Globalization of Climate Risks

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Abstract
This article also aims to highlight the strategic implications of the long-term global climate change related trends for the development of the agricultural sector in Romania, arguing the need for a smart strategy in terms of climate change. Also briefly presented are the challenges related to climate change and the implications for Romania and the strategic directions assumed by the Ministry of Agriculture and Rural Development in the Strategy for Medium and Long-term Agri-Food Sector Development in the 2020-2030 horizon.

Keywords: climate change, agricultural sector, pollutant emissions, drought, climate risk management strategies

JEL Classification: Q15, Q18, Q54, Q57

1. Introduction

Research within this article is circumscribed to the world's most recent concerns. We note that research on the world has evolved a lot, due to a number of considerations: 1) the role of agriculture in the economy and society; 2) increasing risks in agriculture due to climate change; 3) high volatility of crops, costs, prices and incomes at farm level.

From a historical point of view, the United States is the largest contributor to global warming, responsible for about 25% of global carbon dioxide emissions. China is currently emitting greenhouse gases as much as the United States and India is not long behind, but the United States is far ahead of these countries in terms of greenhouse gas emissions of inhabitants. Moreover, in terms of cumulative greenhouse gas emissions, the United States is by far the world's leader, and no other nation is fit for it. The problem of climate change is that greenhouse gas emissions continue to grow at an alarming rate. If these emissions remain at current levels, many parts of the world may be uninhabitable by the end of this century. However, the overall greenhouse gas emission rate does not stabilize but accelerates.

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One of the cruel ironies of the climate change crisis is that developed countries such as the United States have contributed most to global warming and yet less developed countries will suffer the worst side effects. Part of the challenges facing less developed countries is that many of them are located in regions where natural resources, especially water and food supply, are much rarer even without the negative effects of global climate change. Moreover, both because of these natural resource constraints and economic constraints, less developed countries will be less able to adapt to climate change when they occur.

Although the European Union has a relatively low share of global emissions worldwide, agriculture remains a sensitive sector. While greenhouse gas emissions in the EU-28 decreased by 20% between 1990 and 2013, their decline in the agricultural sector was more pronounced, 23% over the same period, amid a fall in the number of animals, good agricultural practices, reducing the use of nitrogen fertilizers, and better management of natural fertilizers.

In addition to the energy and climate change targets set out in the Europe 2020 Strategy and the Energy Strategy 2030, the EU Commission has also proposed a long-term Roadmap 2050 calling on European countries to address the long-term climate change challenges aims to reduce carbon dioxide emissions by 2050. The European Union, like other major world economies, will have to significantly reduce GHG emissions to keep global warming below 2° C. Romania, as an EU Member State, implements European policies in the field of energy and climate change and aims to reduce greenhouse gas emissions, both ETS and non-ETS, which is also the category of agriculture. Romania recorded one of the largest decreases in greenhouse gas emissions from agriculture at EU level, with a decline of 49% between 1990 and 2013, although lower than the decrease in the same period at national level (56%).

The relatively high contribution of agriculture to greenhouse gas emissions (14.9% in 2016) is due to the use of energy in this sector, the type and significance of agricultural emissions largely depending on the way in which soils are managed, the share of the livestock sector and biomass management.

2. Methodology

Several research methods have been used during the research. A first category is represented by qualitative research methods such as: analysis, synthesis, comparison, use of induction and deduction analysis couple, and comparative analysis. Another toolkit was the structural and dynamic analysis. Thus, we have identified the statistical links, links and interdependencies that are formed between different phenomena and processes and the degree of correlation as a method by

which we studied the relation and the interdependence between two phenomena or characteristics of a phenomenon expressed numerically.

We also identified the degree of functional dependence that is the correspondence that can be established between two variable sizes, so that, given an arbitrary value of one of the two sizes, it uniquely determines the value of the other magnitude. The two functionally dependent variables can be qualitative or quantitative characteristics.

