considerably affects the level of transaction costs – e.g. in recent years tens of thousands of European farms and processors have been closed due to the impossibility to adapt to (invest for) newly introduced EU standards for quality, safety, environmental preservation, animal welfare, certification etc.

Principally, in the conditions of stable and well-working public regulation (regulations, quality standards, price guarantees, quotas) and the effective mechanisms for laws and contract enforcement, a preference is given to the standard (spotlight and classical) market contracts. When rights and rules are not well defined or changing, and the absolute/contracted right effectively enforced, that lead to the domination of primitive form of risk management (subsistence farming, personalized and over-integrated forms) and the high vulnerability to diverse (natural, private, market, contractual, policy etc.) risks. The later was the case during the post communist transition in East Europe characterized by the fundamental restructuring, the "rules change" and ineffective public enforcement, a high exposure to "new" (natural, market, entrepreneurial, private, contractual, institutional, international etc.) risks by the newly evolving private structures, unsustainable organizations, large gray economies, undeveloped or missing (agrarian credit, insurance, extension supply etc.) markets, individuals (e.g. thefts) and organized (e.g. providers of "security services") risk introduction devastating the private businesses and the household welfare [Bachev, 2010a].

The dimensional characteristics of the activity and transactions (the *combination* of uncertainty, frequency, assets specificity, and appropriability)[14] are critical for the management choice.

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[13] That is *formal* and *informal* rights and rules, and the system(s) of their enforcement [North]. They are defined by the (formal, informal) laws, tradition, culture, religion, ideological and ethical norms, and enforced by the state, convention, community pressure, trust, or self-enforcement.

[14] First three factors are identified by Williamson [1981], and the forth added by Bachev and Labonne.

When *recurrence* of the transactions between the same partners is high, then both sides are interested in sustaining and minimizing costs of their relations (avoiding opportunism, sharing risk, building reputation, setting up incentive, adjustment, and conflict resolution mechanisms). Here continuation of the relations with a particular partner/s and designing a special mode for transacting has a high economic value and the costs for its development could be effectively recovered by frequent exchange. When a transaction is *occasional* (incidental) then the possibility for opportunism is great since the cheating side can not be easily punished by turning to a competitor (losing future business).

When *uncertainty* surrounding transactions increases, then costs for carrying out and secure transactions go up (for overcoming information deficiency, safeguarding against risk etc.). Since bounded rationality is crucial and opportunism can emerge the agents will use a special private form diminishing transaction uncertainty – e.g. trade with origins; providing guarantee; using share-rent or output-based compensation; an obligatory collateral for providing a credit; participating in inputs-supply or marketing cooperative; complete integration.

The transaction costs get very high when *specific assets* for the relations with a particular partner are to be deployed. Here a costless alternative use of the specific assets is not possible (loss of value) if the transactions fail to occur, are prematurely terminated, or less favorable terms are renegotiated (in contract renewal time before the end of the life-span of the specific capital). Therefore, the dependant investment/assets have to be safeguarded by a special form such as a long-term or tied-up contract, interlinks, hostage taking, joint investment, quasi or complete integration. Often, the later is quite expensive, investment in the specific capital not made, and the activity/transactions can not take place or occurs without (or loss of) comparative advantages in respect to the productivity [Bachev, 2011b].

If a high *symmetrical* (risk, capacity, product, timing, location etc.) dependency of the assets of the counterparts exists (a regime of "bilateral trade") there are strong incentives in the both parties to elaborate a special private mode of governance (e.g. interlinking the credit, inputs and insurance supply against the marketing of output). A special *relational contract* is applied when detailed terms of transacting are not known at outset (a high uncertainty), and a framework (the mutual expectations) rather than the specification of the obligations of counterparts is practiced. Here partners' (self)restrict from opportunism and are motivated to settle emerging difficulties and continue relations (a situation of frequent reciprocial trade).

When *unilateral* dependency exists (risk of unwanted "exchange", quasi or full monopoly), then the dependent side has to protect the investments against possible opportunism (behavioral uncertainty/certainty) through integrating transactions (unified organization, joint ownership, cooperative); or safeguarding them with an interlinked contract, exchange of economic hostages, development of collective organization to outstand asymmetrical dependency (for price negotiation, lobbying for Government regulations) etc.

The activity and transacting is particularly difficult when *appropriability of rights* on behavior, products, services or resources is low. Because of the bounded rationality, the costs for the protection, detection, verification, and a third-party (court) punishment of unwanted exchange extremely high. The agents would either over-produce (e.g. negative externalities) or under-organize such activity (positive externalities) unless they are governed by an efficient private or hybrid mode - cooperation, strategic alliances, a long-term contract, trade secrets, or a public order.

The progress in science and technologies significantly improves the risk management and facilitate the diversification of its form. For instance, the introduction of new (resistant) plant and livestock varieties; the mechanization and standardization of operations and products; the application of information, forecasting, monitoring, storage, and transportation technologies, all they improve significantly the risk management in agri-food chain [COST; Hefnawy]. The modern application of the science and technologies is also associated with the production and/exposure to the new type of risks – e.g. green-house gas emitions, genetic contamination, natural resource depletion, technical over-dependency etc.

Finally, the ***natural environment and its evolution*** are critical factors for the management choice. For instance, certain geographical regions (mountainous, river beds, tropics, etc.) are more prone then others for natural menace and risks like soil erosion, soil and water contamination, frosts, droughts, floods, pest attacks, diseases, wild animal invasions etc. What is more, evolution of the natural environment associated with a global worming, extreme weather, plant and animal diseases, drought, flooding and other natural disasters, is posing series of new challenges for the risk management in the agrarian and food sector [Hefnawy; OECD, 2011].

The identification of the *"*critical factors" of the risk management choice, the range of practically possible forms, and their efficiency (costs and benefits) for the individual agents, stages, subsectors, countries, food chains and public at large, is to be a subject for a special *micro-economic study.*

The *comparative analysis* is to be employed to select among the feasible forms the most efficient one reducing the overall risk to an *"acceptable"* level and minimizing the *total* (risk assurance and governance) *costs*. Most of the elements of the efficiency of the risk governance are hardly to quantify – e.g. the individuals' personal characteristics, the amount of the risk, the level of benefits and costs[15] associated with each mode etc. That is why a *qualitative (Discrete structural) analysis*[16] could be used. The later matches the *features of a risk* to be managed (the probability, significance, acceptance level, needs for collective action etc.) and its *critical (institutional, technological, behavioral etc.) factors* with the *comparative advantages* (the effective potential) of the *alternative modes* to inform, stimulate an appropriate behavior, and align the interests of associated agents, and to overcome, reduce, control, share, dispute, and minimize the overall costs of that risk.

In a *specific* market, institutional, technological and natural environment the effective risk governance choice will depend on the combination of the risk features (probability of occurrence, likely magnitude of damages) and the critical dimensions of the activity/transactions (appropriability, assets specificity and frequency). Figure 2 presents a matrix with the principle forms for the effective risk governance in agri-food sector.

[15] The "measurement problems" associated with the transaction benefits and costs are well specified [Bachev, 2011b]. They also prevent the utilization of the traditional (Neoclassical) models simply by adding a new "transacting", risk management etc. activity [Furuboth and Richter].

[16] The operationalisation of the Discrete Structural Analysis of the economic organization is done by Williamson [1981].

Critical dimensions of activity / Risk features				Appropriability				
				High				*Low*
				Assets Specificity				
				Low		*High*		
				Frequency				
				Low	*High*	*Low*	*High*	
Severity of damages	*High*	Probability /uncertainty	*Low*	**M/CC**	**M/CC**	**SC**	**VI**	**PO**
			High	**M/CC**	**SC**	**CO**	**CO**	
	Low		*Low*	**na**	**na**	**SC**	**VI**	**na**
			High	**M/CC**	**M/CC**	**TPI**	**VI**	**CO & TPI**

M – free market; **CC** – classical (standard) contract); **SC** – special contract; **VI** – vertical (internal) integration; **CO** – collective organisation, **TPI** – needs for a third-party involvement; **PO** – needs for a public organisation

Figure 2. Principle modes for risk governance in agri-food sector

For instance, likely probable and low damaging risks combined with a small assets specificity and appropriability usually do not necessitate (motivate, economically justify) *any risk management*.

A high "standard" risk could be effectively managed through a *free market* mode such as a standard *(classical)* insurance, inputs supply, marketing etc. *contracts*.

Highly probable and damaging risks with a good appropriability and frequency of transactions between the same partners require a *special* (e.g. relational) *contract*. The later form is also appropriate for the risks surrounding with low uncertainty, high assets specificity and appropriability, and occasional character of the relations between the counterparts.

Principally, risks combined with high specificity, appropriability and frequency could be effectively managed though a *vertical integration* (internal risk management, contract forward or backward integration for risk sharing or mitigation).

Highly likely and menacing risks combined with a high assets specificity and a good appropriability call for a *collective organization* (cooperation, collective action). Moreover, such risk/costs sharing organization could be easily initiated and maintained since the condition of a high risk and assets dependency is in place.

A serious transacting risk exists when the situation of assets specificity is combined with a high uncertainty, low frequency, and good appropriability. The elaboration of a special governing structure for private transacting is not justified, the specific (risk reducing) investments not made, and the activity/restriction of activity fails to occur at an effective scale ("market and contract failure"). Here, a *third-part* (private, NGO, public) *involvement* in the transactions is necessary (assistance, arbitration, regulation) in order to make them more efficient or possible at all. The unprecedented development of the special origins, organic farming, systems of "fair-trade" are good examples in this respect. There is increasing consumer's demand (a price premium) for the organic, original, and fair-trade products associated with some forms of (natural, poor household, labor, quality etc.) risk

management. Nevertheless the supply of the later products could not be met unless effective trilateral governance including an independent certification and control is put in place.

Similarly, for risks with a low appropriability a third party *(public)* intervention is necessary to secure the effective risk management. Moreover, while a high probability low danger risks need a *collective organization assisted by a third-party* ("quasi" public organization for risk sharing and mitigation), the high damaging risks necessitate a *public organization*.

Stages in the analysis and improvement of risk management

The *analysis* and the *improvement* of the risk governance in the agri-food chain is to include following *steps* (Figure 3):

First, identification of *existing* and *emerging* threats and risks in agri-food chain. The persistence of certain risks is a good indicator for ineffective management [Bachev and Nanseki]. The modern science offers quite reliable and sophisticated methods for assessing various risks *to* or *caused* by the agri-food chain [DTRA & IIBR; Trench et al.].

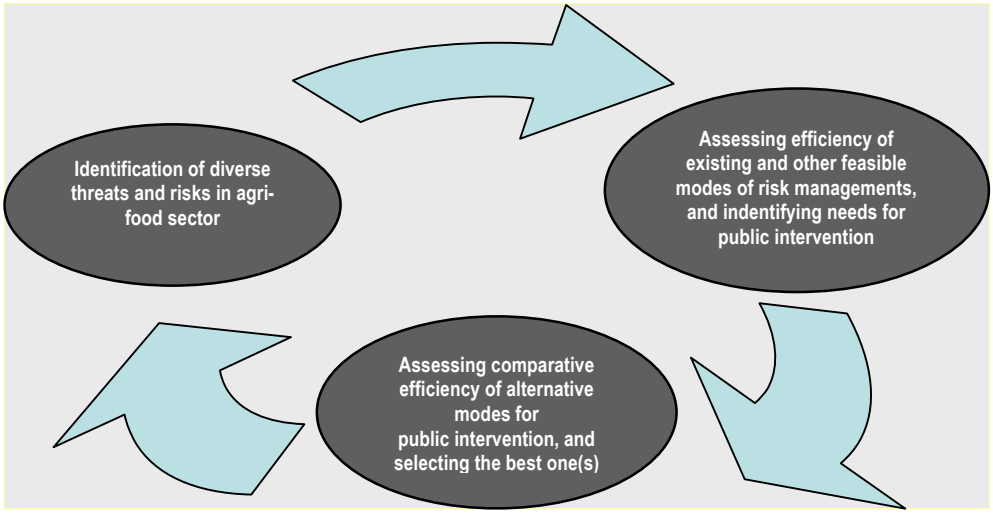


Figure 3. Analysis and improvement of risk management in agri-food sector

Second, specification of *existing* and *other feasible modes* of risks governance, and assessing their efficiency, sustainability and prospects of development.

The *efficiency* of individual modes shows the capability for risks detection, prevention, mitigation and recovery at lowest costs while the *sustainability* reveals the "internal" potential to adapt to socio-economic, technological and environmental changes and associated threats and risks. A holistic framework for assessing the efficiency and the evolution of governing modes is suggested by OECD [2011] and Bachev [2010a].

