

MODERN AGRICULTURAL INSURANCE DEVELOPMENT ALTERNATIVES

EMILIA CLIPICI¹

¹ *University of Pitești, Pitești, Romania*

Abstract: *For the development of agricultural insurances, new tools emerged which eliminate many of the problems of traditional agricultural insurances (for example, moral hazard, adverse selection, high transaction costs) making them more viable and making their management more efficient. This article presents the expert systems (as artificial intelligence solution), which, if implemented, would promote the current insurance products, enabling a selection according to each farmer's needs and possibilities, such systems being continuously improved based on the answers received from farmers; the index-based insurance implementation, which is different from other types of insurance because allowances are not calculated from the farmer's individual loss, an index independent from the respective farm being used instead.*

Key words: *traditional agricultural insurances, expert systems, the index-based insurance implementation*

INTRODUCTION

One of the most useful and most popular methods of reducing risks in agriculture is the Agricultural insurance, which depends, however, on farmers' level of incomes and on the range of risks covered by it. Due to the fact that farmers' incomes are low, the range of risks covered by the traditional agricultural insurance is reduced, and the level of complexity of the agricultural undertakings, of the animal breeding and of the agricultural conditions is high, which is why this product is not sufficient for the reduction or elimination of the risks to which agricultural producers are exposed.

Weather is hard to forecast in the long term, and thus new risk hedging instruments are required which can address some of the current limitations of classical agricultural insurances. At international level, new techniques are used, according to which the insurance indemnity is paid only when a threshold pre-established through statistical calculations is reached, namely by using index-based insurances, which can help avoid the negative consequences of agricultural specific risks. These insurances, in combination with other improved risk management instruments, either ex ante (better irrigation systems, better adapted varieties, better works aimed at preventing floods, better advisory services) or ex post (improving the services provided by insurance companies), are strong instruments for the efficient management of risks in agriculture, thus making agricultural insurances viable and less dependent on public subsidies.

MATERIALS AND METHODS

The research is mainly based on a deductive approach, starting from general information, towards the specific one, however, the inductive approach is also used, from specific towards general, in such a way as, to draw general conclusions starting from the results of quantity and quality studies.

In order to carry out a broad study of the specialised literature on agricultural insurance, without claiming I have made an exhaustive study, throughout the scientific research, I used certain bibliographic references collected from articles published in international journals (ISI, B+), specialised books on agricultural sciences and finance approaching the topics addressed, legal regulations on agriculture insurances, reports prepared by the European Commission and public institutions in Romania.

RESEARCH RESULTS

Agricultural insurance market is an essential market of any consistent specific (production or income) risk management policy in agriculture, but has certain limitations. These limitations are related to the lack of transparency and standardization: the conditions provided by insurance companies vary significantly. For this reason, the excessive variability of the conditions prevent the development of a transparent and competitive market, beneficial to both parties (the insurance company and the farmer). For agricultural support, it would be useful to have a standardization of the general and special conditions of the policies, the development of the insurance in group, of the weather index-based one, and providing acceptable franchises that could boost the market.

The lack of state guarantees and reinsurers determine insurance companies which sell “agricultural insurance” products to charge high insurance premiums due to the nature of systemic risks in agriculture. This leads to the conclusion that overall agricultural insurance systems need public support, which, if it is granted ad-hoc, may restraint the development of agricultural insurances.

Agricultural insurances vary depending on the object of the insurance: animals (mainly related to non-epidemic diseases and accidents) or crops, which can insure one risk, or multiple risks (the extended crop insurance is the insurance against hail, which often includes other risks, such as fire – single risk insurance – or the frost risk insurance, or the insurance against a limited number of weather-related events – combined risk insurance).



Fig 1. Evolution of gross premiums paid in the period 2008-2013 for crops

Evolution of gross premiums paid in the period 2008-2013 for animals

Types of agricultural insurance (Ionita, 2008):

1. **Yield insurance** is the type of policy that covers yield losses for a given crop due to any meteorological event. The meteorological origin of the damage has to be identifiable to avoid moral hazard and adverse selection. In general, all the fields of a farm with the same crop have to be insured. Use of the term ‘multi-risk’ or ‘multi-peril crop insurance (MPCI)’ is avoided here because it is applied to both combined insurances and to yield insurances, depending on the circumstances.