3. Results

At an international level, the European Union is actively engaged in climate negotiations and in supporting partner countries in implementing adaptation and mitigation strategies through active programs such as the Global Climate Change Alliance.

The EU's objectives and policies related to these climate change obligations are articulated in three key EU policy papers: (i) the Energy Package, (ii) Europe 2020, and (iii) the 2050 Roadmap. In addition, a range of policies and EU Regulations support the implementation of both adaptation and mitigation measures.

Europe 2020. Europe 2020 is the main policy framework for the EU 2014-2020. It promotes smart, sustainable and inclusive growth and sets measurable EU targets in five key areas including specific climate change and energy targets (target area 3). The strategy and associated objectives address two dimensions of climate change: 1) building a greener and more competitive, low carbon economy that uses resources more efficiently and resists climate risk, and 2) protecting the environment and preventing biodiversity loss. It also highlights seven representative initiatives supported by the European Commission in order to catalyze progress in these areas. The "Resource Efficient Europe" representative initiative aims to help decouple economic growth from resource use, support the transition to a low-carbon economy, modernize the transport sector and promote energy efficiency. In addition, the EU has imposed a "Green Growth Roadmap" to build a green, low-carbon, competitive Europe by 2050, involving greenhouse gas reductions of 80-95% below 1990 levels.

Objective 20-20-20 The EU Climate and Energy Package presents "20-20-20 objectives". This is a binding legislative package, approved in December 2008, to ensure that the EU achieves a 20% reduction in greenhouse gas emissions compared to 1990 levels; an increase in the share of EU energy consumption produced from renewable energy sources to 20%; and a 20% improvement in energy efficiency. The EU has offered to step up its emissions reduction to 30% by 2020 if other major developing and developing world countries are committed to engaging

adequately in the global emission reduction effort. In Romania, these targets mean a combined energy generation target of 38% renewable energy generation by 2 020, final gross final energy consumption including 24 percent renewable energy (in increase from 18% in 2005) and targeted improvements in energy intensity of 1.5% pa.

Roadmap 2050. From a longer-term perspective, the European Commission document "Roadmap for moving to a competitive low carbon economy by 2050" is a long-term policy plan that suggests that the EU should reduce its emissions to 80 percent below 1990 levels by 2050 with intermediate milestones of 40 percent reductions by 2030 and 60 percent reduced by 2040. It proposes ways in which the main sectors responsible for emissions Europe - energy generation, industry, transport, buildings and constructions, as well as agriculture - can make the transition to a low-carbon economy in a cost-effective way. The Roadmap argues that switching to a low-carbon society can boost Europe's economy by increasing innovations and investing in clean and zero-carbon technologies and energy. Energy efficiency will be one of the key drivers of the transition and will allow for significant savings in fuel costs (reducing imports and sustaining energy security). The Roadmap aims to guide sectoral policies, low-carbon strategies and long-term investment plans of Member States.

The European Commission has also proposed recent scenarios for the 2030 objectives as an intermediate step between the 20-20-20 target of the 2020 target and the ambitious 80-95% reduction targets of the 2050 Roadmap. These targets were proposed for the first time in the Green Paper of the Commission published for consultative purposes in March 2013. The proposal includes specific targets for a 40% reduction in GHG emissions and more renewable energy use (about 30%), improving energy efficiency and investing in a better and smarter energy infrastructure by 2030. Although no specific country targets have been proposed so far, some EU countries, for example, the EU Green Growth group called for an ambitious reduction in EU emissions to be raised. Under the United Nations Framework Convention on Climate Change (UNFCCC), many parties have proposed emission targets and measures to negotiate in 2020. The EU's 2030 targets can be considered as ambitious targets.

In its regular reports, the Intergovernmental Panel on Climate Change (IPCC) has a long-term approach, analyzing the potential impacts of climate change on their determinants. Table 1 presents these elements compiled by the IPCC for Europe.