That stage is to identify the *deficiencies* of dominating (market, private, and public) modes to solve the existing and emerging risks, and to determine the *needs for a (new) public intervention*. For instance, when appropriability associated with the transaction/activity is

low, there is no pure market or private mode to protect from associated risks[17]. Emerging of a special large-members organization for dealing with low appropriability to cover the entire "social" risk would be very slow and expensive, and they unlikely be sustainable in a long run (free riding). Therefore, there is a strong need for a *third-party public intervention* in order to make protection of such risk possible or more effective – either pure public organization (e.g. public assurance for high damage natural or economic disasters) or "quasi public" mode (collective organization assisted/ordered by a third party) for high probable lower damaging risks (Figure 2).

Third, identification of the *alternative* modes for public intervention to correct (the market, private, public) failures, assessing their *comparative efficiency*, and *selection* the best one(s).

The comparative assessment is to be made on (technically, economically, politically) *feasible* forms as mode(s) minimizing the *total* risk management (implementing *and* transaction) *costs* selected. The analysis is to take into account the overall *private* and *social* costs – the *direct* and *indirect* (individual, third-party, tax payer, assistance agency etc.) expenses, **and** the *private* and *public transacting costs.* The later often comprise a significant portion of the overall risk management costs and are usually ignored by analysts – e.g. costs for the coordination, stimulation, mismanagement of the bureaucracy; for the individuals' participation and usage of the public modes (expenses for information, paper works, payments of fees, bribes); the costs for community control over and for the reorganization of the bureaucracy (modernization and liquidation of public modes), and the (opportunity) costs of public inaction, etc.

Initially, the existing and emerging problems (difficulties, costs, risks, failures) in the organization of market and private governance have to be specified. The appropriate pubic involvement would be to *create institutional environment* for: making private investments less dependent, decreasing uncertainty surrounding market and private transactions, increasing intensity of exchange, protecting private rights and investments etc. For instance, the State establishes and enforces quality, safety and eco-standards, certifies producers, regulates employment relations, transfers management rights on natural resources etc., and all that increases the efficiency of market and private risk management.

Next, practically possible modes for increasing appropriability have to be considered. The low appropriability is often caused by unspecified or badly specified private rights and obligations. In some cases, the most effective government intervention would be to *introduce and enforce new private and groups (property) rights* – on diverse type of risks and its trading; on natural and biological resources; on food safety and clean environment; tradable quotas for products, inputs, emissions; on intellectual property, origins etc. That intervention transfers the organization of activity/transactions into market and private governance, liberalizes market competition and induces private incentives (and investments) in certain agrarian risk management.

In other instances, it is more efficient to put in place *public regulations* for risk minimization: for utilization of resources, products and services (e.g. standards for labor, product, and environmental safety); introduction of foreign species and GM crops, and for

[17] Respecting others rights or "granting" risk protection rights to others could be governed by the "good will" or charity actions (e.g. eco-sustainability movement initially evolved as a voluntary activity). In any case, the voluntary initiatives could hardly satisfy the entire social demand especially if they require significant costs.

(water, soil, air, comfort) contamination; ban on certain inputs, products or technologies; regulations for trading ecosystem service protection; trade regimes; mandatory risk and eco-training and licensing of operators, etc.

In other instances, using the incentives and restrictions of the *tax system* is the most effective form for intervention. Different sorts of tax preferences are widely used to create favorable conditions for the development of certain (sub)sectors and regions, forms of organization, segment of population, or types of activities. For instance, the environmental taxation on emissions or products (inputs, outputs of production) is applied to reduce use or emissions of harmful substances; tax reductions are used to assist overcoming the negative consequences of natural disasters by private agents etc.

In some cases, *public support* to private organizations is the best mode for intervention. Programs for modernization, enterprise adaptation, income support, environmental conservation, public risk-sharing etc. are common in most countries around the world. For instance, in the USA farm crop insurance has emerged as the most important farm program while insurance payments to farmers are the largest source of farm assistance [Zulauf and Orden].

Often providing *public information, recommendations, and training* to farmers, entrepreneurs, residence, and consumers in risk management is the most efficient form.

In some cases, *pure public organization* (in-house production, public provision) is the most effective as in the case of critical infrastructure; food safety inspections; research, education and extension; agro-meteorological forecasts; border sanitary and veterinary control; recovery from the natural catastrophe etc.

Usually, the specific modes are effective if they are applied alone with other modes of public intervention. The necessity of *combined intervention* (governance mix) is caused by: the complementarities (joint effect) of the individual forms; the restricted potential of some less expensive forms to achieve a certain (but not the entire) level of the socially preferred risk prevention and mitigation; the possibility to get extra benefits (e.g. "cross-compliance" requirement for participation in the public programs); the specific critical dimensions of governed activity; the risk and uncertainty (little knowledge, experience) associated with likely impact of the new forms; the administrative and financial capability of the Government to fund, control, and implement different modes; and the dominating policy doctrine.

The level of effective public intervention (governance) also depends on the kind of risk and the scale of intervention. There are public involvements which are to be executed at *local* (ecosystem, community, regional) level, while others require *nationwide* governance. And finally, there are risk management activities, which are to be initiated and coordinated at *international* (regional, European, worldwide) level due to the strong necessity for trans-border actions or the consistent (national, local) government failures. Very frequently the effective governance of many problems and risks requires *multilevel* governance with a system of combined actions at various levels involving diverse range of actors and geographical scales.

The public (regulatory, provision, inspecting) modes must have built mechanisms for increasing the competency (decrease the bounded rationality, powerlessness) of the bureaucrats, beneficiaries, interests groups and public at large as well as restricting the possible opportunism (cheating, interlinking, abuse of power) of the public officers and stakeholders. That could be made by training, introducing new assessment and

communication technologies, increasing transparency, and involving experts, beneficiaries, and interests groups in the management of public modes at all levels.

Generally, *hybrid modes* (public-private partnership) are much more efficient than the *pure* public forms given coordination, incentives, control and cost-sharing advantages. The involvement of the farmers, beneficiaries and interest groups increases the efficiency, decreases asymmetry of information, restricts opportunisms, increases incentives for private co-investment, and reduces management costs. For instance, the enforcement of most labor, quality, animal welfare, and environmental standards is often very difficult or impossible at all. Stimulating and supporting (assisting, training, funding) the private voluntary actions are much more effective then the mandatory public modes in terms of incentive, coordination, enforcement, and disputing costs [Bachev, 2010a].

If there is strong need for a third-party public involvement but the effective (government, local authority, international assistance) intervention in risk management is not introduced in a due time, then significant risks to individuals and public at large would persist while the agrarian "development" substantially deformed.

Dealing with many problems and risks in the agri-food sector/chain would require *multiform, hybrid, multilevel*, and *transnational* intervention, and therefore the appropriate *governance mix* is to be specified as a result of the comparative analysis. The later let improve the design of the (new) public intervention according to the specific conditions of the food-chain components in the particular country or region in terms of increasing security and decreasing costs.

Suggested new approach also let predict likely cases of the (new) public failures due to the impossibility to mobilize a political support and resources or ineffective implementation of otherwise "good" policies in the particular conditions. Since *public failure* is feasible, its timely detection permits foreseeing the persistence/rising of certain risks, and informing the local and international communities about the consequences.

The risk management analysis is to be made at *different levels* – the individual component (inputs supply, farm, processing, transportation, distribution etc.), regional, sub-sectors, food-chain, national, and international according to the *type of risks* and the *scales of collective actions* necessary to mitigate the risks. It is not a one time exercise completing in the last stage with a perfect system of risk-management. It is rather a *permanent process* which is to improve the risk-management along with the evolution of socio-economic and natural environment, the individual and communities' awareness, and the modernization of technologies. Besides, the public (local, national, international) failure often prevails which brings us into the next cycle in the improvement of risk-management in the agri-food sector.

For the application of the suggested new approach, besides traditional statistical, industry etc. data, a *new type of data* are necessary for the diverse type of risks and the forms of governance, their critical factors for each agent, the level of related benefits and costs etc. Such data are to be collected though interviews with the agri-food chain managers, stakeholders, and experts in the area.

2. Contemporary opportunities and challenges for agri-food risk management

The modern agri-food chains involve millions actors with different interests, multiple stages, and divers risks requiring a complex, multilateral and multilevel governance at a large scale. For instance, in the EU the number of employed persons in the agri-food chain reaches

48 million working in almost 17 million different holdings and enterprises (Table 1) while final consumers comprises 500 millions[18].

Table 1. Number of enterprises and persons employed in EU agri-food chain (1000)

Number		Agriculture	Food and beverages activities			
			Manufacturing	Wholesaling	Retailing	Services
		2007	2008			
Holdings and enterprises	EU - 27	13 700.4	267.9	275.1	1 060.2	1 448.4
	Bulgaria	493.1	5.1	5.4	31.5	19.2
Regular farm labor force and persons employed	EU - 27	26 669.4	4 725.0	2 001.5	7 369.7	7 316.5
	Bulgaria	950.0	106.5	44.9	102.0	92.0

Source: Eurostat, 2011a

Various existing and emerging (natural, technological, health, behavioral etc.) *threats and risks* along with the modern agri-food chains are well-identified [DTRA & IIBR; Eurostat, 2011a; Humphrey and Memedovic; OECD).

Diverse *market* and *private* modes have emerged to deal with the specific risks driven by the ethics, competition, consumer demand, business initiatives, and trade opportunities – e.g. direct marketing, voluntary codes (professional and corporate social, labor, environmental etc. responsibility), industry standards, insurance schemes, guarantees, fair-trade, trade with brands, origins, organic and quality products etc. (Figure 4).

Risks	Modes of governance		
	market	private	public
Natural disasters and extreme weather; Pests and diseases; Improper using pesticides and chemicals; Using contaminated water and soils; Improper animal health practices; Poor waste disposal; Using prohibited antibiotics; Using contaminated feeds; Animal-borne diseases; Improper handling and storage; Poor cooling system; Poor sanitation and	Clientatli-sation; Direct marketing; Informal branding; Insurance purchase; Organic production; Specific origins; Brands; Eco-system services; Special (quality, eco-) labeling; Outsourcing; Security services; Fair trade system; Standards insurance	Improved inputs, technology, variety and structure of production; Product and income diversification; Self-insurance forms; Patronage and community insurance; Voluntary initiatives; Professional codes; Building (good) reputation; Guarantees; Private producers labels and brands; Private traders labels and brands; Private and collective origins and specialties; Private products recalls; Long-term contracts; Interlink contracts (inputs and service supply against marketing); Inputs and service cooperatives; Production cooperation; Joint-ventures;	Mandatory (products, process, labor, animal-welfare, environmental) quality and safety standards; Regulations/bans for using resources, inputs, technologies; Regulations organic farming; Quotas for emissions and using products/resources; Regulations for introduction foreign species/GMC; Regulations for plant and animal nutrition and healthcare; Licensing for using agro-systems and natural resources; Mandatory farming, safety, eco-training; Mandatory certifications and licensing; Compulsory food labeling and information; Public accreditation and certification; Mandatory records keeping and traceability coding; Public products recalls; Public food, veterinary, sanitary, border control; Public price and income support; Public preferential crediting; Public funding farms and processors adaptation; Public safety nets and disaster reliefs; Financial support to organic production, traditional and special

[18] figures get much bigger if we take into account the total number of the global agents involved in the EU agri-food chains – farmers, processors, importers etc. from around the world.

hygiene; Using unhygienic containers, processing units, and transport facilities; Improper grading and packaging; Using prohibited food-additives; Inputs, resources and output contamination; Chancing social demands; Market price fluctuation; Market failures; Political and institutional instability; Ignorance of agents; Opportunistic behavior of counterpart, collation partner, a third party or public officer; Criminal intrusion; Terrorist attacks	contract; Hedging with future price contacts	Internal audits; NGOs; Professional and consumer associations; Good Agricultural Practice; Good Hygienic Practice; Good Manufacturing Practice; Good Transport Practice; Good Trade Practice; GLOBALGAP; Private and collective food quality and safety management systems; Certification; Licensing; Third-party verification; Inputs supply integration; Integration into processing and marketing; Franchises; Risk pooling and marketing cooperatives; Vertical integration; Consumers cooperatives	products, private and collective actions; National GAPs, cross-compliance requirements; Public education, information, advise; Designating vulnerable/dangerous zones; Tax rebates, exception, breaks; Eco-taxation (emissions, products, wastes); Public eco-contracts; Public food and security research/extension; Assistance in farmers, stakeholders, security cooperation; Public promotion/partnerships of private initiatives; Public food security monitoring, assessments, foresights; Public food reserves and buffer stocks; Public prevention and recovery measures; Public compensation of (private) damages; Disposal of (old) chemicals, degradated lands and water purification; Protected Designation of Origin, Protected Geographical Indication, Traditional Specialty Guaranteed; European Rapid Alert System for Food and Feed; EU policies, support and enforcement agencies (EFSA, ECDC, ECHA, CFCA, OSHA, EEA); International Standardization Organization (ISO 22000); UN (FAO, WHO) agencies interventions (Codex Alimentarius; Early Warning Systems; Crisis Management Centers); Bilateral and multilateral trading agreements/rules (WTO); National and international anticrime/antiterrorists bodies

Figure 4. Major risks and modes of governance along with modern agri-food chain

Furthermore, different *bilateral and multilateral private* forms are widely used to safeguard against the risks, explore the benefits, and facilitate the exchange – e.g. clientalisation, contractual arrangements, cooperation, complete backward or forward integration etc.

