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Decision making in agriculture and insurance as a risk management tool

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Business or any other activity in agriculture is at higher risk comparing with other sectors. Accordingly, agricultural risk is associated with negative outcomes stemming from imperfectly predictable biological and climatic variables. These variables include natural adversities (for example, pests and diseases); climatic factors are not within the control of agricultural producers. So in agriculture it is very important to identify, evaluate and manage risk, only then decisions made in a farm will bring profit and other positive results. Consequently, this article presents the main steps for making effective decisions in agriculture. Secondly, it introduces one of the most effective risk management tools – insurance. This article presents insurance types and systems, their advantages and disadvantages. And, finally, it illustrates how the scenario analysis method for making decisions in agriculture can be used. The main advantage of the scenario analysis method is that it can evaluate qualitative and quantitative information. Using the scenario analysis method, it is possible not only to evaluate each risk or group of risks, but also to evaluate the performance of management tools and to decide which insurance type is the most useful.

Key words: decision making, agriculture risk, insurance, scenario analysis method

INTRODUCTION

Agricultural business organizations are facing risk more than other business sectors because agricultural products and services are related to natural processes and biological assets: plant and animal diseases. Agriculture is particularly exposed to adverse natural events such as insect damage and poor weather conditions that negatively impact production. The economic costs of major climatic disasters may increase further in the future due to climate changes. So farmers have to develop risk management strategies to cope with these adverse events, sometimes they have to use government assistance. So in agriculture it is very important to evaluate and manage agriculture risk, to select the best management methods. One of risk management ways is to use insurance. Agricultural insurances are extremely useful because risks appear due to uncontrollable climatic changes. Meanwhile it is very difficult to make choice what kind of insurance to use, what type of insurance is best to a farmer according to his specific needs.

So purpose of this article is to justify insurance as a risk management tool, to distinguish between the types of insurance and their features, and to analyze the decision making process in agriculture.

Tasks:

1. To analyze the decision making process and the main decision making steps.
2. To distinguish insurance as one of risk management strategies and analyze its features.
3. To create a decision making scheme for decision making in agriculture.

To achieve this purpose, general science research methods were used. Generalization, deduction, comparison and synthesis techniques were used for analysing decision making process, insurance types, advantages and disadvantages of insurance systems.

ANALYSIS OF RISK EVALUATION AND MANAGEMENT INFLUENCE ON DECISION MAKING

Risk in agriculture is always a concern around the world since 1933 when the base of risk analysis was established by Knight (2002). Analyzing literature in the field of agricultural risk (Halter, 1971; Dillon, 1971; Hardaker, 2006; Landanyi, 2003), we can find that evaluating and managing risk in agriculture is difficult. The enterprise of agriculture has to deal with many uncertainties. Agricultural economics literature has provided several studies to estimate farmer risk preferences (Gomez-Limon et al., 2003; Isik, Khanna, 2003; Toledo, Engler, 2008), or generate models to understand how a farmer decides among a set of random choices (Hardaker et al., 2004; Bradshaw, 2004). In general, all these studies focus on a limited set of risk sources, excluding several measurable and non-measurable risk factors from the analysis. To this effect, measuring the importance of different risk sources influencing farmers' decisions, as well as constructing management tools to assist the decision process have received less attention in the literature. In the analyzed literature any specific instructions or guidlines how decinions should be made in agriculture taking into account the uniqueness of this sector were not found.

According to Baquet et al. (1997), there are five distinct risk factors in agriculture: productive risk, marketing risk, financial risk, human risk, environmental risk. Meanwhile Hardaker et al. (2004) include political and business risks in this list. So each of these risks play a role in the farmer's decision making process, thus it is very important to evaluate and measure risks in agriculture properly.

Risk management may be divided into a number of steps that should be gone through in a routine and cyclic way by every organization. These steps are outlined by Hardarker et al. (2004) in Fig. 1.