Table 1 Adapting to climate change in Europe

The key risk	Estimates of adaptation effects	Determined factors
Negative impact on grain yields and grain yields increasing variability yields as a result of climate change	The estimated impact varies by crop, region, and adaptation scenarios, with approximately 10% of projections for 2030-2049 showing gains of more than 10% and about 10% of crops with losses over 25% compared to the end of the century XX century. After 2050 the risk of a more severe impact increases and depends on the heating level.	Heating trend Trend of drought CO2 fertilization Extreme temperatures Extreme precipitation
Increase water restrictions. Significant reduction in the amount of water available from rivers and underground sources, combined with increased demand for water (irrigation, energy and industry, population consumption) and reduced water drainage and seepage as a result of increased evaporation, especially in the south Europe	Proven adaptation potential from adopting more water-efficient technologies and water-saving strategies (irrigation, plant varieties, land-use options, industries, consumption of the population) Implementation of best practices and governance tools in river basin management plans and integrated water management	Heating trend Trend of drought Extreme temperatures
Increased economic losses and the number of people affected by extreme phenomena: impact on health and well-being, labor productivity, air quality, increased risk of uncontrolled fires in southern Europe and the boreal region of Russia.	Implementing alert systems Adaptation of the infrastructure of buildings and workspaces, transport and energy infrastructure Reducing emissions to improve air quality Improving uncontrolled fire management Developing insurance products against the volatility of agricultural yields according to weather conditions	Extreme temperatures

Source: IPCC (2014) Climate Change 2014 Impacts, Adaptation and Vulnerability, p. 22.

The need for a smart agriculture strategy from the perspective of climate change

The FAO estimates show that total demand for agricultural and food products will increase by about 60% by 2050, as a result of one-third of the world's population. The share of crops for human use will increase steadily as the population increases. Changes in land use by human factor decision, such as conversion of forests into agricultural land or for infrastructure (including for mining), are a major annual blow to biomass in Africa, the Middle East, Eastern Europe, Central Asia and Russia.

Rising concerns about food, water and energy security are also highlighted by transnational land acquisitions in the last decade, especially in developing countries.

Combined with population growth and climate change, rising food demand will in turn create significant water resource threats. Even if water is to be used more efficiently, intensifying agriculture to meet the growing demand for food and feed worldwide - as a result of population growth and dietary changes - could lead to severe water shortages in many regions of the world.

The escalation of the shortage of resources from other parts of the world that could result from these trends has profound implications for Europe. Most obviously, increasing competition raises issues related to security of access to resources. Their prices have increased in recent years, after several decades, when they seemed to be in decline in the long run. Higher prices reduce the purchasing power of all consumers, but the effects are often felt more acutely by the poorest population.

These developments have both direct and indirect implications for resource security prospects. Long-term supply and access to food, energy, water and material resources depend not only on improving resource efficiency and ensuring Europe's resilient ecosystems, but also on global dynamics. Unfortunately, European efforts to reduce environmental pressures are increasingly counterbalanced by accelerating deterioration in other parts of the world.

According to the FAO (2013), the concept of smart agriculture in terms of climate change brings together practices, policies and institutions that are not necessarily new but are used in the context of climate change. The main features of a smart climate change strategy identified by the FAO would be: (i) not providing unique technological solutions and not a universal solution with a strong local specificity; (ii) is based on an integrated approach to management of production systems and natural resources; (iii) address solutions to adapt to climate change and increase resilience to shocks; (iv) identifies barriers to adaptation measures and provides adequate solutions; (v) treat mitigation policies as potential co-benefits; (vi) in terms of funding, it is combined with traditional sources of investment in agriculture.

The leadership of the IEA / RDS Forum for Smart Climate Change has conducted a poll that interviewed many international actors with a role in agriculture and climate change. According to survey results, the vast majority of those surveyed believe that Smart Climate Change is equally important and appropriate in all countries, regardless of their level of development.

Through this survey, three pillars have been identified to lead to smart agriculture from the perspective of climate change: (i) resilience and adaptation to climate change; (ii) agricultural incomes, productivity and food security; (iii) mitigation of greenhouse gas emissions.