Special *trilateral forms* have evolved to enhance security and partners and consumers confidence including an independent (a third-party) certification and inspection. Trade internationalization is increasingly associated with the *collective private* actions (standards, control mechanisms etc.) at a transnational and global scale (e.g. GLOBALGAP).

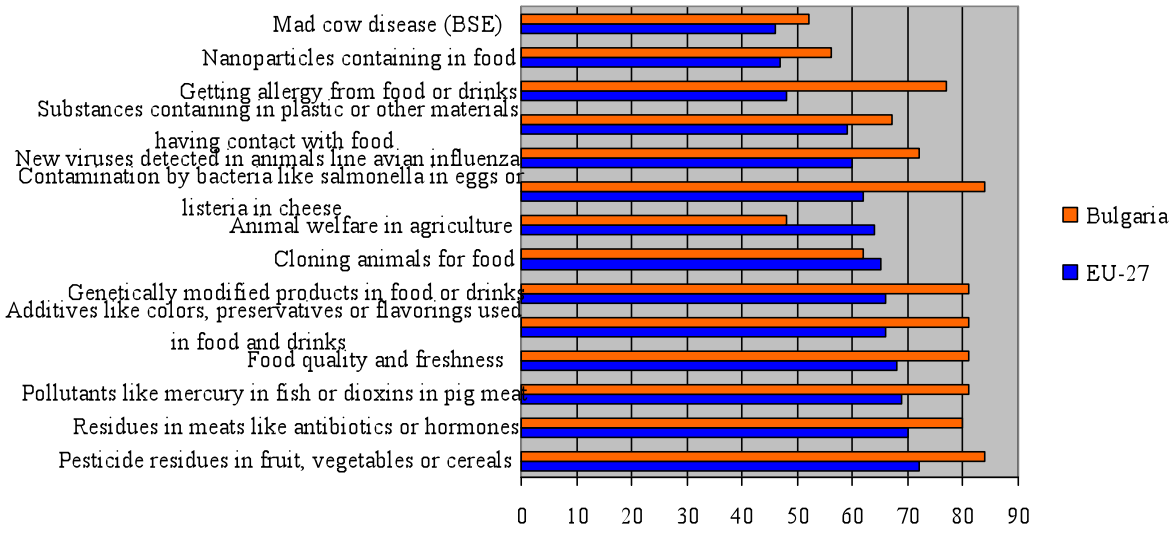
The property (security and safety) rights modernization, and the market and private "failures" brought about needs and modes for *public interventions* (assistance, regulations, provision) in the agri-food sector. Moreover, the scope and stringency of publicly-imposed rules expend constantly embracing new products, methods, dimensions (human, animal, plant, eco-health), hazards (GMC, nanotechnology, terrorism), and information requirements.

Furthermore, the globalization of exchange, and threats and risks increasingly require setting up a *transnational public order* (e.g. ISO, WHO, FAO, WTO etc.). For instance, there are common (traceability, precaution, communication) principles, (food, veterinary, phytosanitary, feed, environmental etc.) legislation, and implementing and enforcing agencies (such as EFSA, ECDC, ECHA) for the agri-food chains in the EU (including for imported products).

Consumers concerns about the food-safety risks significantly have increased after the major food-safety "events"/crisis in recent years (e.g. Avian flu; Mad-cow and Foot-and-

mouth diseases; poultry salmonella; contaminations of dairy, berries, olive-oil; natural and industrial disasters impacts etc.). For instance, since 2005 there has been an augmentation of the respondents "worrying about food-safety problems" in the EU and it comprise a significant share now (Figure 5); as much as 48% of the European consumers (in Bulgaria 75%) indicate that the consumed food "very or fairly likely" can damage their health etc. [Eurobarometer].

The number of cases and incidence rates of various foodborne and waterborne diseases is significant even in developed countries. For example, in the USA yearly 1 in 6 or 48 million people gets sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases [CDC]. In the EU there are also a number of confirm cases of foodborne diseases having a high incidence rate, most notably Giardiasis (167,025), Campylobacteriosis (190,579) and Salmonellosis (134,606) [ECDC].



Source: Eurobarometer

Figure 5. Indicate if you are worried in relation with following food-safety problems (% of respondents)

There are a number of *(new) opportunities* for the risk governance in the agri-food chain (Figure 6):

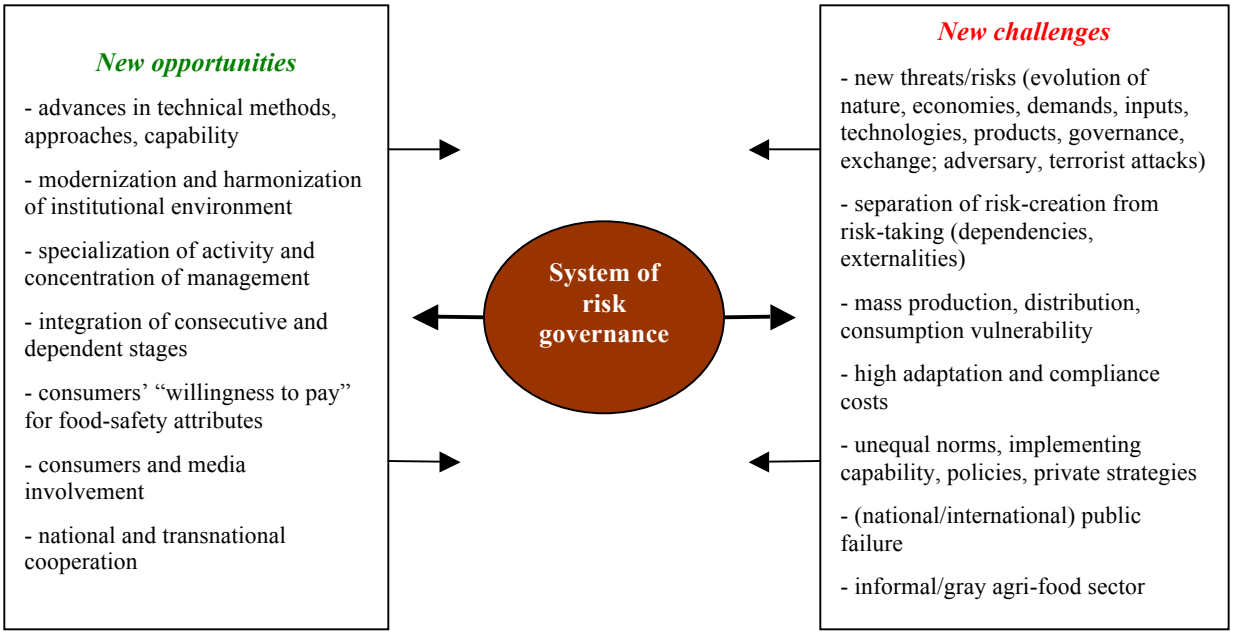


Figure 6. Opportunities and challenges for risks governance in agri-food chain

First, the advances and the dissemination of the *technical* food-chain, training and risk-management *methods* (such as microbiological, genetic, electrical, laser, robotic, immunological, chemical and biosensors, nanotechnology, ICT etc.), the integral and food-chain *approaches*, and the research, monitoring, testing, decision, and foresighting *capability* for the risk-detection, assessment, prevention, and mitigation [COST; Trench at al.]. For instance, the advancements in detection, assessment and mitigation methods and technologies associated with the biological and the chemical risks have been presented at a recent international conference [DTRA & IIBR].

Second, the modernization and the *international* harmonization of the *institutional environment* (private, corporate, collective, NGOs, public food-safety and related standards, rules, enforcements etc.). For instance, the EU membership improves considerably the "rules of the game" in the new member states like Bulgaria; the market access rules, and/or the "corporate responsibilities" induce the agri-food sector transformation of exporting countries in Africa, Latin America and Asia etc.

Third, the considerable development of the *specialization* of activities (including in the risk-taking, monitoring, management) and the *concentration of (integral) management* in the food-production, processing, servicing, and distribution - centralized innovation and enforcement; time, scale, and scope economies; easy third-party control etc. For instance, the market share of the three largest food-retailers comprise between 27-91% in the EU states [Eurostat, 2011a]; the food-safety training, certification, inspection, and information are big international business [Humphrey and Memedovic] etc.

Forth, the quasi or complete *integration* of the food-chain's consecutive or dependent stages creating mutual interests, and the effective and long-term means for the risk-perception, communication, and management. For example, in Bulgaria the (raw) milk supply is closely integrated by the (dairy) processors through on-farm (collecting, testing) investments and interlink (inputs, credit, and service supply against milk-delivery) contracts

with the stallholders, while the dairy marketing is managed by branding and long-term contracts – standards and bio-labels [Bachev, 2011a].

Fifth, the increasing consumers "willingness to pay" for the food-safety attributes such as chemical and hormone bans, safety and inspection labels, original and special products etc. [Trench at al.]. The later justify and make economically possible the paying-back of the costs for a special governance.

Six, the growing *consumers'* (representation, organizations) and the *media* involvement, and the *national* and *transnational* (information, technical, managerial, training, certification etc.) *cooperation* of partners and stakeholders improving agents choice, inducing public and private actions, enhancing risk-management communication, efficiency, and speed.

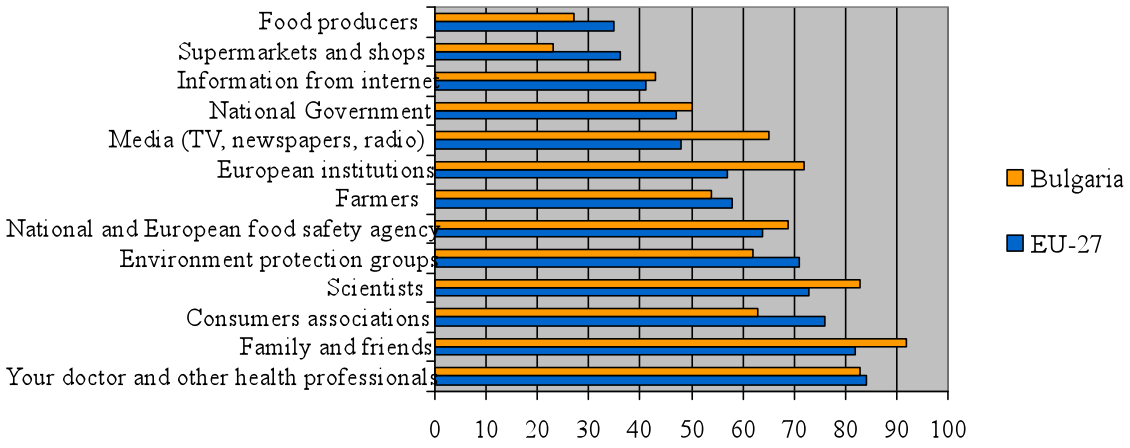
The modern development is also associated with a number of *(new) challenges* for the risk governance in the agri-food chain:

i/ the emergence of new threats, risks and uncertainty associated with the evolution of *natural environment* (e.g. climate change, water stress, "new" plant, animal and human hazards etc.) as well as the new human induced *economic, financial, food, food safety, water, environmental etc. crises* at large *(transnational, global) scales*. For instance, in the EU the household waste associated with the food (packaging, animal and vegetal wastes) is quite significant as merely its animal and vegetal components amounts to 23.8 million tones and comprises almost 11% of the all household waste[19], or 48 kg per capita [Eurostat, 2011b].

ii/ the increasing new threats, risks and uncertainty connected with the *inputs, technologies,* and *products* differentiation and innovation – e.g. Fukushima nuclear accident severely affected the agri-food sector in Japan and beyond [Behdani]; there are uncertainties and safety concerns associated with the growing application of nanotechnologies and GMCs etc. [Eurostat, 2011a].

iii/ the increasing specialization and concentration of activity and organizations which *separates* the *"risk-creation"* (incident, ignorance, opportunistic behavior) and the *risk-taking* (unilateral-dependencies, quasi-monopolies, spill-overs, externalities etc.). That makes the risk-assessment, pricing, communication, disputing, and liability through the (pure) market and private modes very difficult and costly. For instance, cheating, misleading, and pirating are common in the food-chain relations - high information asymmetry, detection, disputing, and punishment costs [Bachev, 2010a]. It is indicating that for the risk information consumers in the EU trust more to the "health professionals", "family and friends", "consumers associations", "scientists" rather than the "food producers" and "supermarkets and shops" (Figure 7).