Analyzing the context includes strategic, organizational and risk management aspects. The strategic context defines the relationship between the organization or the farm and its environment, identifying the organization's strength, weaknesses, opportunities and threats. In Hardaker et al. (2004) opinion, the organizational context relates to the process of setting and communicating goals and objectives and the division of responsibility for various types of decision making among people in

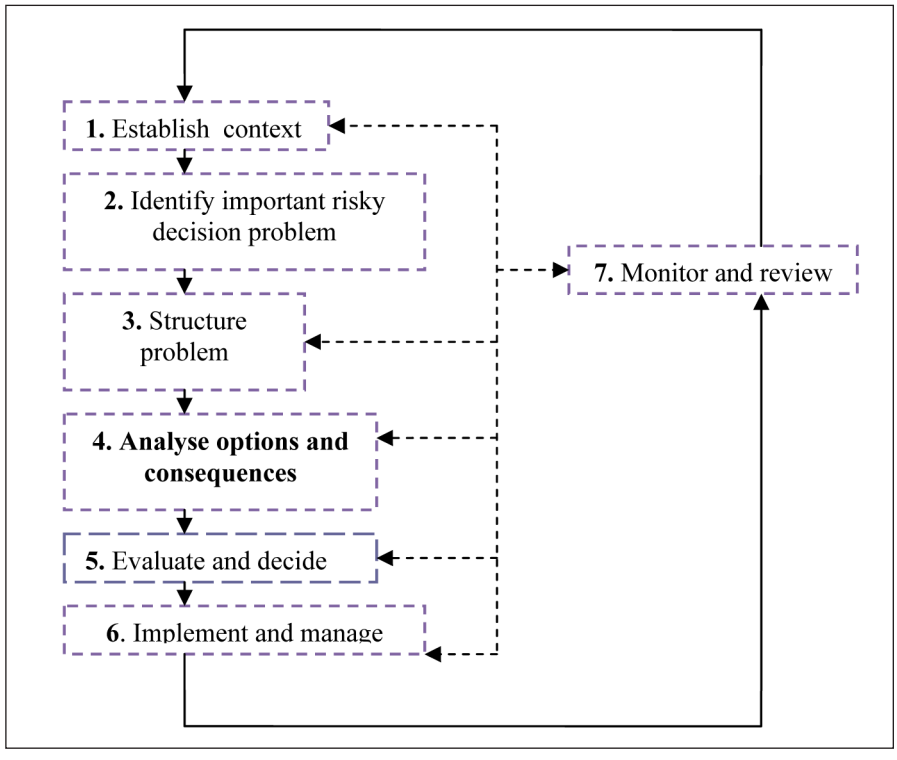

Fig. 1. Steps in risk management (Hardarker et al., 2004)

the organization. Therefore the risk-management context relates to defining the scope of the current pass through the risk management process illustrated in Fig. 1.

The step which identifies a risky decision problem includes such items like what might happen, why and how, and how organization might be affected. Next step – structure problem – identifies the exact nature of the risk being considered. Questions to which answers may be sought include: Who faces risk? Who suffers if things go wrong? What are the basic and proximate causes of the risk? How the risk is currently managed? What other options are available to manage the risk? Who decides what to do? Meanwhile risk analysis often starts with consideration of the chances of occurrence of the risk, followed by assessment of the consequences, given current risk-management practice. Risk evaluation flows from and is linked to the previous step of risk analysis. It is concerned with evaluating the risky consequences of the available decision options to reach a decision on what to do for the best. Implementation of a decision simply means doing what has been decided upon. But it is necessary to take into consideration that according to the nature of risk, circumstances will change as events unfold, requiring active management of risk. Moreover, because risk management involves choices made with imperfect information, it is likely that some risk-management options will turn out to be unsatisfactory. So monitoring and review are therefore necessary to establish that the risk-management is working and to identify aspects where further decisions need to be made (Hardaker et al., 2004).

Decisions in agriculture are more risky than in other business sectors because agriculture depends on weather conditions and biological asset (plants and animals). All these reasons only show that risk evaluation and management in the agriculture sector request special attention.

