Risk Management in Agri-food Chain

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30 May 2012

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Abstract: This paper incorporates the interdisciplinary New Institutional Economics and presents a comprehensive framework for analyzing the risk management in 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. Next, it presents stages in analysis of risk management and for the improvement of public intervention in the risk governance. Finally, it identifies contemporary opportunities and challenges for risk governance in agri-food chain.

Key words: risk management; market, private, and public governance; agri-food chain
JEL Classification: D23, D81, L14, L22, L25, O17, Q12, Q13, Q18, Q52

Introduction

Around the globe the issues of management of diverse (natural, market, criminal, policy etc.) risks in agrarian and food sectors are among the most topical in academic, business and policies debates (Babcock, 2004; CIPS, 2012; Deep and Dani, 2009; EU, 2011; OECD, 2008; Olsson and Skjöldebrand, 2008; RPDRM, 2012; Schaffnit-Chatterjee, 2010; Shepherd et al., 2006; Trench et al., 2011; Weaver and Kim, 2000). In 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 put additional challenges on existing system of risk management in agri-food sector.

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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, 2005; DTRA & IIBR, 2011; Hefnawy, 2011; Jaffee et al., 2008; Luning et al., 2006). In most economic 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 his risk aversion risk probability and magnitude of damages modeled (Gerasymenko and Zhemoyda, 2009; OECD, 2011). Market and private failures are acknowledged, and the needs for public intervention in risk management increasingly recognized. At the same time, 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. As a result the efficiency and complementarities of risk management modes can not be properly assessed.

Despite 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, 2010; EU, 2011; Humphrey and Memedovic, 2006; OECD, 2011; Luning et al., 2006). 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, 2010, 2011c).

This paper incorporates the interdisciplinary *New Institutional Economics* (Coase, 1939, 1960; Furuboth and Richter, 1998; North, 1990; 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 the factors of governance choice. *Next,* it presents stages in analysis of risk management and for the improvement of public intervention in the risk governance. *Finally*, it identifies contemporary opportunities and challenges for risk governance in agri-food chain. The ultimate goal 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.

1. 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 *idiosyncratic,* accidental, low probability, unpredictable events, or *systematic* - high probability, "predictable" event.

The risk and threat could be of *natural* (e.g. adverse weather, insect attract, catastrophic event), *technological* ("pure" technical failures), or *human origin* (individual or collective actions/inactions, "human nature"), or a combination of them. The *individual* behavior and actions causing risks may range from: *agent's ignorance* (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* (stealing property or yields, arson, invasion on individual safety); *terrorist attacks* (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 demand, market price volatility, international competition, market "failures" and disbalances such as "lack" of labor, credit, certain inputs); *collective orders* ("free riding", codes of behaviors, industry standards, strikes and trade restrictions, community rules and restrictions); or *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) or it could be *caused* by the agri-food sector (risk *from* farming, from food processing, *from* food-distribution etc.). The risk could be *internal* for 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, entities, industries; or it 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 - 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 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.