[19] these levels and shares are believed to be underestimates.



Source: Eurobarometer

Figure 7. In case a serious food-safety risk is found I would trust for risk information to (% of respondents)

iv/ the widespread mass production, distribution, and consumption increases the *vulnerability* of the agri-food chain expending the scope and the severity of natural, incidental, opportunistic, criminal or terrorist risks. For instance, in the EU there has been a progressive number of the official notifications based on the market and non-member countries controls, food-poisoning, consumer complaints, company own-checks, border screening and rejections approaching 8000 in 2009 [Eurostat, 2011a].

v/ the increasing *adaptation* and *compliance costs* (capital, training, certification, documentation etc.) for the rapidly evolving market and institutional environment which delay or prevent the reformation of smaller farms and food-chain enterprises [Trench et al.; Bachev, 2010a]. For instance, in Bulgaria the dairy and meat processors adaptation to the EU standards have continued 10 years while two-thirds of them ceased to exist before the country accession to the EU in 2007 [Bachev, 2011a].

vi/ the public and private food quality and safety standards and the efficiency of their enforcement differ considerably between the industries, countries, and regions [Humphrey and Memedovic]. That is a result of the *unequal norms* (e.g. GAPs, formal and informal rules) and the *implementing* and *enforcing capability*, and/or the deliberate *policies* or the private *strategies* (e.g. multinationals sell the "same" products with unlike quality in different countries). The "double/multiple standards" is responsible for the inequality of exchange, and the dissimilar threats and risks exposure of individual agri-food systems.

vii/ the *wide spreading "public failures"* in the food-chain (risk) management – the bad, inefficient, delayed, under or over interventions; gaps, overlaps, infighting and contradictions of different agencies and rules; high bureaucratic costs; unsustainable and underfunding etc. For instance, the Bulgarian Food Agency and its Risk Assessment Center were established with a 5 years delay after joining the EU (in 2011); the EU Acquis Communautaire are still not completely implemented in the country (capability deficiency, mismanagement, corruption); trust to the EU rather than the national institutions prevails [Bachev, 2010a]. There are also numerous instances of the *international* assistance or

governance *failures* when institutions are "imported" rather than adapted or designed for the specific local conditions [Bachev, 2010a].

viii/ the production, marketing, and consumption traditions, the high food or governance costs, the will and capacity deficiency, all they are responsible for the persistence of a large risky *informal/gray* agri-food sector around the globe without an effective control, and substandard, fake, and illegitimate products and activities. For instance, merely one-third of the Bulgarian dairy farms comply with the EU milk-standards, only 0.1% possess safe manure-pile sites, a half of produced milk is home-consumed, exchanged or directly sold [Bachev, 2011a].

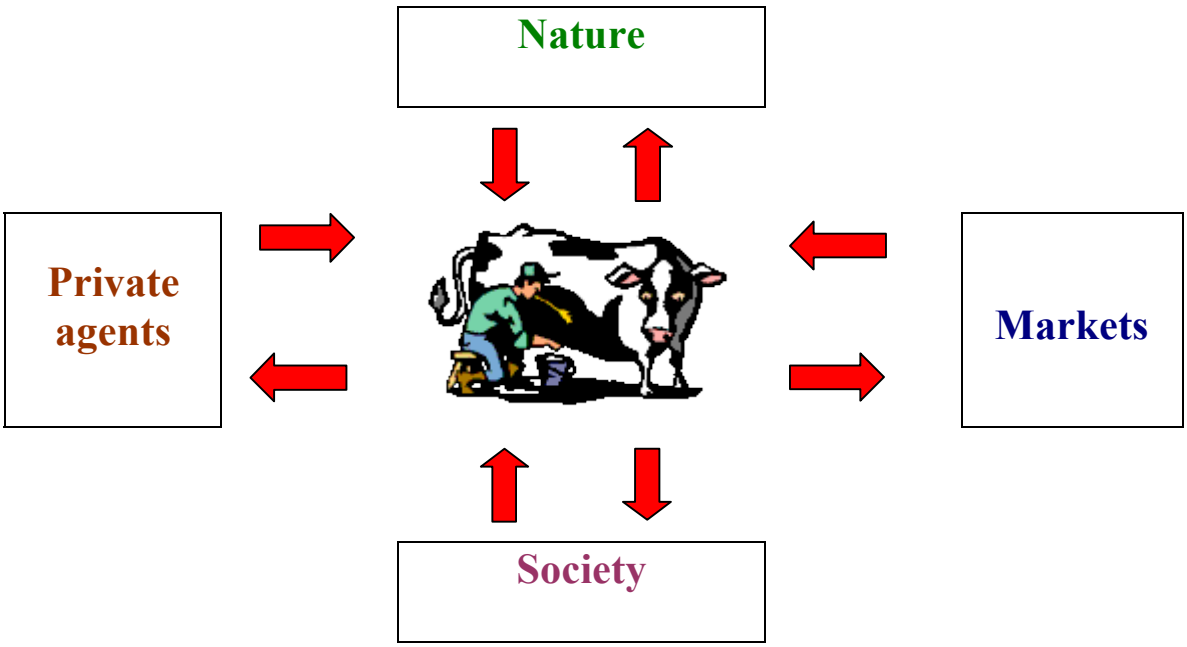
ix/ the multiplying new treats and risks associated with the *adversary* (e.g. by a competitor) and the *terrorist* attacks, and the emerging *governing* and *exchange forms* (e.g. street-sells; internet, phone and mail-orders; shopping-trips etc.). All they require specific non-traditional risk-management methods and modes such as guards; policing; intelligence; multi-organizational and transnational cooperation etc.

3. Assessing risk management in Bulgarian dairy sector

Modes and efficiency of governing risks for dairy farms

Bulgarian dairy sector has been among the most significantly affected by the fundamental post-communist transformation after 1989 and the process of EU integration in recent year[20].

The major generic type of risks facing by the dairy farms and causing by the dairy sector are natural, market, private and societal (Figure 8).



[20] Bulgaria joints the European Union on 1 January, 2007.

Figure 8. Generic types of Risk Faced and Caused by the Bulgarian Dairy Farming

The major **natural risks** for the dairy farms are:

- occasional or epidemic livestock, crop and labor diseases;
- invasion of wild animals (wolfs, bears) on farm livestock;
- bad meteorological conditions (extreme temperatures, hails, frosts);
- damages from pest and predators;
- natural disasters like floods, mudslides, fires, thunders etc.

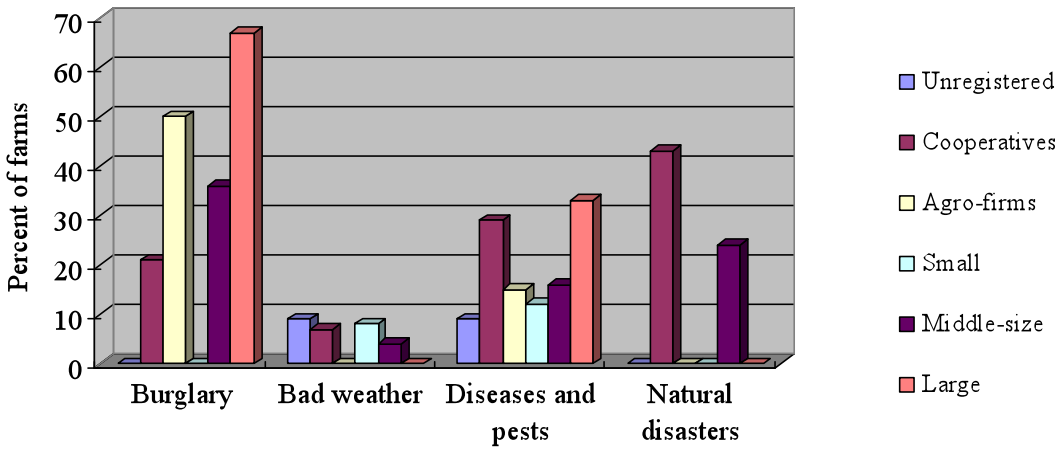
Most dairy farms use traditional methods to protect from the natural hazards: small-sized farm, more sustainable animal and crop varieties, appropriate livestock structure (more goats and sheep, few cows), private dogs and guards, production diversification, remoteness of plots, keeping "emergency fund" etc.

During the entire transition now the primitive technologies and agro-techniques have been widespread among the majority of farms. Due to the lack of knowledge, possibility and/or financial means the application of sustainable varieties, proper livestock care and diet, veterinary and extension services, chemical application and irrigation of lands have been very insufficient by most holdings [Bachev, 2012b]. For instance, the amount of fertilizers and pesticides used in agriculture has declined considerably, and their current per ha application is 22% and 31% of the 1989 level[21]; there is 21 folds decline in the water used in agriculture due to the considerable distortion of irrigation facilities and the high water price etc.

All these have contributed to degradation of farmlands and livestock capability having a harmful impact on livestock and crop yields, and farmers' income and welfare. Moreover, no adequate healthcare and feeding of animals, and irrigation and crop rotation have been introduced to adapt (counterbalance, resist to) the effects and risks of global climate change on farms [Bachev, 2012b].

During much of the post communist transition the farms had no access to specialized insurance products since they were either unavailable or too expensive. *Agrarian insurance market* has been developing in the last few years but it is still not wide-used (Figure 9).

[21] Now, N, P and K fertilizers are applied for 37.4%, 3.4% and 1.9% of utilized agricultural lands [MAF].



Source: interviews with farm managers

Figure 9. Type of purchased insurance by Bulgarian dairy farms

The larger farms[22] have stronger incentives to *sell the risk out* because they are highly specialized and in the case of hazardous event damages are quite significant. Besides, these enterprises possess bigger financial means to insure livestock, crops and related assets. In some cases, the big farms posses better positions to negotiate more favorable insurance terms than the bulk of the farms (big contracting power, economy of scale, available on farm experts or outside expertise).

Moreover, "purchase of insurance" is usually explicitly requested by the banks and/or public agencies for participating in diverse commercial and public support programs. The big commercial farms are the main recipients of such loans and grants and often unwillingly pay supplementary price (for insurance supply) to obtain the "interlinked" outside funding. In this case, related risk is carried by a specialized market supplier (insurance company rather than bank or public agency) and debtor-farms are charged with extra costs to assure needed bank loan or public support.

The majority of farms can not afford the purchase of risk insurance because of the high (unaffordable) premiums, unfavorable terms of insurance contracts (not-tailored to particular conditions of an individual farm), and low satisfaction from the services of commercial insurance providers (frequent disputes about the terms of contracts and extent of harms, lengthy delays of payment for damages etc.).

On the other hand, the insurance companies are reluctant to deal with the small farms because of the miniature size (high transacting costs, low profit), and the high possibilities for pre- and post-contractual opportunism. Consequently, a great part of farming resources and activities is not assured (insuring labor is practically absent, most animal, machineries

[22] The average milk-cows per farm is 3.3, buffalo-cows 7.3, ewes 10 and she-goats 3.1. The holdings with 1-2 heads comprise around 80% of all cow farms (and 30% of the livestock) and 64% of the buffalos farms (and 11% of the livestock) in the country, while the share of ewes and she-goat holdings with up to 9 heads in total farms is accordingly 30% (83% of livestock) and 96% (67% of livestock) of all holdings [MAF].

and buildings are uncovered etc.), and a considerable majority of farmers bear the entire risk of failures.

Despite the potential efficiency (non-for-profit organization, members orientation, tailoring products to farms needs) the collective modes for farm insurance have not evolved in the country. Here the high transaction costs for the initiation and development of a large member organization, and the conflicting interests of different farms impedes that process.

Moreover, an effective public intervention has not been undertaken to assist (initiate, support, legislate) farmers in organization of ("quasi-public", "quasi-private") mode for collective supply of agrarian insurance. Neither badly needed agrarian guarantee and/or compensation fund has been launched. Subsequently, a good part of the affected smaller and middle-size farms (having little internal capacity to bear yield failures and property damages) experience severe looses, and see the scale of their operations (assets, financial means) and welfare further decreased.

In the last years and especially after the country's EU accession the public veterinary, disease, technology etc. control and the emergency assistance to livestock holdings have been enhanced - e.g. isolation and distortion of endangered animals, compensation of farms etc. These measures aim at protecting against significant industry and/or public risk(s) from certain diseases and epidemics – e.g. mad cow disease, foot and mouth disease, avian influenza etc. They have been driven by the public concern for potentially huge economic losses for farms, related industries, export, and/or human health hazards.