RISK MANAGEMENT STRATEGIES AND INSURANCE

Once the risk has been identified and assessed, various strategies can be used for its minimization. Two types of risk management strategies are normally distinguished (EC, 2001):

– strategies concerning on-farm measures: selection of products with low risk exposure (e. g. benefiting from public intervention), selection of products with short production cycles, diversification of production programmers, vertical integration self-insurance or individual stabilization accounts;

– risk sharing strategies: marketing contracts, pre-risk sharing strategies: marketing contracts, production contracts, hedging on future markets, participation in mutual funds and insurance.

In this article attention will be focused on insurance. According to Anca, Georginam (2009), insurances represent an element of reducing the economic uncertainty and a means of resuming the temporarily suspended activity. Insurances do not reduce the variety risks, but people are better prepared to face them. In the context of a free, undirected economy, any personal investment is exposed to risks and uncertainty, especially in agriculture where, due to specific problems regarding the production process – the large output cycle, the slow turning of capital, the rate of profit which is much lower compared to other economic branches – a strong protection of investments is required.

Insurance is defined as the equitable transfer of the risk of a loss from one entity to another in exchange for a premium. The risk bearing entity is the insurance company. The company assumes this liability once it accepts payment of a premium amount determined by the insurance company. The company carefully evaluates the risks and then determines adequate premiums to cover expected loss payments, administration expenses and a profit margin. The risk transferring entity is the purchaser of the insurance such as a car owner, homeowner, farmer or bank. This party has determined that the risk of loss is too great to assume and so for a certain payment (premium) the risk is now transferred to an entity or insurance company that can better afford the potential loss.

Agricultural insurance is one financial tool that agricultural producers can utilize to mitigate the impacts of unpreventable risks. There are several types of insurance schemes that are described in Table 1.

As it is seen from the Table, the more a farmer wants to reduce his risk, the more he has to pay

Table 1. **Types of insurance and their features (made by authors)**

Type of insurance	Descriptions	Features
Single-risk insurance	Single-risk insurance covers against one peril or risk, e. g. hail.	Very useful for farmers who have small farms and grow only on culture.
Combined (peril) insurance	Combined insurance means a combination of several risks covered (two or more risks, mostly with hail as basic cover). In some countries this type of insurance is also referred to as multi-risk insurance.	Main disadvantages: big premium / fee, farmer has to buy whole insurance package and cannot form by its unique needs.
Yield insurance	Yield insurance includes yield guarantee, based on regional average yield or on individual historic yield, where the main risks affecting yield (e. g. drought) are comprised. In some countries (e. g. USA) this type is also called combined or multi-peril insurance.	This kind of insurance ensures stable income to a farm, but has rather high insurance fee.
Revenue insurance	Revenue insurance combines yield and price risks coverage in a single insurance product. It can be product-specific or whole-farm.	Insurance fee is higher than that of yield insurance. This kind of insurance protects not only from weather conditions, but also from price fluctuation.
Income insurance	Income insurance covers income, so it covers yield and price risks, but the costs of production are also considered. Usually this type of insurance is not product-specific, but whole-farm income.	
Whole-farm insurance	This type consists of a combination of guarantees for different agricultural productions in a farm. Depending on the coverage of the guarantees, it can be whole-farm yield insurance, or whole-farm revenue insurance or whole farm income insurance.	A very complex insurance system, a farmer cannot differentiate between prohibited risks and look for the optimal insurance premium rates.
Area yield index insurance	Indemnities are computed from the decrease of the average yield in an area.	Farmers receive a flexible insurance for them with the opportunity to choose the most acceptable insurance indices.
Area revenue index insurance	Indemnities are computed from the decrease on the product of the average yields and prices in an area.	
Indirect index insurance	Indirect index insurance reports to those indices of yields or vegetation computed from weather based indices, satellite images and others.	
Stabilization accounts	Stabilization accounts are a form of self-insurance. They consist of individual accounts where farmers put an amount of money every year, which they can withdraw in a year of big losses. Stabilization accounts can be based on yield, revenue or other indices.	Farmers have to ensure safety of money by themselves.

to the insurance company. It is also important to note that risks are insurable, if the following basic conditions are fulfilled (Skees, 1997; Skees, Barnett, 1999):