The results of the survey show that the three pillars appear equally important for all countries, which differs from the relative weight given to each. As expected, respondents in developing countries have highlighted the priority of farm incomes and resilience to the effects of climate change, and those in advanced agriculture countries see the reduction of GHG emissions more important.

Following the climate risk typology, intelligent management of these is also a complex issue, requiring special techniques from some seemingly simple to innovative tools.

Risk management may consist of: (i) eliminating risk; (ii) risk mitigation; (iii) risk sharing; (iv) the transfer of risk.

Risk elimination is intended to eliminate the risk. It is an option that depends largely on natural factors, especially in the case of plant production and therefore difficult to achieve.

Risk mitigation may consist of: optimizing resource allocation, program development, diversification of production structure, use of frost-resistant varieties, drought, diseases and pests, cooperation with specialized units in the fields of agricultural services, transport and marketing, and training of agricultural producers and others.

The distribution of risk is usually the use of the agricultural insurance system.

The transfer of risks is related to the use of market-based instruments such as more or less sophisticated tools such as stock or index management tools (ATR tools).

There are several types or "families" of traditional risk management tools:

(i) Allocation of resources - the risk of not finding the necessary resources or not finding them in sufficient quantity must be taken into account by the agricultural producers in the evaluation of the future activity they are to carry out in order to obtain the production results. An economic activity or a business can only be competitive to the extent that it converts resources into higher value outputs.

(ii) The production structure and its optimization - mainly aims at the use of high performance technologies, enabling higher yields and improving the quality of agricultural products.

(iii) Fiscal and budgetary instruments are a means of stabilizing agricultural income and require a national state authority to recognize that agriculture is affected by specific natural shocks that lead to a "normal" agricultural income volatility.

(iv) Insurance contracts are used to prevent independent risks and "end-to-end" risks. Contracts covering the risks at the category limit provide income coverage or profit margins and are sometimes referred to as hybrid contracts because the insurers who manage them manage the risks by grouping the independent risk component and reproducing the risk of options on the financial market (if available).

(v) Financial contracts are used to cover systemic risk and consist mainly of forward and futures contracts (futures and options).

(vi) State security devices are a form of support made available by the state to the agricultural sector in the event of catastrophic events and constitute a measure to ensure social stability (from the point of view of the consumer and/or the producer).

All these tools used to manage agricultural sector specific risks can be divided into ex ante and ex-post instruments according to the agent's decision to form the instrument before or after the occurrence of the risk event. Normally, ex-post instruments are made available by state authorities, and this under certain conditions. On the other hand, the tools provided by specialized firms, often private (such as insurance companies, banks, trading companies, stock exchanges, OTC markets), are often ex-ante instruments whose price is established on the basis of a risk assessment and the nature of the contract.

At the same time, risk management tools can also be classified according to the risk management technique used. Some instruments (i) reduce risk through stabilization and diversification techniques (there are only transaction costs) and others (ii) transfer the risk to a third party in return for a net premium (plus transaction costs). With the help of the first group instruments, symmetric risk management can be ensured; in other words, the maximum values offset the minimum values, the difficulty being to determine the value that is "minimum" and "maximum". With instruments in the second group, risk asymmetric management is ensured, whereby the possibility of obtaining compensation in the event of a bad event only affects a part of the distribution of income and the ability to take advantage of the positive side of the distribution.

We continue to present the most important tools for managing agricultural risks.

4. Optimizing resource allocation

Depending on the specific conditions and the possibilities of agricultural holdings, the products can be obtained through very diverse combinations of resources.

Thus, according to the different way of combining the resources, they will result in different results, both in terms of outputs, as well as of the costs and profits obtained.

Possibilities of combining the resources and the different effects they may generate calls for knowing how resources act in their various combinations, to conduct an appropriate risk management.