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

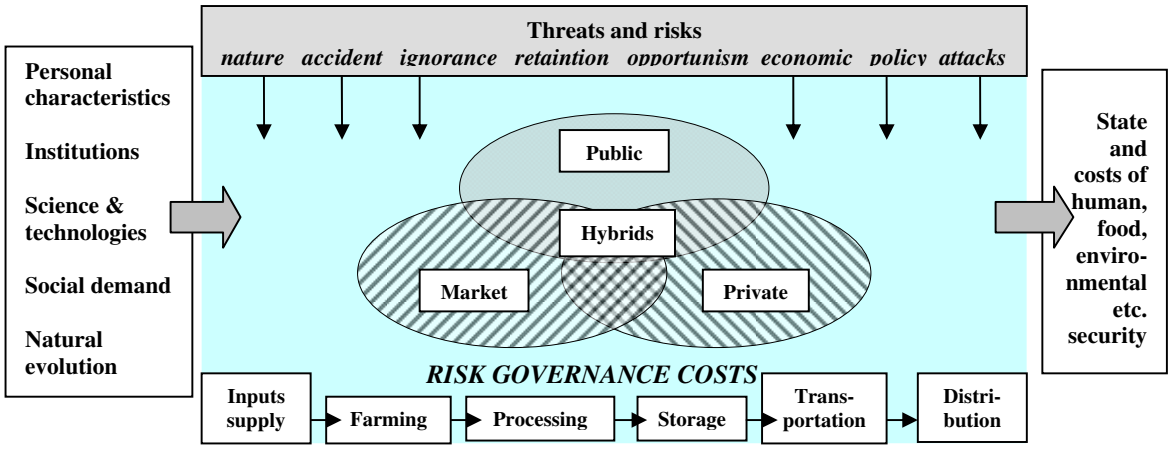


Figure 1. Generic risks, factors, stages and modes of risk governance in agri-food sector

- *private modes* ("private and collective order") - diverse private initiatives, and specially designed contractual and organizational arrangements tailored to particular features of risks and agents - codes

of behavior, diverse (rational, security, future etc.) contracts, cooperatives, associations, business ventures etc.

- *market modes* ("invisible hand of market") - various decentralized initiatives governed by free market price movements and 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, regulation, ban, assistance, funding, assurance, taxation, provision etc.

Sometimes, 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, appropriate (pest, disease, weather resist) varieties, technology and production structure, product diversification, dislocation etc. Similarly, *off-farm* enterprise (income) diversification is a major strategy for risk management in most of the European farms (Bachev and Tanic, 2011).

However, very often, 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. 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.

2. Efficiency of risk management

Individual modes of risk governance are with *unequal* efficiency since they have dissimilar *potential* to reduce likelihood and impact of risk, and command different *costs* (Bachev, 2010). Principally, the market or 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 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 (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 (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 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 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. 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 despite "common" interests and the huge potential for risk minimization collective organization for risk-sharing are not or hardly developed by stallholders.

[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, 2009).

[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.

[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, 2010).

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. Besides, individual agents have quite different interests for effective management of a particular risk(s) since they get unlike benefits and costs from risk management.

Last but not least important, there is no singe *universal* form for 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 low probable "standard" (natural, criminal) risk could be effectively governed by a classical market contract (purchase of insurance), most behavioral risks require special private modes (branding, long-term or interlink contracts, vertical integration), a high damaging risk from 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, 2008).

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 or society) or practically impossible (when uncertainty associated with future events is enormous, the transaction costs are very high). For instance, certain natural risk will always exist despite the available system of 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 subsequent rights and obligations of each party. Subsequently, some transacting risk will always retain. Therefore, an effective risk management is always connected with needs for some *trade-off*

[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.

between the benefits from reducing a particular risk (saved costs, minimized 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 new type of risk/costs – e.g. the vertical integration eliminates the "market risk" but creates a risk from opportunisms of partners. Moreover, the level of (overall) risk exposure is typically determined by the *"critical"* (most important) risk and the integral risk is rarely a sum of the individual risks.

Frequently, there are a number of possible *(alternative)* forms of governance of a particular type of risk – e.g. "risk to 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. In certain cases, some forms of risk management are practically impossible or social unacceptable – e.g. insurance markets do not develop for many kind of agro-food risks and the *private management* is the only option; 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 EU, there are strict regulations on GMC, "precaution principle" is mandatory for 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. 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 *long-term* (future) costs for recovering damages including associated *transaction costs* (disputes, expertise, low suits etc.) for claiming experienced losses[7].

In any case an *individual, group, community, sectoral, chain, national and international* efficiency of risk management have to be distinguished. It is often when elimination of a risk for one agent induce a

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

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

(new) risk for another agent – e.g. agri-food price fluctuation causes income risk to producers but benefit speculators; application of chemicals reduce risk for farmers but produce significant negative effects (e.g. water, soil and air contamination) on residents, consumers, affected industries etc.

Furthermore, risk management is only a *part* of the overall governance of divers (production, consumption, and transaction) activities of agents[8]. That is why the total efficiency (benefits, disadvantages, costs saving and risk minimization potential) of various modes for individual agents and public at large are to be taken into account[9].