– symmetric information: the insurer and the insured have (nearly) the same information as regards the probability distribution of the risk (the probability of a bad outcome). This is normally not the case, the main problems being moral hazard and adverse selection. Therefore, insurance solutions are only viable and can be offered at reasonable cost, if these problems can be adequately dealt with;

– independent risks: risks should be (nearly) independent across insured individuals. If risks are systemic (dependent), special measures have to be taken in order to make insurance solutions viable;

– large number of exposure units: the law of large numbers allows an accurate prediction of average future losses and the calculation of the premium;

– calculable chance of loss: in order to fix the premium rates, the insurance company must be able to estimate both average frequency and average severity of loss. For low probability

risks with potentially catastrophic outcomes it is difficult to fix a rate;
– actual losses occurring must be determinable and measurable;
– in the perception of the potential buyer of a policy, potential losses must be significant, otherwise he will bear the risk himself. At the same time, the premium must be economically affordable.

It is intresting to note that different countries have different insurance systems. Consequently, there are three insurance systems: private, public and private-public. Table 2 iliustrates the main advantages and disadvantages of each system.

All systems have advantages and disadvantages. In Lithuania there is a private-public insurance system because the State supports insurance in the field of agriculture.

DECISION MAKING PROCESS IN AGRICULTURE

Earlier in this article we discused the decision making process and all types of insurance. So in this part we will analize the logical framework how decisions in agriculture should be made: the main steps are showed in Fig. 2.

Table 2. **Advantages and disadvantages of insurance systems (made by authors)**

Insurance system	Advantage	Disadvantage
Private system	– insurance is made by private companies, so they offer the best possible insurance products for farmers; – flexibility in terms of insurance; – farmer access to exclusive insurance terms depending on the insured crop acreage.	– State gives no support and does not encourage farmers to insure crops; – crop protection is provided only to certain risks under certain conditions; – private insurers are not interested in the organization of crop insurance for high risk and potentially large losses; – system performance depends on the number of the insured.
Public system	– State insurance companies provide compensation for damage to insured risk cases; – State insurance system has the minimum to go bankrupt.	– State insurance does not offer flexible insurance products to farmers and does not address the potential competitive business environment; – compulsory insurance is often not acceptable to small farmers, who would bear the risks themselves; – compensation insurance premiums depend not only on the state, but also on the regional economic situation and the possibilities for compensation to farmers.
Private-public system	– by the prohibition of private insurance companies in collaboration with the State; – State shall support the insurance companies and farmers – as part of the crop insurance scheme and the promotion of risk management on farms; – insurance companies offer a wider range of risks insured, more insurance packages; – insurance companies are taking on greater risk; – farmers receive compensation payments, insurance, make it possible to optimize the management of risks on farms, state subsidies for insurance premiums; – State carries out promotion and information measures in the agricultural risk management and crop insurance system issues.	– insurance companies are not interested in competing and reduce insurance rates, since the State compensates for insurance premiums; – insurance companies do not provide flexible insurance product packages; – farmers are faced with the problem of insurance reimbursement because of the reimbursement rules and delays in the process; – private sector influence in the system is limited.