Furthermore, some farms have got public aid to cover losses (or recover) from the recent natural disasters – animal diseases, floods, rainstorms, mudslides, and extreme droughts. The later modes have been incidental and affected mostly the larger operators having incentives and capability to deal with the complicated (and costly) bureaucratic procedures.

Finally, an effective public system for farmers' training and advise in important areas such as entrepreneurship, environmental and risk management, diversification etc. has not been established in the country.

Subsequently, most farms do not have proper internal and outside (market, collective, public) insurance against the natural risks and face constantly hazards and damages. Affected smaller and middle-size holdings experiences severe looses, and sees their assets, scale of operations, and welfare further decreased.

The market risk in dairy farming is mostly associated with:

- the high market uncertainty in terms of demand for milk, quality requirements, supply of critical inputs;
- the huge competition and price fluctuation;
- the (semi)monopoly condition in the inputs supply and marketing;
- the missing markets situation.

Unlike the natural risk, the market related risk can not be assured by a purchase of insurance. Special governance is to be put is place to safeguard farmers' investments.

The emergence and persistence of the vast subsistence and part-time farming has been an effective mode to protect the household assets and labor in the conditions of great institutional and economic uncertainty [Bachev, 2010a]. During the transition period market and contract trade of owned capital was either impossible or very expensive - "missing" markets, high uncertainty, information asymmetry, opportunism, little job opportunities and

security. There was also great uncertainty associated with the market supply of basic foods in terms of costs, stability, quality, origin etc.

The *internal family production* was the most effective way of protecting and getting return on the available household resources (labor, land, livestock, savings etc.). In some instances, a *group subsistent or market oriented farming* (partnership) between relatives or close friends developed to allow continues operation, part-time farming, effective concentration of resources, benefiting from the complementarily of partners' assets and skills, and exploration of economies of scale and scope.

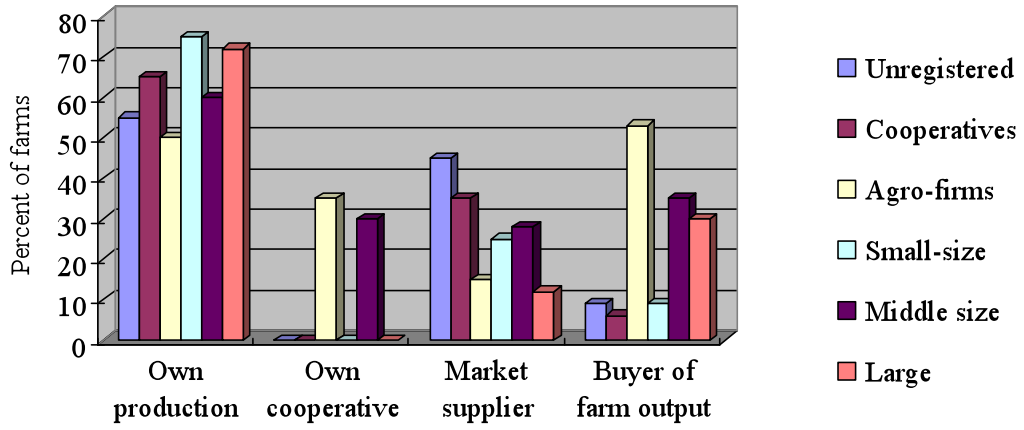
Similarly, the missing market for the critical farm inputs and services was a major reason for the development and sustainability of the *production cooperatives*. The big interdependence and complementarities of the assets, and the "not-for-profit" and membership orientation, attracted many smallholders. Production cooperatives evolved as an effective (cheap, stable) form of supplying highly specific to the farms forage, mechanization service, essential inputs, storage, processing etc.

The larger farms integrate entirely the forage supply exploring the economies of scale and scope and safeguarding against the risk associated with the price, quality, time of delivery, and behavioral uncertainty of the outside procurement. Our survey demonstrates that all commercial farms secure a significant portion of needed forage for the livestock though *own-production*. Likewise, they own (rather than rent) the dairy animals, and all critical assets (milking equipment, barns, machineries) are either owned or protected through long-lease contracts.

Furthermore, private form to govern bilateral trade between the farms and the processor has been increasingly employed interlinking the supply of critical inputs (forage, cooling tanks etc.) with the marketing of output (Figure 10). The later diminishes considerably the risk from market inputs supply and marketing of output of dairy farms, and increases the incentives for productive investments.

The significant risks from the market supply of the critical labor and services are typically governed through a *private mode*. In dairy farming most managerial and technological knowledge and even "relationships" with the individual animals are highly farm-specific and extremely important for the productivity. Therefore, the critical activities are secured by family labor and permanent employment (management, everyday care for animals).

The "ineffective" or "missing" market for the general labor is a major source of risk in the sector preventing expansion of the farm size beyond the family borders. The limited and unreliable supply (mostly from the unqualified gypsy population), the inferior labor conditions, the low wages, and the needs for huge farm specific investment (long working hours, lack of holidays, specific knowledge on individual animals, land plots etc.) make it a problem to find and maintain needed hired labor. Reliance on family labor and friends as well as interlinking the labor supply with the "free" housing, land-leasing, food, other services, in some cases with property rights, are all common for the larger commercial farms.



Source: interviews with farm managers

Figure 10. Modes of forage supply in Bulgarian livestock farms

A great majority of the dairy farms report facing significant risks in the milk marketing.

Firstly, the price and quality competition increases all the time (including a cheap import of powder and fresh milk for processing, consumers goods). Recent assessment of the competitiveness has found that most dairy holdings are with low level of competitiveness [Koteva and Bachev]. Furthermore, all commercial farms want to see the milk price augmented in order to allow a modern production and capacity for competition.

Secondly, in some regions the farmers face monopolies experiencing a price-discrimination, delayed payments, not-fulfillment of contracted terms etc. The individual (smaller scale) producers can not store fresh milk and/or transport it to a long distance (low market appropriability of rights, high cite and freshness dependency of the dairy farm). At the same time the incentives to cooperate between competing producers and neutralize the regional monopolies have been low (high transaction costs, opportunism of free-rider type).

Third, many smaller-scale dairy farms have been entirely ignored by the dominating large processors since they are not able to meet the quantity, quality and safety requirements, and command high transportation, training, and transaction costs. These farms have only available a restricted local fresh-milk market with insignificant demand from the minor processors, "street market" or direct delivery to individuals. In some milk-producing but remote areas the farmers experience complete missing market situation - no consumers and processors.

A main response of dairy farms has been *non-market orientation, reducing or ceasing out* dairy activity. For instance, comparing to 1990, the number of cows decreased by 39%, she-buffalos by 59%, and ewes by 73%; only for 2003-2005 the livestock holdings in the country diminished by 20% [MAF].

The effective private modes have also emerged to deal with the marketing risks. When a high capacity, quality, time of delivery, origin dependency with a particular buyer is in place then there are strong bilateral incentives for integration. Diverse modes for marketing arrangements are increasingly applied - long-term delivery contacts, price guarantees, premiums, interlinks etc. There are also few good examples for collective organizations of

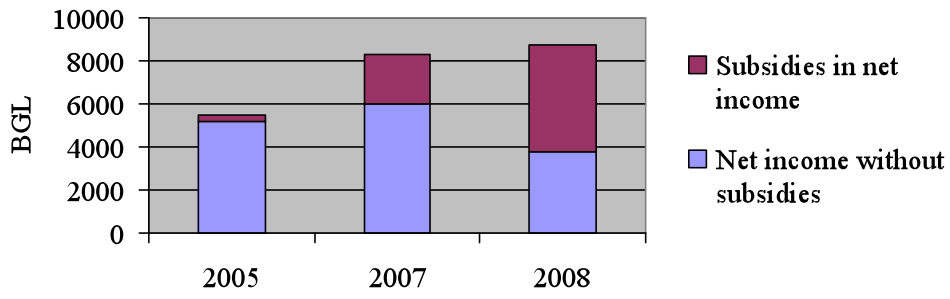
marketing with effective negotiating and enforcing relationships with the downstream partners.

A prospective mode for the protection of highly specialized and specific investments is organic and eco-production. The later comprises a few but growing number of farms and livestock closely integrated into a modern value chain in national and/or international scale[23].

There have emerged two independent associations of the dairy producers in the country. However, they attracted few farms because of the inefficiency in protecting producers' interests with processors and in lobbying for the public support. The sporadic attempts for "collective" actions of the milk producers (protests, milk poring in cities, blocking highways etc.) have given no positive results. Consequently, there are huge income variation for different farms, regions, and years, and a constant reduction in the number of farms.

A *public mode* of production quotas for cow milk was introduced in 2007 aiming at diminishing the risk from market and income instability. The initial experience shows that the individual quotas exceed the nationwide ones and have not been able to eliminate the market risks. What is more, the established non-governmental Milk Board have not been able to secure the effective organization of producers, reconcile conflicts with the processors and lobby for the public support, and its functions have been marked by mismanagement, conflict of interests, and corruption.

In the last years, the strong income decline and protests of producers accompanied with increasing public demands for quality and safety in the sector have induced state subsidizing (national top-ups) for the dairy producers (Figure 11). The later has not improved the deteriorating situation of the sector because of the delays of payments, insufficient scales to secure income growth, and predominately benefiting the large(r) producers.



Source: MAF

Figure 11. Evolution of income support in Bulgarian farms specialized in Grazing Livestock

Diversification into cheep, goat, and buffalo productions (where no quotas exists) as well as into related (processing, restaurant, rural tourism, branding, marketing) and not related activity, is also taking a place as a risk reduction strategy of younger entrepreneurs.

The dairy farms experience major **risks from the individuals and private agents** such as:

[23] A case study for the evolution and the successful market integration of an organic dairy sheep farm is presented by Bachev and Tanic.

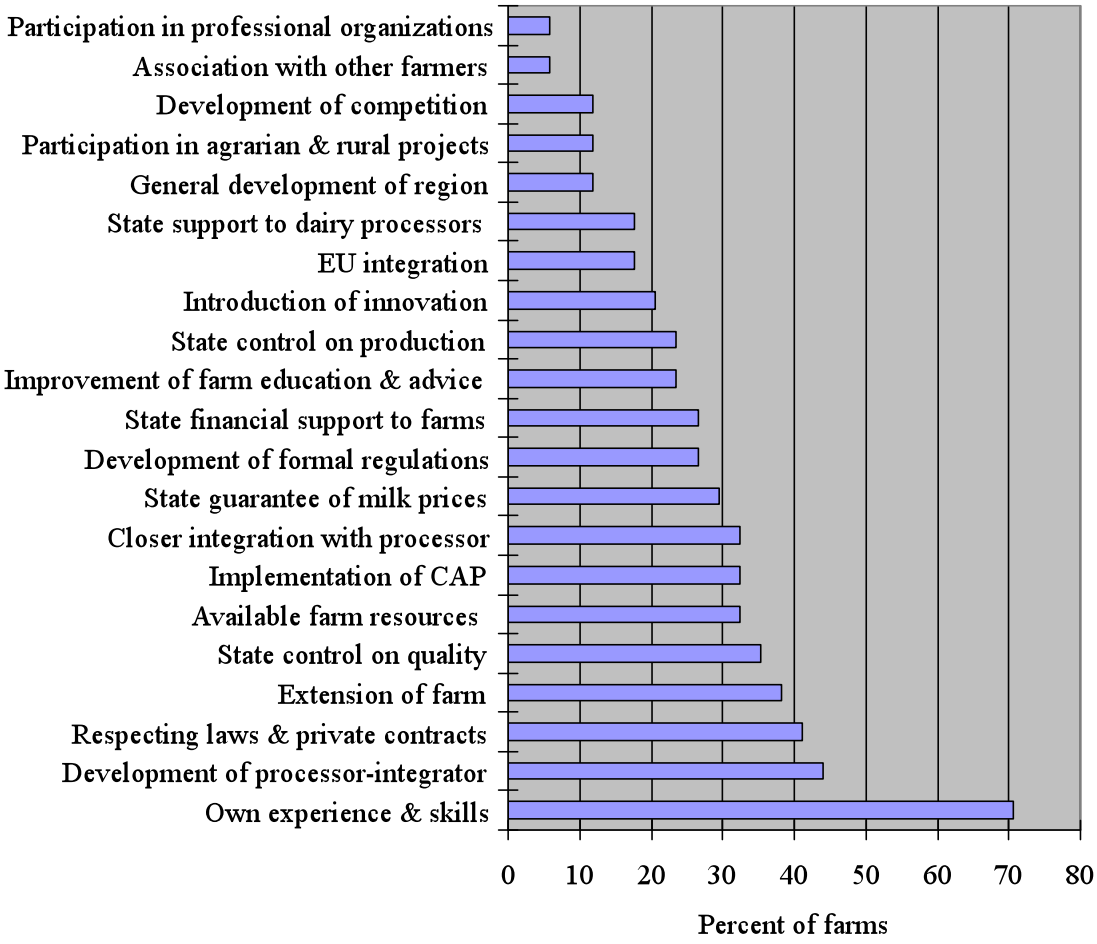
- burglaries and other intrusions on the farm livestock, yields, and property;
- opportunistic behavior(s) in the contractual relations with the hired labor, inputs and service suppliers, buyers of output, and the coalition members in partnership and collective organizations;
- farming or another activity adversely affected the dairy holdings - pollution; unwanted "security services" etc.