According to the specific natural and socio-economic environment, personal characteristics of individuals, and social preferences, various *structure of risk governance* could evolve in different sub-sectors, industries, supply chains, 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[10]. Consequently, a whole range of risks would be left unmanaged which would have an adverse effect on size and sustainability of agri-food enterprises, markets development, evolution of production and consumption, state of environment, and social welfare (Bachev, 2010). Depending on the costs and efficiency of the *specific* system of governance 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

[8] E.g. most of the managerial innovations in farming and agri-food chain have been driven by transaction costs economizing reason (Sporleder, 1992).

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

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

capability) then enormous "gray" agrarian and food sector develops with inferior, hazardous and counterfeit components.

3. Factors of governance choice

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

Risk features like origin, probability of occurrence, likely damages, scale etc. are important factor for the governance choice. For instance, local risk could be managed though a private mode while most of market and environmental risks require collective actions at regional, national or transnational level. For high probability and harmful risks the agents will prefer more secure (more expensive) mode – security investment, purchase of insurance, keeping reserves, taking hostages, interlinked organization. Nevertheless due to lack of economic means many small 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 (Government, international assistance) intervention though insurance, support, safety net etc. schemes to decrease farmers vulnerability.

Personal and behavioral characteristics of agents (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 bigger organization (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 ventures etc.

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). 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). In order to optimize decision-making they have to spent on "increasing their imperfect

rationality" (data collection, analysis, forecasting, training, consultation) and selecting forms minimizing related risks/costs (internal organization, "selling out" risk etc.).

Agents are also given to opportunism and if there is an opportunity for some of transacting sides to get non-punishably extra benefit/rent from exchange he will likely to take an advantage of that[11]. *Pre-contractual* opportunism ("adverse selection") occurs when some of the partners use the "information asymmetry" to negotiate better contract terms. *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). The third form ("free ride") occurs in development of large organizations where individual benefits are not-proportional to 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, 1969).

It is often costly or impossible to distinguish opportunistic from 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) and agents have to protect their rights, investments, and transactions from hazard 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 contract execution stage (Williamson, 1996).

In agri-food sector opportunism is widespread before signing insurance contract (not disclosing the real information for possible risks) or during the contract execution period (not taking actions for reducing damages when event occurs; consciously provoking damages in order to get insurance premium etc.). That augments considerably the insurance prices and restricts utilization of insurance contracts by small enterprises. On the other hand, insuree often "discover" the pre-contractual opportunism of 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, hidden costs) had been well explained and/or adapted to farmers needs.

For many kind of farm related risks markets evolve very slowly and/or insurance services are practically inaccessible by majority of small operators. What is more, for many important risks

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

insurance is not available "for purchase at all" – e.g. risk of lack of market demand for farm products, fluctuation of prices, possible opportunism of 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 assurance supply.

The institutional environment ("rules of the game")[12] 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; 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 impossibility to adapt to (invest for) newly introduced EU standards for quality, safety, environmental preservation, animal welfare, certification etc.

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

Dimensional characteristics of activity and transactions (*combination* of uncertainty, frequency, assets specificity, and appropriability)[13] are critical for the management choice. When *recurrence* of 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

[12] That is *formal* and *informal* rights and rules, and the system(s) of their enforcement (North, 1990). They are defined by (formal, informal) laws, tradition, culture, religion, ideological and ethical norms, and enforced by the state, convention, community pressure, trust, or self-enforcement.

[13] First three factors are identified by Williamson (1996), and the forth added by Bachev and Labonne (2000).

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 costs for its development could be effectively recovered by frequent exchange. When a transaction is *occasional* (incidental) then possibility for opportunism is great since 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). Since bounded rationality is crucial and opportunism can emerge the agents will use special private form diminishing transaction uncertainty – trade with origins; providing guarantee; using share-rent or output-based compensation; obligatory collateral for providing a credit; participating in inputs-supply or marketing cooperative; complete integration.