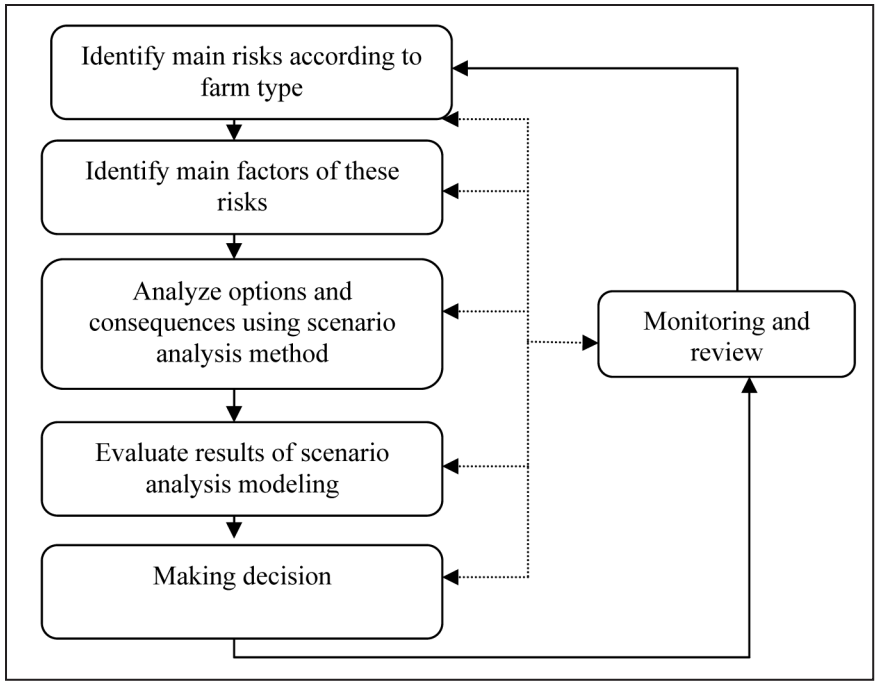

Fig. 2. Steps for making risk management decisions in agriculture (made by authors)

First steps are risk and their factors identification according to the farming type. For different types of farms different kinds of risks are important, e. g. for crop farms production risks and such factors as weather, region and soil conditions, climate changes are very important. Meanwhile, for livestock farms such factors like animal diseases, water supply, animal welfare conditions and so on are important.

So every farmer according to his farm specificity and his current situation has to identify what kinds of risks are the most important to him and elaborate the most relevant factors.

When the problematic situation is identified, it is necesary to evaluate the situation, i. e. to analyse all options and possible consequences.

In authors' opinion, the best way to analyze possible decision options is to use the scenario analysis method. Scenario analysis is a method used in decision-making based on the assumption that future events cannot be predicted with certainty. Each variant develops a characteristic whenever the predictions turn out to be true. A critical step of the analysis is to identify the key factors and the compression of the scenarios. The success of this analysis method depends largely on the technical and methodological expertise of those involved, as well as the quality of the data used. In this case, accuracy of the method depends on farmer's judgment.

The method is very complex – not least because most people look at key factors which multiply the number of rough scenarios. Besides, this method can include not only quantitative, but also qualitative data analysis. This method usually analyzes three situations: "Best case", "Worst case" and "Most likely case". Table 3 gives an example what kind of framework can be used making decisions in agriculture and using the scenario analysis method.

Using the scenario analysis method, it is possible not only to evaluate each risk or group of risks, but also to evaluate the performance of management tools, e. g. what kind of insurance is more useful. According to each insurance feature, advantages and disadvantages (Table 1), a farmer decides what kind of insurance is the best for his farm. Taking into consideration two or three insurance types and putting them into the scenario analysis matrix, it is possible to quantify the extent of the risk, and in the end to decide if it is worth to use insurance or which kind of insurance is more useful for the farmer.

Table 3. **Scenario analysis method for making decisions in agriculture (made by authors)**

Symbol	Indicator	Best case	Most likely case	Worst case
PL	The extent of the risk (possible loss)	*Minimum loss*	*Most likely loss (judging by the past)*	*Maximum loss*
IF	Fee for insurance	*Fee amount according to insurance agreement*		
IFC	Insurance fee compensation	*Depends on insurance agreement and country insurance system (e. g. in Lithuania the State gives 50 percent compensation of insurance fee)*		
IP	Insurance payments	*Depends on insurance agreement and its conditions*		
RTM	Risk in terms of money	*Value is calculated by Formula 1*		

Using the scenario analysis method, the risk level is calculated:

IP–PL–IF+IFC=RTM.

The higher risk RTM, the lower risk and loss. The difference between RTM of the best case scenario and RTM of the worst case scenario shows the possible extent of the risk and the possible cost of made decisions.

When RTM is calculated, the farmer can decide which type of insurance is the best for his current situation. And according to his view to risk he will make a relevant decision.

It is important to draw attention that in Lithuania crop insurance for farmers is very beneficial because of these reasons:

1) State supports crop insurance: the State gives 50 percent of compensation of insurance fee;

2) yield insurance gives more advantages to access credit (lower interest rates, lower taxes);

3) yield insurance is one of necessary conditions for getting EU support.