There is not an effective *public system* (police, municipal guards, court) for the protection and the recovery of property, and for the punishment of offenders. The farmers are extremely vulnerable for thieves and organized crimes since most farm output and property is "in open", dispersed in wide areas and many locations.

The permanent risk for the agrarian property is widely assured by *private modes*. Our survey has found that the "costs for protection" for all type farms are significant in terms of time and resources spent, hired security guards and services, "payments for property protection and restoration" etc. Besides, the insurance coverage against burglary is most used market assurance of the bigger producers (Figure 9).

The high transitional uncertainty and insecurity (reputation is not important, difficulties to formulate and dispute contracts), the little contractual experience (difficulties to protect own interests), the impossibility to write a complete (labor, service supply) contract in farming and dispute contractual terms, the high cost for contract enforcement through the court system (inefficiency, corruption), all they are responsible for the considerable risk from contractual failure[24]. Not accidentally, most farm managers consider the "respecting laws and private contracts" as one of the most important factors for development of dairy farms (Figure 12).

[24] Similarly to the market related risk no insurance for the protection from the "contractual risks" could be bought on market.



Source: Survey data from Plovdiv region

Figure 12. Most significant factors for development of Bulgarian dairy farms

In order to mitigate the risk from pre- and post-contractual opportunism the private modes are broadly employed. Since possibilities for opportunisms are great (high information asymmetry, uncertainty, costs for supervision and direction) it is typical to use self-enforced own and/or family labor for all critical operations [Bachev, 2010a]. Therefore, the effective operation size in most dairy farms is determined by the available household labor. Small partnerships are practiced exclusively between relatives and friends where the costs for coordination, decision-making and motivation is low (here mutual goals and trust govern effectively relations).

In the large holdings, additional core labor is hired on the permanent basis and the output-based compensation, interlinking, social disbursements, supplementary services and paid holidays are further used to enhance motivation.

Similarly, a high-dependency from a particular buyer is effectively governed through reciprocal (rather than classical) contracts interlinking inputs, credit, extension etc. supply against the milk marketing.

The large *collective* (production, inputs supply, marketing, processing) *modes* are rare because of the diversified interests of farmers (different age, unlike size and type of

operations, extent of diversification and market orientation); the bad perception associated with the "collective" forms (historical legacy, widespread mismanagement, low sustainability); the huge transaction costs for initiation and development; and the lack of appropriate legislation and incentives for association until recently.

There are situations where the dairy farms are badly affected by the harmful activities of other farms and industries influencing livestock welfare and behavior, causing pollution or other damages.

There are also cases of conflicts of interests over the limited natural resources with other agents. Most farmers have no means to defend against such hazards since the appropriate legislation is not in place (farmers has no rights) or it is difficult (costly) to protect and dispute assigned rights though existing forms (ineffective public enforcement, strong "private" pressure). Consequently, the farmers suffer considerable damages (on yields, produce quality, animal welfare etc.), perform bellow safety and quality standards, reduce or cease livestock activities.

The post communist transition has been associated with the unprecedented changes in the institutional structure **(social and institutional risks).** There has been huge uncertainty about the directions and the kind of changes, and instability (dynamics, constant amendments, controversies) in the structure of rights, legislation, regulations, taxation, public organizations, authorities' responsibilities, public support mechanisms etc.

The new public administration has been ineffective, incompetent, unpredictable, and corrupted. Carrying out farming and business in such environment has been associated with significant risks and costs for studying, complying with, safeguarding from the formal regulations and the "informal rules" of the bureaucracy (authority).

Most livestock operation has been carried by numerous small-scale and primitive holdings often located within the residential borders. They contribute significantly to air, water and soils pollution, and discomfort of the local population. The conflicts between the farms and neighborhoods are common in recent years and bring about strong community demand (formal and informal pressure) to limit or relocate activities.

Carrying livestock activity is risky because of the frictions with the community and uncertainty/certainty about the potential need and costs for adaptation. That particular risk has been responsible for the low (investment) incentives for modernization in smaller (subsistent, semi-market, commercial) holdings. The later additionally contributes to a greater exposure to natural, market, and other type institutional risks.

A considerable risk for the most dairy farms has come from the uncertainty (presently "certainty") surrounding the modes of introduction of EU CAP in the country. Until accession there was not clear the pace and scale of implementation of the EU rules in the dairy sector of the country. The EU quality, hygiene, veterinary, environment, animal-welfare etc. standards were introduced in 2007 and there was a transition period for the adaptation to the new requirements (until end of 2009). In addition public measures have been implemented to support adaptation, modernization and market orientation of farms.

Nevertheless, there were merely 900 farms with 50000 cows meeting the EU raw-milk quality standards (0.5% of all cow-farms and 13% of cows in the country). At the same time, most holdings with milking cows (81%) had no milking installations and only 0.1% of the dairy farms were with safe manure pile cites [MAF].

The public support has been initiated and moved from zero to positive territories since 2007 – e.g. currently subsidies accounts for 27% of the net income in farms specialized in grazing livestock [MAF]. Nevertheless, the special public measures for the farm adaptation, market orientation and modernization has affected a tiny number of the dairy holdings (mostly large operators). Consequently, the greatest portion of farms had to move into informal sector and perform bellow the official quality and safety standards.

Our survey of the commercial dairy farms has found out that different type farms have unequal capacity for the adaptation to the new EU requirements. Most holdings have no sufficient potential for adjustment to the new institutional norms (Table 2). That is particularly truth for the small-scale unregistered producers which dominate the sector. Only a third of the dairy farms believe their production capacity corresponds to the modern requirements of competition, productivity, eco-performance and animal welfare. Merely one-seventh of the dairy farms have internal capacity and access to outside sources to fund the necessary investment associated with the adaptation to the new standards. Thus, most dairy farms are effectively at risk to be ceased since do not and can not comply with the legal requirements.

Table 2. Share of farms with big and good capacity for adaptation to new EU requirements for dairy sector (per cent)

Farms capacity	Type of farms			Total
	Unregistered	Firms	Coops	
Extend of knowledge on new requirements	22.7	63.6	100	38.2
Available skills and knowledge for adaptation	22.7	54.5	100	35.3
Available production capacity	27.3	45.4		32.3
Improvement of quality and hygiene standards	36.4	72.7	100	50
Improving animal welfare	31.8	72.7		44.1
Improving environmental performance	31.8	54.5		38.2
Finding necessary investment	9.1	27.3		14.7

Source: survey data from Plovdiv region

The planed "market orientation" of the huge (semi) subsistence farming has not taken place. Programmed funding with the National Plan for Agrarian and Rural Development under Measure 141 "Support for Restructuring of Semi-market Holdings" has been greatly underutilized (merely 15% of the target reached) because of the lack of interest and complicated bureaucratic requirements and procedures.

It is not feasible to envisage any improvement in the small (semi market and commercial) holdings due to the high costs for farm enlargement and adjustment to the new market and institutional environment (no entrepreneurial capital available, low investment and training capability of aged managers). Besides, most of the farm operators are old in age and have no successor willing to undertake the business. Since there is no existing or prospective market for a "whole dairy farm" in the country, the incentives for the long-term investments for farm modernization are absent.

Nevertheless, there will be technically and politically impossible to enforce the official standards in that enormous informal sector of the economy (especially during the period of the economic crisis and the lack of any alternative income opportunities in rural areas). Thus there is no significant immediate institutional risk for these farms and they will likely dominate the sector in years to come.

Modes of governing risks from dairy farms

Major **risks to environment** from dairy farms are associated with the pollution of soils, air and waters; unsustainable use of farmland and grasslands; and significant contribution to greenhouse-gas emissions.

Until recently the voluntary initiatives, private organizations, market driven modes (such as organic farming), and public intervention, all have had no significant importance for the protection of environment and governing eco-risks from the dairy farming [Bachev, 2012b]. The cross-compliance eco-requirement and a range of public eco-measures are introduced with the EU CAP implementation – eco-conditionality, eco-standards, eco-regulations, eco-education, financial support to eco-activities, organic farming, zones with eco-difficulties, market-orientation and diversification of farms etc.

As a (side or planed) results from the restructuring of farms and the production structures and methods there is considerable amelioration of surface and ground waters quality. Nevertheless, Nitrate Vulnerable Zones cover 53% of country's territory and 68% of utilized agricultural lands [MAF]. In drinking water, 5% of the analyses show deviation of N up to 5 times above appropriate level, while in water for irrigation in 45% of the samples N concentrations exceed contamination limit 2-20 folds [EEA]. The lack of effective manure storage capacity and sewer systems, and numerous illegal garbage locations in the rural areas, improper use of N fertilizers, crop and livestock practices, non-incompliance with rules for farming in water supply zones etc. all are responsible for that problem. What is more, decreasing amount of manure has been used for fertilization of merely 0.17% of the utilized farmlands in recent years.

Furthermore, erosion is a major factor for the land degradation as one-third of the arable lands are subjected to wind erosion and 70% to water erosion [EEA]. Deforestation, uncontrolled pasture, ineffective agro-techniques and crop rotation, plowing pastures, deficiency of anti-erosion measures are etc. contribute to that problem. In some regions overgrazing of the public (state, municipality) pastures by private and domestic livestock is a significant problem while in others the under-grazing poses sustainability problem.

A negative rate of fertilizer compensation of N, P and K intakes dominate in the country being particularly low for P and K [MAF]. In addition unbalance of nutrient components has been typical with application of 5.3 times less P and 6.7 times less K with appropriate N rate. Consequently, deterioration of agricultural lands comes as a result – the share of land affected by acidification increases, and thousands tons of N, P_20_5 and K_20 are irreversibly removed annually from the soils.

There is a considerable reduction of GHG emissions from the agriculture since 1989 [EEA]. Nevertheless, agriculture has been the major ammonia source accounting for two-thirds of national emission as most NO_2 emissions comes from agricultural soils, manure management and burning of stubble fields. Similarly, the methane emission from agriculture represents about a quarter of the national, and the biggest portion of CH_4 comes from the fermentation from domestic livestock and manure management.

Consequently, there is a considerable risk to the nature and the amount and quality of the eco-system services related to the development of dairy farming in the country.

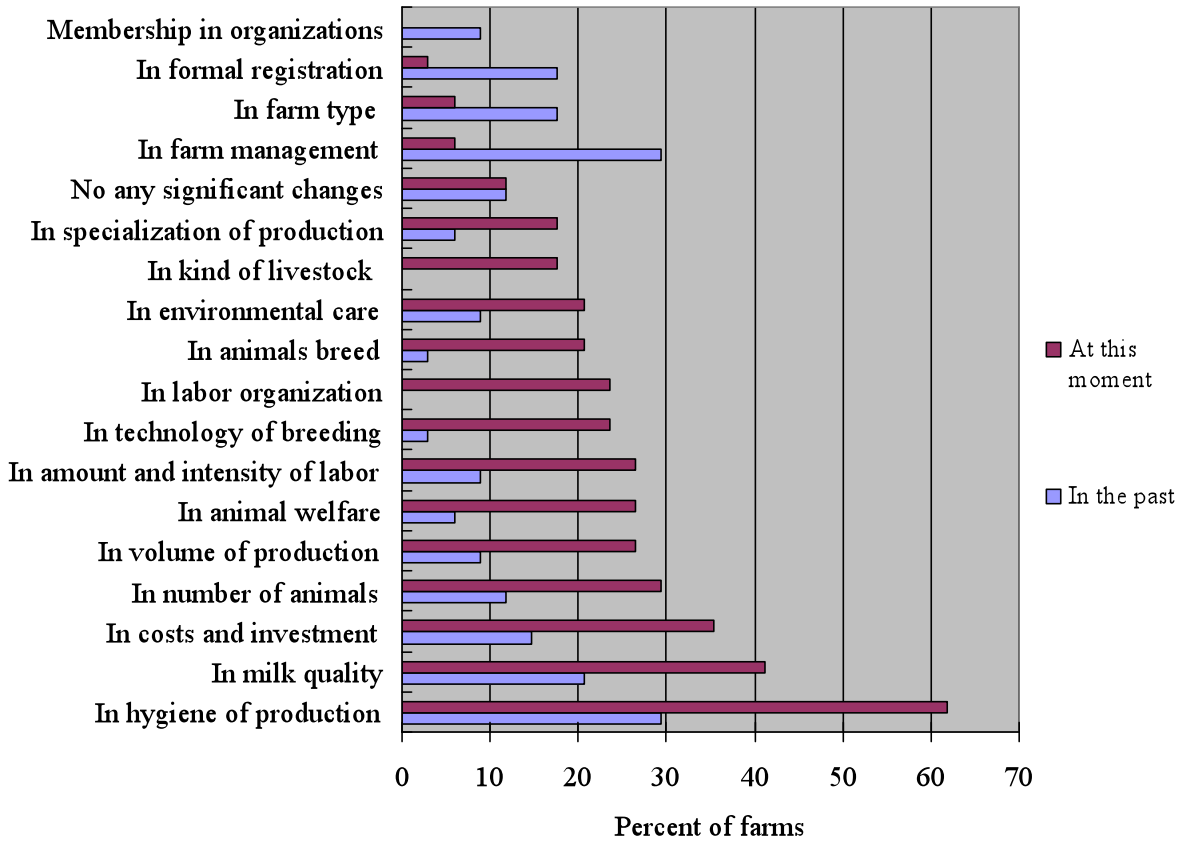
The livestock farming has been a significant **risk to the public** which is mostly associated with the quality, authenticity, and safety of livestock products; the livestock diseases causing considerable treat to human health; the new public, ethical etc. concerns about the environment preservation and improvement, animal welfare, keeping tradition etc.