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

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

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

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 protection, detection, verification, and a third-party (court) punishment of unwanted exchange extremely high. Agents would either over-produce (e.g. negative externalities) or under-organize such activity (positive externalities) unless they are governed by efficient private or hybrid mode - cooperation, strategic alliances, long-term contract, trade secrets, or public order.

The progress in science and technologies significantly improves risk management and facilitate diversification of its form. For instance, introduction of new (resistant) plant and livestock varieties; mechanization and standardization of operations and products; application of information, forecasting, monitoring, storage, and transportation technologies, all they improve significantly risk management in agri-food chain (COST Foresignt 2030; Hefnawy, 2011). Modern application of science and technologies is also application with production and/exposure to new type of risks – green-house gas emitions, genetic contamination, natural resource depletion, technical over-dependency etc.

Finally, the ***evolution of natural environment*** – global worming, extreme weather, plant and animal diseases, drought, flooding and other natural disasters are posing series of new challenges for risk management in agrarian and food sector (Hefnawy, 2011; OECD, 2011).

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

The *comparative analysis* is to be employed to select among feasible forms the most efficient one reducing the overall risk to *"acceptable"* level and minimizing the *total* (risk assurance and governance) *costs*. Most of the elements of the efficiency of risk governance are hardly to quantify – e.g. the individuals' characteristics, the amount of risk, the level of benefits and costs[14] associated with each mode etc. That is why a *qualitative (Discrete structural) analysis*[15] could be used. The later matches the *features of a risk* to be managed (probability, significance, acceptance level, needs for collective action) and its *critical (institutional, technological, behavioral etc.) factors* with the *comparative advantages* (effective potential) of *alternative modes* to inform, stimulate appropriate

[14] E.g. "measurement problems" associated with the transaction benefits and costs are well specified (Bachev, 2011b). They also prevent utilization of traditional (Neoclassical) models simply by adding a new "transacting", risk management etc. activity (Furuboth and Richter, 1998).

[15] Operationalisation of Discrete Structural Analysis of economic organization is done by Williamson (1981).

behavior, and align 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 combination of risk features (probability of occurrence, likely magnitude of damages) and the critical dimensions of activity/transactions (appropriability, assets specificity and frequency). Figure 3 presents a matrix with the principle forms for effective risk governance in agri-food sector. For instance, high "standard" risk could be effectively managed through a *free market* mode such as a standard *(classical)* insurance, inputs supply, marketing etc. *contracts*. However, serious transacting risk exists when condition of assets specificity is combined with high uncertainty, low frequency, and good appropriability. Elaboration of a special governing structure for private transacting is not justified, specific (risk reducing) investments not made, and activity/restriction of activity fails to occur at effective scale ("market and contract failure"). Here, a *third-part* (private, NGO, public) *involvement* in transactions is necessary (assistance, arbitration, regulation) in order to make them more efficient or possible at all. The unprecedented development of special origins, organic farming, systems of "fair-trade" are good examples in this respect. There is increasing consumer's demand (price premium) for organic, original, and fair-trade products associated with some forms of (natural, poor household, labor, quality etc.) risk management. Nevertheless their supply could not be met unless effective trilateral governance including independent certification and control is put in place.

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

4. Stages in analysis and improvement of risk management

The *analysis* and *improvement* of risk governance in agri-food chain is to include following *steps* (Figure 3): **First,** identification of *existing* and *emerging* threats and risks in agri-food chain. Persistence of certain risks is a good indicator for ineffective management. Modern science offers quite reliable and sophisticated methods for assessing various risks *to* or *caused* by agri-food chain (DTRA & IIBR, 2011; Trench et al., 2011).