Crop insurance against a defined risk (for example hail) - disadvantages:

- The percentage of damage is measured according to a well-defined risk
- The most commonly used product of the private sector

2. **Whole-farm yield insurance** refers to all the crops produced by the farm. A yield reduction in one crop will not be compensated by the insurer if the global production reduction of the farm does not reach the trigger.

Crop insurance against multiple risks (Multiple Peril Crop Insurance - MPCCI) - disadvantages:

- Crop insurance based on average productions against most or all risks
- It usually involves the intervention of the government through subsidies
- Significant problems: cost, inappropriate selection, objectivity
- Expensive due to the nature of the insured risks and to their consequences on the design of insurance schemes in agriculture. Three sets of problems affect the agricultural insurance schemes and lead to high prices for the industry: The high correlation of the agricultural production risks; Asymmetric information (between farmers and insurers); High transaction costs

- Fiscal effect: governmental subsidies to cover the high costs of the agricultural crop insurance schemes

- Limited coverage – a low number of farmers and crops/agricultural activities either due to rationalizations (fiscal limitations), either due to the fact that most farmers manage risks more efficiently (by diversifying incomes); focus of the policies on the main crops (maize, soy, wheat and cotton cover 80% of the total premiums - 4 billion USD);

- Selected beneficiaries – support programme dedicated to a low number of big farms, in the market, with high fiscal costs;

- The assistance in case of disaster was not eliminated – despite substantial subsidies, the US government spends increasing amounts for damages on the account of disasters.

3. **Revenue insurance** (adopted as product in the USA, Canada, Brazil, and India) combines yield and price insurance. The farmer is paid if the total value of his production if it falls below a threshold. **Income insurance** takes also into account the costs of production; it is only applied in US.

Index insurance based on area production - disadvantages:

- All farmers in a territory (risk area) receive damages based on the reduction of the average area production (for example >30%)

- No individual adjustments are made for each farmer's loss

Index insurance based on area production - advantages:

- Low cost of the policy distribution, low moral risk, and low risk of inappropriate selection

- Applicable only to well-correlated catastrophic risks (for example drought)

- The main problem: the availability of historical records, production estimates at territorial level (county), and defining the influence areas

4. All the former types of insurance are based on the results of the individual farms, and losses are adjusted measured on the field. However, **index insurances** are based on a common index for an area. In **area-yield insurance**, the compensation paid to the farmer (and the trigger) depend on the statistical yield for the year in a predefined area, usually an administrative unit. **Area-revenue insurance** is based on the area yield multiplied by the area price. If the average yield/revenue in that area is below a certain threshold, all the farmers in the area insured for that crop are compensated. **Indirect-index insurance** does not refer to the average yield in an area but to a meteorological indicator or satellite images. Weather derivatives can be included in this category of insurances.

Weather index-based insurance

- Damages based on weather data recorded at weather stations
- A product that is being implemented in many countries, with a rapid expansion in India
- Insurance contracts for which damages are paid based on the records of a variable at weather stations
- The basic variable should not be the production itself, it should be a basic indicator of the production:
 1. Precipitations – the most important weather index for agriculture
 2. Temperature
 3. Winds – especially in areas with dry/semi-dry climate and light soils
 4. Vegetation indices (satellite records)
 5. Minimum insolation requirements
 6. Strong storms (hurricanes)
- The index-based insurance is applied based on measurements of the main variable, not on the payment of damages for measured losses – Major challenge = to determine the basic risk.

For the implementation of weather index-based insurances, with the purpose of reaching the highest level of objectivity and transparency required, there must be sufficient data, a strong correlation between the index and the losses at producer level, and no influence of either the insurer or the insurance policy holder in relation to the moral hazard and the adverse selection. Due to the fact that the payment of the compensation is based on deviations of the index value, not on individual losses, no assessments are needed at individual level.

The application of the modern technology through expert systems within agricultural insurances has the advantage of informing farmers in relation to the existing insurance products and of understating the programmers' reasoning, in such a way as to enable users, regardless of their training level, to make the best suited decision for the respective moment.