All that brings to the life appropriate policies, regulations and support measures. There has been increasing pressure, control, and sanctions on the dairy farms both by the processors and the state for complying with the new requirements (Table 3). Most dairy farms had to make or are being undertaking significant changes related to the novel institutional requirements in order to sell milk (Figure 13).

Table 3. Control from the processor and the state on farms (% of farms)

Control on:	Processor	State body
Milk quality	94.1	52.9
Milk safety	47.1	17.6
Hygiene of production	58.8	44.1
Animal health	20.6	55.9
Forage for animals	11.8	35.3
Care for animals	8.8	35.3
Care for environment	8.8	41.2
Control is permanent	2.9	20.6
Sanctions and punishments are applied	38.2	8.8

Source: survey data from Plovdiv region



Source: survey data from Plovdiv region

Figure 13. Changes to be made to sell milk to "Dimitar Madzarov"LTD

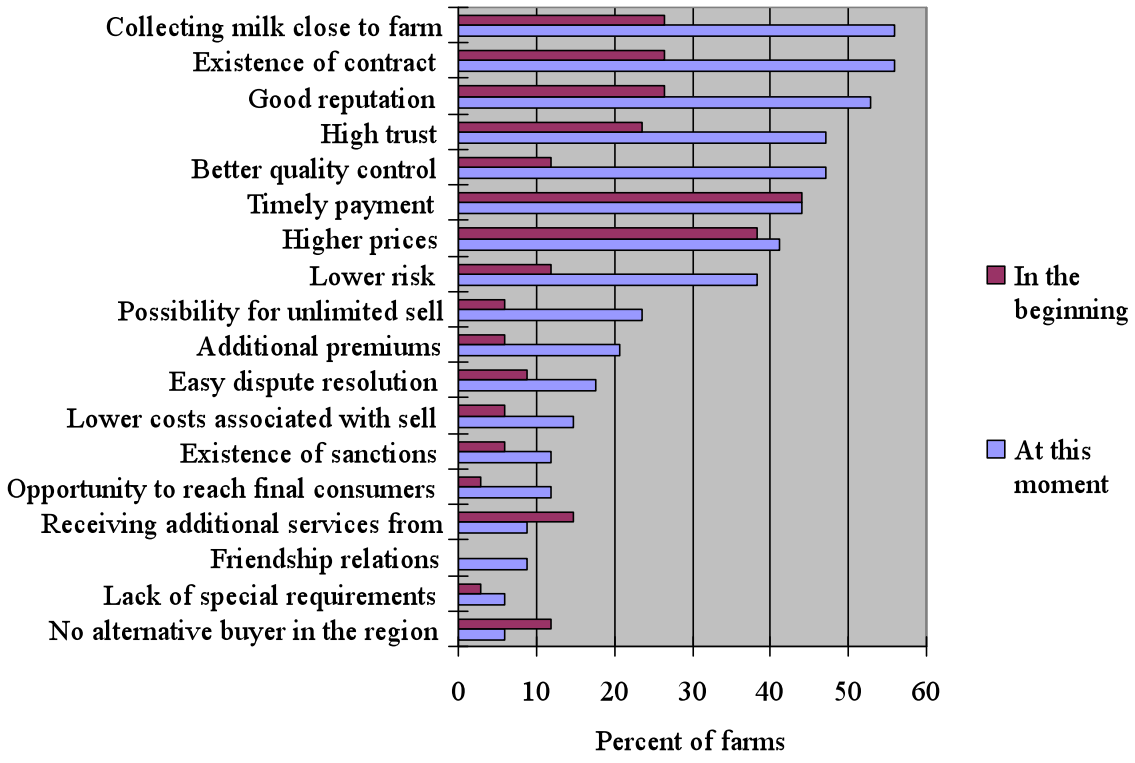
Our surveys show that many of the specific EU regulations are not well-known by the implementing authorities and a great portion of farmers [Bachev, 2010a]. The lack of readiness, experiences and capability would require some time lag until the "full" implementation of the CAP in Bulgarian conditions. Besides, most farm managers have no adequate training and/or managerial capability, are old in age with small learning and adaptation potential. Therefore, there will be significant inequalities in application of the new laws and standards in diverse sectors, farms of different type and size, and various regions of the country.

The dairy farms pose considerable **risks to other farms, individuals, private agents**. There are many incidences for using others grasslands and crop yields, or otherwise damaging land and property by the dairy farmers. Some dairy holdings pose a serious risk for the comport of individuals and others businesses (e.g. organic farms, recreation and tourism operators, water suppliers etc.). These risks are mitigated privately by the affected individuals and businesses through negotiating, monitoring, employing guards, or illegitimate means.

The small-scale and semi-subsistence farms have been major milk suppliers to the dairy processors putting them in a big (capacity, cite, quality, origin, safety) dependency. Divers private modes are broadly used by the processors to deal with those risks.

We have identified an effective system for the governing risk in relations of "Dimitar Madzarov" LTD with more than 1000 small-scale milk suppliers from Plovdiv region [Bachev, 2011a]. In the last 10 years this dairy-processing company has developed a comprehensive system for the protection of interests and the coordination, stimulation, controlling, and conflict resolution with the farmers including: building a good reputation and trust, constant communications, regular group discussions of problems, training of farmers in new industry and institutional requirements, using written delivery contracts, significant relation-specific on-farm investments (in milk collecting, cooling, and controlling facilities and staff), permanent verification of the quality and the registration of delivered milk by each farm, punishment for the offenders, effective and regular payment mode, differential prices stimulating farm enlargement and increasing milk-supply, interlinking interest-free crediting against the marketing of milk, providing assistance to the farmers in construction and preparation public support projects, encouraging farms grouping etc.

Namely this special governance has contributed considerably for the tighter integration with the dairy farms, increasing efficiency of the bilateral relations, enhancing the farms' relation investments, and their adaptation to the company's requirements for milk quality and quantity (Figure 14). Involved farms consider the development of "Dimitar Madzarov" LTD as one of the most important factors for their own farm development (Figure 13).



Source: Survey data from Plovdiv region

Figure 14. Main reasons for selling milk to "Dimitar Madzarov"LTD

The dairy farming has been responsible for the great **risks to markets** during transition now.

There was a deficiency in the quantity of different type milks during the market adjustments in the first years of the transition. The risks of insufficient supply and the price volatility were successfully overcome by the market (rather than failed public[25]) governance - opening up markets, development of market competition and demand. Up-to-date the risk for the consumers which is associated with the authentic quality, safety, origin of milk and dairy products has been a serious issue and informal (and illegitimate) market is considerable.

The introduction of the EU standards for milk production and trade is causing a new risk for the insufficient supply of local milk. The biggest dairy processors have been trying to overcome the shortages of quality local milk through processing imported fresh and/or powder milk. Nevertheless, they increasingly face another problem (risk) of the low consumer demand for dairy products based on the non-fresh milk.

In order to deal with that capacity and quality deficiency risk some processors are introducing specific modes for the risk governance – origin and quality guarantee, brand names, traditional and eco-products etc. The later has brought a variety of private modes for the governing vertical relations backwards with the supplying farmers, and upwards with the food chains, retailers, and importers [Bachev, 2011a].

A public intervention is also undertaken aiming at modernizing and commercializing the dairy farms, and stimulating the production of dairy, local and eco-products – e.g. introduction and protection of rights on dairy products (e.g. special regulations for the Bulgarian yogurt and cheese), special traditional and organic products, subsidies for the modernization of farms and adaptation to the EU quality and safety standards, support for the market orientation, public training and advisory services to farmers etc.

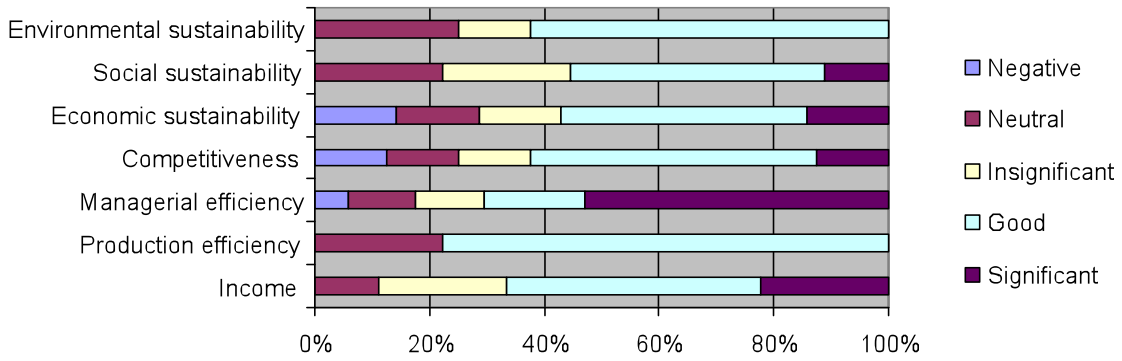
Impact of EU CAP on farms' risk management capability

The EU integration and the implementation of CAP have affected positively the risk management capability of the commercial dairy farming in the country.

According to the considerable portion of the dairy farms managers the EU CAP implementation has had a good or significant impact on the income, efficiency, competitiveness and sustainability of their holdings (Figure 14). The positive effect of the new policies is especially great for the managerial efficiency of farms which improves their ability to govern divers risks in the new conditions.

Nevertheless, a good proportion of the commercial dairy holdings managers assess as neutral or even negative the CAP impacts on different aspects of their farms development. The new policies measures affected particularly negatively the competitiveness, the economic sustainability, and the managerial efficiency of numerous dairy enterprises. That indicates for unchanged or deteriorating capability for risk management (lack of financial means, worsen ability to face and adapt to market competition) in some substantial part of the dairy farms as a result of the introduction of the EU policies.

[25] In 1990 there were numerous unsuccessful attempts to stabilize markets by controlling prices, banning import or export, introducing quotas and tariffs etc.

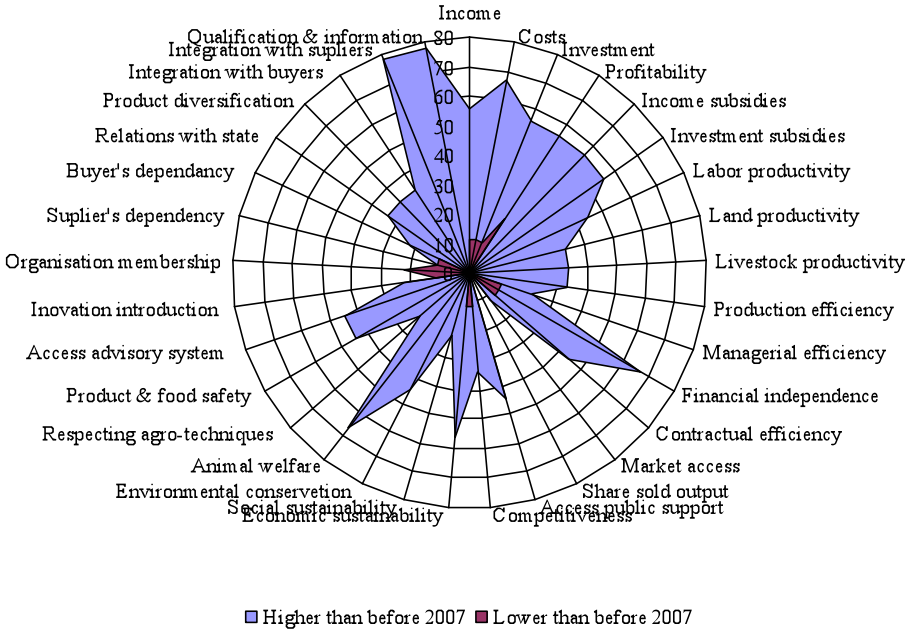


Source: interviews with farm managers

Figure 15. Impact of EU CAP implementation on Bulgarian dairy farms

Furthermore, there have been progressive trends in the development of dairy farms and their relations with other agents comparing to the period before EU accession (Figure 15).