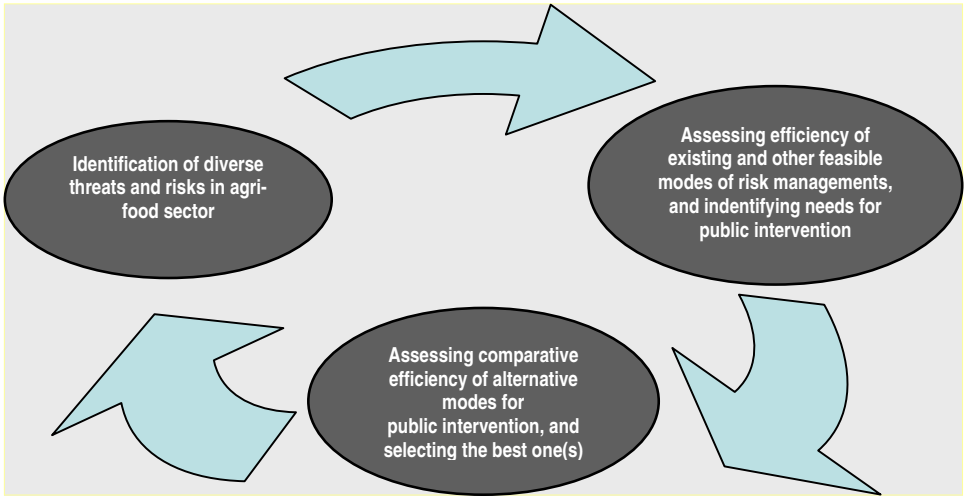


Figure 3. Analysis and improvement of risk management in agri-food sector

Second, specification of *existing* and *other feasible modes* of risks governance, and assessing their efficiency, sustainability and prospects of development. *Efficiency* of individual modes shows capability for risks detection, prevention, mitigation and recovery at lowest costs while *sustainability* reveals ”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 (2010). That stage is to identify *deficiencies* of dominating (market, private, and public) modes to solve existing and emerging risks, and to determine the *needs for (new) public intervention*. For instance, when appropriability associated with transaction/activity is low, there is no pure market or private mode to protect from associated

risks[16]. 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 *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 *alternative* modes for public intervention to correct (market, private, public) failures, assessing their *comparative efficiency*, and *selection* the best one(s). 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** *private* and *public transacting costs.* The later often comprise a significant portion of the overall risk management costs and are usually ignored – e.g. costs for coordination, stimulation, mismanagement of bureaucracy; for individuals' participation and usage of public modes (expenses for information, paper works, payments of fees, bribes); costs for community control over and for reorganization of bureaucracy (modernization and liquidation of public modes), and (opportunity) costs of public inaction, etc.

Initially, existing and emerging problems (difficulties, costs, risks, failures) in 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. For instance, 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, 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

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

resources; on food safety and clean environment; tradable quotas for products, inputs, emissions; on intellectual property, origins etc. That intervention transfers organization of 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 (standards for labor, product, environmental safety); introduction of foreign species and GM crops, and (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.

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

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 case of critical infrastructure; food safety inspections; research, education and extension; agro-meteorological forecasts; border sanitary and veterinary control; recovery from natural catastrophe etc.

Usually, 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: complementarities (joint effect) of individual forms; restricted potential of some less expensive forms to achieve certain (but not entire) level of socially preferred risk prevention and mitigation; possibility to get extra benefits (e.g. “cross-compliance” requirement for participation in public programs); specific critical dimensions of governed activity; risk and uncertainty (little knowledge, experience) associated with likely impact of new forms; administrative and financial capability of Government to fund, control, and implement different modes; and 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 strong necessity for trans-border actions or consistent (national, local) government failures. Very frequently effective governance of many problems and risks requires *multilevel* governance with 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 competency (decrease bounded rationality, powerlessness) of bureaucrats, beneficiaries, interests groups and public as well as restricting possible opportunism (cheating, interlinking, abuse of power) of 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 management of public modes at all levels.

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

If there is strong need for third-party public involvement but 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 agrarian "development" is substantially deformed.

Dealing with many problems and risks in 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 design of (new) public intervention according to the specific conditions of food-chain components in particular country or region in terms of increasing security and decreasing costs. Suggested new approach also let predict

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

The risk management analysis is to be made at *different levels* – individual component (inputs supply, farm, processing, transportation, distribution), regional, sub-sectors, food-chain, national, and international according to the *type of risks* and *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 risk-management along with the evolution of socio-economic and natural environment, individual and communities' awareness, and modernization of technologies. Besides, public (local, national, international) failure often prevails which brings us into the next cycle in improvement of risk-management in agri-food sector.