All these reasons should be taken into consideration by making decisions how to manage risk in agriculture. According to authors, the method illustrated in Table 3 is universal and can be used not only by Lithuanian farmers, but also by other countries farmers. In this case, the main variables of the method are the following: country insurance system (the State supports insurance fees or not) and types of products that can be offered by insurance companies.

The last step of the decision making scheme in agriculture (Fig. 2) is monitoring and review. Monitoring is a process that means to be aware of the state of a system. This step is necessary for system evolution, for making better decisions, for learning from mistakes.

CONCLUSIONS

1. Agricultural business organizations are facing risk more than other business sectors because agricultural products and services are related to natural processes and biological assets: plant and animal diseases. Agriculture is particularly exposed to adverse natural events, such as insect damage and poor weather conditions that negatively impact production.

2. Making decision in a farm, it is necessary to follow these steps: establish context, identify important risky decision problem, structure problem, analyse options and consequences, evaluate and decide, implement and manage, monitor and review. Only when made decisions will be effective, they will allow to avoid losses.

3. There are two types of risk management strategies: strategies concerning on-farm measures and risk sharing strategies. Meanwhile, insurance is recognised to be a basic instrument for maintaining stability in farm income, through promoting technology, encouraging investment, and increasing credit flow in the agricultural sector, it is one of the most effective risk management tools.

4. Making decision in agriculture, it is gainful to follow these steps: identify main risks according to the farm type; identify the main factors of these risks; analyze options and consequences using the scenario analysis method; evaluate the results of scenario analysis modelling; make the decision and implement monitoring and review.

5. For making decisions in agriculture it is gainful to use the scenario analysis method. This method includes quantitative and qualitative data. The method is very complex because most people look at key factors which multiply the number

of rough scenarios; at least three situations "Best case", "Worst case" and "Most likely case" are analyzed.

6. In Lithuania using insurance as a risk management tool is beneficial for farmers because of these reasons: the State supports crop insurance and gives 50 percent compensation of the insurance fee; yield insurance gives more advantages to access credit (lower interest rates, lower taxes); yield insurance is one of necessary conditions for getting EU support.

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SPRENDIMŲ PRIĖMIMAS ŽEMĖS ŪKYJE IR DRAUDIMAS, KAIP RIZIKOS VALDYMO PRIEMONĖ

Santrauka

Žemės ūkyje užsiimant verslu ar kita veikla rizika yra didesnė nei kituose sektoriuose. Žemės ūkis kitaip nei kitos sritys yra priklausomas nuo klimato ir biologinių elementų: augalų ir gyvulių gerovės. Minėtieji veiksniai priklauso nuo natūralių sąlygų (pavyzdžiui, kenkėjų, ligų), klimato veiksnių ir nepriklauso nuo žmogaus valios. Dėl to vykdant žemės ūkio veiklą yra labai svarbu identifikuoti, įvertinti ir tinkamai valdyti riziką, kad ūkyje priimami sprendimai būtų efektyvūs ir pelningi. Taigi šiame straipsnyje pateikiama schema, nurodanti pagrindinius žingsnius, padedančius priimti efektyvius sprendimus žemės ūkyje. Šiame straipsnyje taip pat pristatytas ir vienas geriausių rizikos valdymo būdų – draudimas. Išanalizuoti draudimo tipai ir sistemos bei pagrindiniai jų privalumai ir trūkumai. Taip pat pateikiamas scenarijų analizės metodas, kaip itin naudinga priemonė, padedanti įvertinti galimas alternatyvas ir priimti tinkamus sprendimus žemės ūkyje. Pagrindinis šio metodo privalumas, kad jis gali vertinti tiek kiekybinius, tiek ir kokybinius duomenis. Naudojant scenarijų analizės metodą galima įvertinti ne tik žemės ūkio riziką, bet ir jų valdymo priemonių naudingumą.

Raktažodžiai: sprendimų priėmimas, žemės ūkio rizika, draudimas, scenarijų analizės metodas