More than a half of the holdings see an increased income, investment, subsidies, profitability, and economic sustainability after the EU integration. Two-third of them report higher costs, financial independence, and animal-welfare. Almost 78% of farms experience superior qualification and information, and bigger integration with the suppliers. All that is likely associated with decreased risks and improved risk management in the majority of commercial dairy holdings.



Source: interviews with farm managers

Figure 16. Importance of dairy farms' indicators comparing to the period before EU accession (percent of farms)

At the same time, more than 22% of dairy farms reports lower than before profitability and memberships in professional organization, and higher dependency from the buyers and processors. Every 11 out of 100 farms has got a poorer income, investment, managerial and contractual efficiency, competitiveness, innovation introduction, and economic sustainability, and a higher indebtedness and dependency from the suppliers comparing to the period before EU integration.

Therefore, a good portion of the dairy farms in the country have not improved or wakened their capability for risk management during the EU integration and CAP implementation.

Conclusion

The analysis of the modes, efficiency and challenges of risk management in agri-food chain let us withdraw a number of academic, business and policies recommendations:

First, the governance (along with the technical, information etc.) issues are to take a central part in the risk management analysis and design. The type of threats and risks, and the specific (natural, technological, behavioral, dimensional, institutional etc.) factors, and comparative benefits and costs (including third-party, transaction, time) are to be taken into account in assessing the efficiencies, complementarities and the prospects of alternative (market, private, public and hybrid) modes. The system of the risk management is to adapt/improved taking advantage of the number of the new opportunities and overcoming/defending against the evolving new challenges summarized in the paper.

Second, more hybrid (public-private, public-collective) modes should be employed given the coordination, incentives, control, and costs advantages. The (pure) public management of the most agri-food-chain risks is difficult or impossible (agents opportunism, informal sector, externalities). Often the introduction and enforcement of new rights (on food security, risk-management responsibility etc.), and supporting the private and collective initiatives (informing, training, assisting, funding) is much more efficient.

Third, a greater (public) support must be given to multidisciplinary and interdisciplinary research on (factors, modes, impacts of) the risk governance in the agri-food chain in order to assist effectively the national and international policies, the design of modes for public interventions, and the individual, collective and business actions for the risk management.

The analysis of the post-communist development of dairy farming has identified quite specific risk structures facing by and causing from this sector of Bulgarian agriculture. The huge market and institutional instability and uncertainty, and the high transaction costs, have blocked the evolution of effective market and collective modes for the risk protection. A great variety of private modes (internal organization, vertical integration, interlinking etc.) have emerged to deal with the significant natural, market, private, and institutional risks faced by the dairy farms and affected agents.

Diverse risks associated with the Bulgarian dairy farming were not effectively governed and persist during the transition now. That was a consequence of the ineffective public (Government, international assistance etc.) intervention to correct market and private sector failures in the risk governance. The later have had considerable negative impacts on

the evolution of (size, productivity, sustainability of) the farms, the development of the markets, the structure of production and consumption, and the state of environment.

The EU integration and CAP implementation improved significantly the risk management capability of a great portion of commercial dairy holdings. At the same time, a good portion of the dairy farms have not improved or even wakened their capability for risk management in the new economic and institutional environment. Furthermore, certain risks related to the dairy sector "disappeared" due to the ineffective risk governance and declining dairy farming. That would lead to a further deformation in the development of dairy and related sectors unless effective public (regulations, assistance, control etc.) measures are taken to mitigate the existing problems and risks.

References

Babcock, B. (2004). *Economics of Risk Management in Agriculture*, Center for Agricultural and Rural Development. Iowa State University, www.card.iastate.edu/risk_management.ppt

Bachev, H. (2010a). *Governance of Agrarian Sustainability,* New York: Nova Science Publishers.

Bachev, H. (2010b). Framework for Analysis of Agrarian Contracts, *Management Research and Practice* Vol. 2 Issue 1, 39-66.

Bachev, H. (2011a), Dairy Supply Chain Management in Bulgaria, *IUP Journal of Supply Chain Management*, 2, 7-20.

Bachev H. (2011b). Needs, Modes and Efficiency of Economic Organizations and Public Interventions in Agriculture, *Review of Economics & Finance*, 3, Academic Research Centre of Canada, 89-103.

Bachev, H. (2011c). Governing of Chemical and Biological Risks in Agri-food Sector: Modes, Efficiency, Challenges, in *Exploring Multidisciplinary Approaches to Chemical and Biological Defense*, Proceedings DTRA & IIBR Workshop, June 19-23, 2011, Eilat, Israel.

Bachev, H. (2012a). Risk Management in Agri-food Sector, *Contemporary Economics*, Volume 6, Issue 3.

Bachev H (2012b). Management of Agro-Ecosystem Services: Framework of Analysis, Case of Bulgaria, in *Advances in Environmental Research*. Vol.17, Ed. Justin A. Daniels, New York: Nova Science, 119-164.

Bachev, H. and M.Labonne (2000). *About Organization of Agrarian Innovations*. Montpellier: INRA.

Bachev, H. and S.Tanic (2011). Issues and challenges for farm and enterprise diversification and integration of small scale farmers into value chains in EECA, in *"Enabling Environment for producer-agribusiness linkages in EECA"*, ed. S.Tanic, FAO: Ankara.

Bachev, H. and T.Nanseki (2008), Risk Governance in Bulgarian Dairy Farming, Proceedings 12th Congress of the European Association of Agricultural Economists *"People, Food and Environments – Global Trends and European Strategies"*, 26-29 August 2008, Ghent, http://ageconsearch.umn.edu/bitstream/44136/2/240.pdf

Barker, G. (2005). *Tools for assessing and managing food chain risks*, Presentation to RELU conference Rural Economy and Land Use: The Challenge for Research 19-21 Jan 2005, Birmingham http://www.relu.ac.uk/events/Jan05/Presentations/p4%20Barker.PDF

Behdani, B. (2012). *Japanese Catastrophe and the Dark Side of Global supply Chains* http://www.nextgenerationinfrastructures.eu/images/Japanese%20Catastrophe%20and%20the%20Dark%20Side%20of%20Global%20supply%20Chains%20(1).pdf

CDC (2011). Centre for Disease Control and Prevention, USA. http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html

CIPS (2012). *Risk management in food supply chains*, CIPS, http://www.cips.org/Documents/Resources/Knowledge%20Summary/Risk%20Management%20in%20food%20supply%20chains.pdf

Coase, R. (1937). The Nature of the Firm, *Economica* 4, 386-405

Coase, R. (1960). The Problem of Social Costs, *Journal of Law and Economics* 3, 1-44

COST (2009). *COST Foresight 2030, Benefiting from the Digital Revolution*, COST Workshop on Food Security, Final Report, June 30- July 2, 2009, Gent, Belgium.

Dani, S. and A. Deep (2010). *Investigating risk management capability within UK food supply chains* http://lboro.academia.edu/SamirDani/Papers/1060574/Investigating_risk_management_capability_within_UK_food_supply_chains

Deep, A. and S. Dani (2009). *Managing Global Food Supply Chain Risks: A Scenario Planning Perspective,* POMS 20th Annual Conference, Orlando, Florida U.S.A., May 1 to May 4, 2009

http://www.apec.org.au/docs//Supply%20Chain%20Risk%20Assurance/124_SCRA.pdf
Derrig, R. (2002). Insurance Fraud.*The Journal of Risk and Insurance*. 69(3), 271-287.
DTRA & IIBR (2011). *Exploring Multidiciplinary Approaches to Chemical and Biological Defence* (2011), Proceedings, DTRA & IIBR Workshop, June 19-23, 2011, Eilat, Israel.
Furuboth, E. and R. Richter (1998). *Institutions and Economic Theory: The Contribution of the New Institutional Economics*. Ann Arbor: The University of Michigan Press
Gerasymenko, N. and O. Zhemoyda (2009). *New Challenhes for Risk Management in Agri-food Industry*, EAAE 113th Seminar, September 3-6, 2009, Chania, Crete, Greece
http://econpapers.repec.org/paper/agseaa113/58019.htm
ECDC (2010). *Annual epidemiological report on communicable diseases in Europe 2010*, European Centre for Disease Prevention and Control.
EEA (2010). *State of Environment Report*, Executive Environment Agency, Sofia.
Eurobarometer (2010). *Food-related risks*, Special Eurobarometer 73.5.
EU (2009). *The Rapid Alert System for Food and Feed, Annual Report 2009,* European Commission.
Eurostat (2011a). *From farm to fork – a statistical journey along the EU's food chain*, Eurostat.
Eurostat (2011b). *Waste statistics*, Eurostat.
Hefnawy, M. (editor) (2011). *Advances in Food Protection Focus on Food Safety and Defens*e, Springer.
Humphrey J. and O.Memedovic (2006), *Global Value Chains in Agri-food Sector*, Vienna: UNIDO.
Jaffee S., P. Siegel and C. Andrews (2008), *Rapid Agricultural Supply Chain Risk Assessment*, World Bank.
Koteva, N. and H.Bachev (2011). A Study on Competitiveness of Bulgarian Farms, *Economic Tought,* 7, 95-123.
Luning P., F. Devlieghere and R.Verhé (2006), *Safety in the agri-food chain*, Wageningen Academic Publishers.
MAF (2011). *Agrarian Report*, Ministry of Agriculture and Forestry, Sofia.
North, D. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press, Cambridge.
OECD (2008). *Managing Risk in Agriculture: a Holistic Approach*, OECD.
OECD (2011). *Managing Risk in Agriculture Policy Assessment and Design*, OECD.
Olson M. (1969). *The Logic of Collective Actions: Public Goods and the Theory of Groups*. Harvard Univ. Press.
Olsson, A. and C. Skjöldebrand (2008). Risk Management and Quality Assurance Through the Food Supply Chain – Case Studies in the Swedish Food Industry, *The Open Food Science Journal*, 2008, 2, 49-56.
Ramaswami, R., S. Ravi, and S.Chopra (2008). *Risk management in agriculture*, Working papers IDEAS
http://ideas.repec.org/p/ind/isipdp/03-08.html
RPDRM (2012). Disaster Risk Management in food and agriculture, Rome Partnership for Disaster Risk Management
http://home.wfp.org/stellent/groups/public/documents/communications/wfp201794.pdf
Schaffnit-Chatterjee, C. (2010). *Risk management in agriculture. Towards market solutions in the EU*, Deutsche bank Research
http://www.dbresearch.com/PROD/DBR_INTERNET_ENPROD/PROD0000000000262553.PDF
Shepherd, R, G. Barker, S. French, A. Hart, J. Maule, and A. Cassidy (2006). Managing Food Chain Risks: Integrating Technical and Stakeholder Perspectives on Uncertainty, *Journal of Agricultural Economics*, Volume 57, Issue 2, pages 313–327.
Sporleder, T. (1992). Managerial Economics of Vertically Coordinated Agricultural Firms, *American Journal of Agricultural Economics*, Vo l 74, No 5, 1226-1231.
Trench P., C.Narrod, D.Roy, and M.Tiongco (2011), *Responding to Health Risks along Value Chain*, New Delhi: 2020 Conference Paper-5.

Weaver, R. and T. Kim (2000). *Contracting to Manage Risk in Food Supply Chains*, Paper presented at IAMA 2000 Meetings, April 2000, Chicago, Illinois
http://www.icavresearch.org/wp-content/uploads/2009/12/weaver_Kim00.pdf
Williamson O. (1981). The Economics of Organization. *The American Journal of Sociology* 87 (3), 548–577.
Williamson, O. (1996). *The Mechanisms of Governance*. New York: Oxford University Press.
Zulauf, C. and D.Orden (2012). US Farm Policy and Risk Assistance, The Competing Senate and House Agriculture Committee Bills of July 2012, Issue Paper No. 44, Geneve: International Centre for Trade and Sustainable Development.