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

5. Contemporary opportunities and challenges for risk governance in agri-food chain

Modern agri-food chains involve millions actors with different interests, multiple stages, and divers risks requiring complex, multilateral and multilevel governance at a large scale. For instance, number of farmers in EU is several millions, different food-processors and retailers are several hundred thousands, while final consumers reaches 500 millions[17].

Various existing and emerging (natural, technological, behavioral) *threats and risks* along with modern agri-food chains are well-identified (DTRA & IIBR, 2011; Humphrey and Memedovic, 2006; OECD, 2011).

Diverse *market* and *private* modes have emerged to deal with specific risks driven by ethics, competition, consumer demand, business initiatives, and trade opportunities – e.g. direct marketing, voluntary codes (professional and corporate social, labor, environmental etc. responsibility), industry

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

standards, insurance schemes, guarantees, fair-trade, trade with brands, origins, organic and quality products (Figure 4).

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

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

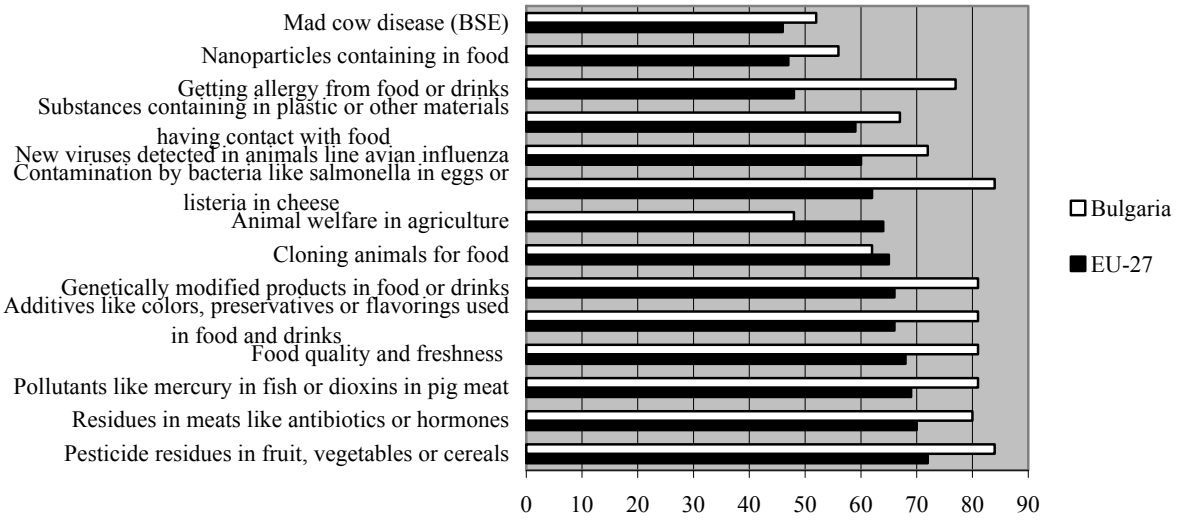
Property (security and safety) rights modernization, and market and private "failures" brought about needs and modes for *public interventions* (assistance, regulations, provision) in agri-food sector. Moreover, the scope and stringency of publicly-imposed rules expend constantly embracing new products,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

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

Consumers concerns about the food-safety risks significantly increase 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). For instance, since 2005 there is augmentation of respondents "worrying about food-safety problems" in EU and it comprise a significant share now (Figure 5); as much as 48% of European consumers (in Bulgaria 75%) indicate that consumed food "very or fairly likely" can damage their health etc. (Eurostat, 2010).