The use of expert systems is based on the assumption that any problem can be solved by a succession of judgements that can be broken down into logical rules. Such a system becomes capable of collecting and storing the experience acquired by highly-qualified people with extensive experience, and to apply it to solve problems in various situations. The existing problem must underlie decision concerning the use of the electronic data processing, and their efficiency can be measured through the results that must be obtained, from which decisions to be made are derived, as well as their consequences for farmers and insurance companies.

CONCLUSIONS

Agricultural insurances are a challenge for the insurance industry due to their complexity, and operate in an appropriate manner for limited risks (such as, for example, hail). On this market, the key challenge consists of insuring farmers against catastrophic risks, especially against drought, and the Government's intervention could be necessary as well as useful in a public-private partnership structure. Weather index-based insurance market can support and supplement governmental measures taken for agricultural insurance purposes. Worldwide, weather risk market for the non-agricultural sectors is developed and keeps expanding, and the adaptation of the agricultural sector to weather index-based products is an opportunity suppliers of product chains and farmers.

The most visible benefits of the agricultural insurance are present when it is associated with agricultural inputs – loans, high-quality seeds, product undertaking contracts. The limitations of the classical insurance of risks in agriculture (informational

asymmetry, adverse selection, moral hazard, distorted stimulation, reduced range of risks than can be covered by insurance companies, high transaction costs, etc.) are solved by index-based insurances, which aim at solving the problem of systemic shocks (a large number of people incur the same loss), especially the weather ones in the agricultural sector.

The emergence of a durable weather index-based insurance system will stimulate the increase in productivity and the international competitiveness of Romanian farmers, processors and other businesses exposed to weather-related risks. At the same time, this agricultural insurance system can support Romania's preparation for fiscal shocks caused by major weather events – drought, floods, and can also facilitate the identification of the population segments that are the most vulnerable to weather changes, and the application of efficient plans for the adjustment to such changes. Unlike the current insurance system, index-based insurances would be based on the market, would be self-sustainable, thus minimizing the governmental involvement needs. The compensation payment process would be managed rapidly and cheaply.

These insurances are very promising for developing countries, because most of them have a high bad weather risk exposure level.

The implementation of expert systems in the agricultural insurance field would be a stimulus for the development of agricultural insurances, due to the fact that, for modern agriculture, it is necessary to maintain funding opportunities under the conditions required by the specificity of agricultural production. In this respect, the use of expert systems in insurances is a crucial lever for agricultural producers as well as farmers' protection, which is why the agricultural sector should be developed, all the more so that as, lately, new risks have emerged due to climate change.

REFERENCES

1. **CHENG, C.H., CHEN, Y.S.**, 2009, Classifying the segmentation of customer value via RFM model and RS theory, *Expert Systems with Applications*, Vol.36, pp. 4176-4184.
2. **HAZELL, P., ANDERSON, J., BALZER, N., HASTRUP CLEMMENSEN, HESS, A., U., RISPOLI, F.**, 2010, *The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihoods*, Rome: International Fund for Agricultural Development.
3. **IONITA, G.**, 2008, Insurance climatic indices based agriculture. World experience and possible use in Romania, ICAR, Bucuresti, Romania
4. **MIGUÉIS, V.L., CAMANHO, A.S., JOÃO FALCÃO E CUNHA**, 2012, Customer data mining for lifestyle segmentation, *Expert Systems with Applications*, Vol.39, pp. 9359-9366.
5. **ŠUBELJ, L., FURLAN, Š., BAJEC, M.**, 2011, An expert system for detecting automobile insurance fraud using social network analysis, *Expert Systems with Applications*, vol. 38, pp. 1039-1052
6. **VIAENE, S., DEDENE, G., DERRIG, R. A.**, 2005, Auto claim fraud detection using Bayesian learning neural networks, *Expert Systems with Applications*, vol. 29, pp. 653-666
7. **WORLD BANK**, 2005, *Managing agricultural production risk: Innovations in developing countries*, Washington, DC: Agriculture and Rural Development Department (ARD), World Bank.