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 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; Criminal intrusion; Terrorist attacks	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 contcart; Hedging with future price contacts;	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; 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	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 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 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. Risks and modes of governance along with modern agri-food chain



Source: Eurobarometer 73.5, 2010

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

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

First, advances and dissemination of *technical* food-chain, training and risk-management *methods* (microbiological, genetic, electrical, laser, robotic, immunological, chemical and biosensors, nanotechnology, ICT), integral and food-chain *approaches*, and research, monitoring, testing, decision, and foresighting *capability* for risk-detection, assessment, prevention, and mitigation (COST, 2009; Trench at al., 2011). For instance, advancements in detection, assessment and mitigation methods and technologies associated with biological and chemical risks have been presented at a recent international conference (DTRA & IIBR, 2011).

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

Third, considerable development of *specialization* of activities (including in risk-taking, monitoring, management) and *concentration of (integral) management* in food-production, processing, servicing, and distribution - centralized innovation and enforcement; time, scale, and scope economies; easy third-party control etc. For instance, market share of three largest food-retailers comprise between 27-

91% in EU states (Eurostat); food-safety training, certification, inspection, and information are big international business (Humphrey and Memedovic, 2006) etc.

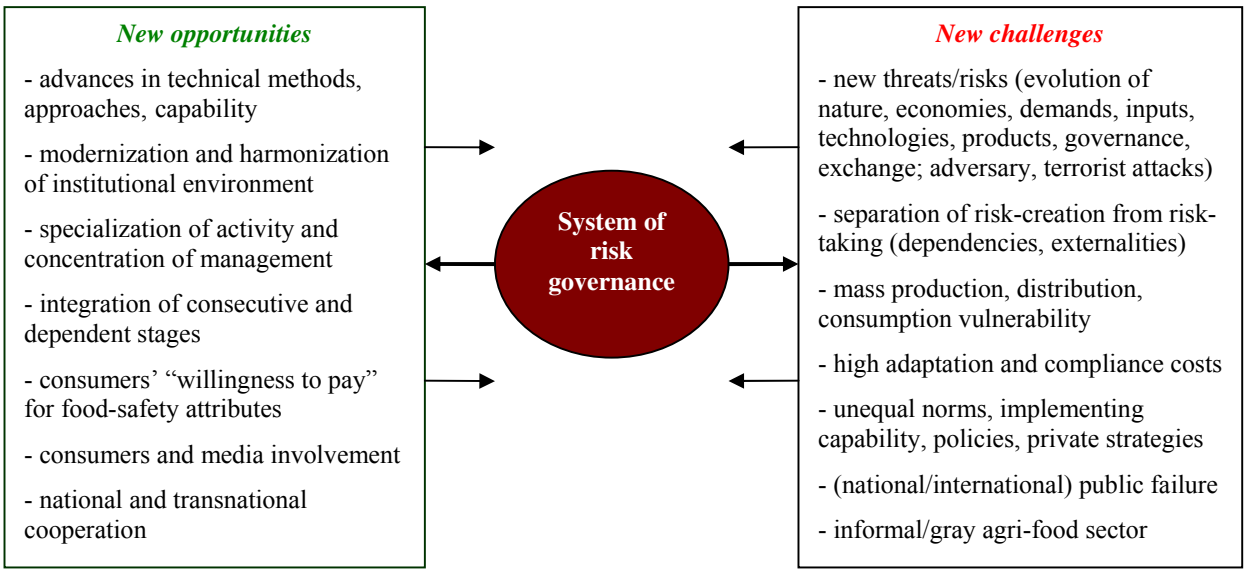


Figure 6. Opportunities and challenges for risks governance in agri-food chain

Forth, quasi or complete *integration* of food-chain's consecutive or dependent stages creating mutual interests, and effective and long-term means for risk-perception, communication, and management. For example, in Bulgaria (raw) milk supply is closely integrated by (dairy) processors through on-farm (collecting, testing) investments and interlink (inputs, credit, and service supply against milk-delivery) contracts with stallholders, while dairy marketing is managed by branding and long-term contracts – standards and bio-labels (Bachev, 2011a).

Fifth, increasing consumers "willingness to pay" for food-safety attributes such as chemical and hormone bans, safety and inspection labels, original and special products etc. (Trench at al., 2011). The later justify and make economically possible paying-back of costs for a special governance.

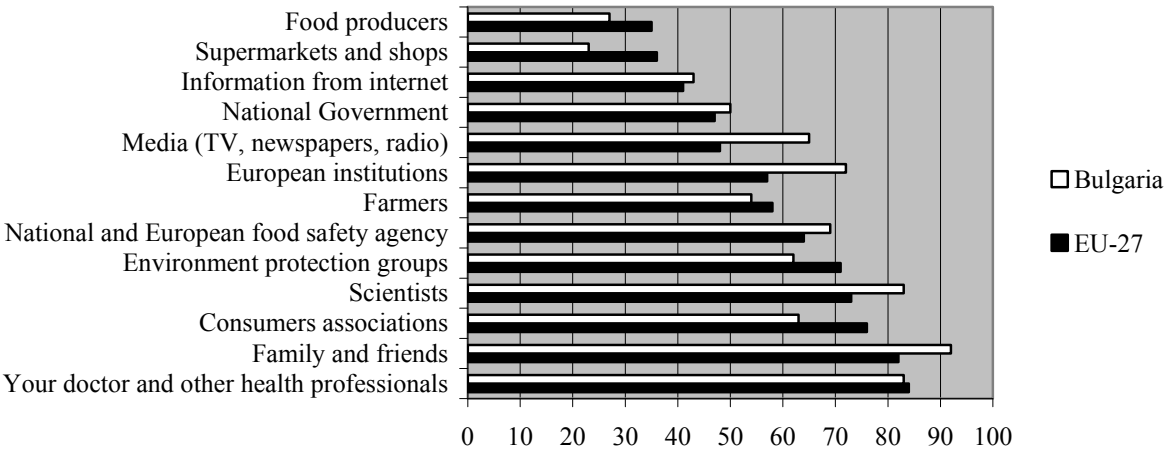
Six, growing *consumers'* (representation, organizations) and *media* involvement, and *national* and *transnational* (information, technical, managerial, training, certification) *cooperation* of partners and stakeholders improving agents choice, inducing public and private actions, enhancing risk-management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

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

i/ 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 new human induced *economic, financial, food, food safety, water, environmental etc. crises* at large *(transnational, global) scales.*

ii/ Increasing new threats, risks and uncertainty connected with the *inputs, technologies,* and *products* differentiation and innovation – e.g. Fukushima nuclear accident severely affected agri-food sector; there are uncertainties associated with growing application of nanotechnologies and GMCs etc. (Eurostat).

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



Source:Eurobarometer 73.5, 2010

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

iv/ Widespread mass production, distribution, and consumption increases *vulnerability* of agri-food chain expending scope and severity of natural, incidental, opportunistic, criminal or terrorist risks. For instance, in Europe there is a progressive number of official notifications based on market and non-

member countries controls, food-poisoning, consumer complaints, company own-checks, border screening and rejections (Eurostat).

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

vi/ Public and private food quality and safety standards and efficiency of their enforcement differ considerably between industries, countries, and regions (Humphrey and Memedovic, 2006). That is result of *unequal norms* (e.g. GAPs, formal and informal rules) and *implementing* and *enforcing capability*, and/or deliberate *policies* or 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 dissimilar threats and risks exposure of individual agri-food systems.

vii/ Wide spreading "public failures" in food-chain (risk) management – 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 has been established with a 5 years delay; the 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, 2010). There are numerous instances of *international* assistance or governance *failures* when institutions are "imported" rather than adapted or designed for the specific local conditions (Bachev, 2010).

viii/ Production, marketing, and consumption traditions, the high food or governance costs, the will and capacity deficiency, all they are responsible for persistence of a large risky *informal/gray* agri-food sector around the globe without 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, 2010).

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

Conclusion

The analysis of 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 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 efficiencies, complementarities and prospects of alternative (market, private, public and hybrid) modes. The system of risk management is to adapt/improved taking advantage of the specified new opportunities and overcoming/defending against new challenges.

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

Third, a greater support must be given to multidisciplinary and interdisciplinary research on (factors, modes, impacts of) risk governance in 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 risk management.

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