Thus, in order to ensure the most efficient agricultural activity, a rational allocation of resources is necessary, the aim being to find the optimal level of allocation. For this, one of the ways that can be used is the application of product and economic functions, functions that highlight the fluctuations of production towards the allocation of inputs. In order to obtain the maximum yield, or the maximum profit, the optimum quantity of a production factor, or optimal quantities, will be determined in the case of several factors of production.

5. Optimizing the production structure

In principle, determining the production structure of the agricultural holding must take into account the coverage of the risk and the generation of an appropriate profit, which means that from the set of variants providing the largest outputs will be chosen the one that ensures the lowest specific expenditures, respectively those in which the highest profit is achieved.

In other words, the production structure must ensure the most efficient use of the natural, material and human conditions of the agricultural holding. It is absolutely necessary for the structuring process to take account of the biological, technological and economic relations existing between the production branches in terms of their relationship with the existing resources. (here we refer to those agro-technical activities that can mitigate the risks of declining production, such as changing the altitude of plant production areas, diversifying plants, changing the sowing period, changing the use of fertilizers, changes in irrigation systems, new hybrids cultivation, changes in land management, changes in disease and insect activities, plant density change, mechanization, weather and climate information systems).

The recording of large productions is largely conditioned by the correct and complete application of modern technologies based on the recommendations of the scientific research in the field and on the experience gained.

Improving technologies contributes to a better use of resources, to increased production and to improving the quality of agricultural products, to production costs, all of which ultimately also reduce risk in certain phases of the agricultural production process.

Thus, reducing production costs and, implicitly, production costs entails a lower cost of recovery, which reduces the risk of stockpiling of the agricultural product in question, leading to a higher sales volume. It has favorable effects in terms of reducing market risk.

6. Fiscal instruments are used to support the stabilization of agricultural incomes

Such an instrument may be the income tax structure, a tax that can be structured to include a rolling average of tax exemptions over a period of several years (n years). It is an ex-post tool that does not involve any costs for agricultural producers. The only costs (reduced) are those borne by the state budget, because the delay in charging income taxes leads to a decrease in the amounts collected.

Another instrument, which is also an ex-post tool, is to set up a preventive savings account by the agricultural producer, which can be credited (optional) in good harvesting years (mandatory withdrawal) in the event of an event bad. Nor does this measure entail any costs for the producer, the only costs being those borne by the state budget due to the delay in the collection of income tax.

7. Instruments and policies for agricultural insurance

Agricultural insurance is provided through insurance contracts that are made available by insurance companies, which are sometimes organized as mutual insurance companies. Farmers pay a commercial premium to the insurance company to compensate them if a bad event affects their products and thus their income. The covered risks are clearly defined and the process of assessing the losses incurred in case of a bad event is known in advance. The farmer provides a certain level of capital based on historical data on his own agricultural exploitation, eg harvest history / ha), external reference elements (eg reference prices at preset dates, average prices, harvest / ha of a group or climatic indices) or on standard costs or actual costs. Net premiums are calculated on the basis of possible losses and extreme losses with a very low probability but which present a high financial risk for the insurance company and for which reinsurance means will be needed. Usually the reached and deductible franchises are proposed at minimum levels. Insurance contracts are ex ante instruments because the commercial premium is paid before a

possible event has been produced, and asymmetric risk management tools because it is transferred to the insurance company for a payment.

In July 2013, the Romanian Government approved a National Climate Change Strategy 2013-2020, with both adaptation and mitigation components. Reduction measures are being developed for the following economic sectors: energy, transport, industrial processes; solvents and the use of other products; agriculture; land use, land use change and forestry; waste management. The Strategy's adaptation component lists 13 priority sectors for monitoring the impacts of climate change: industrial; agricultural and fisheries sectors; tourism; public health; infrastructure, construction and urban planning; Transport; water resources; woods; energy; biodiversity; insurance; recreational activities; education. It also identifies adaptation measures to guide policy-making for the above-mentioned sectors. These include: (i) the integration of adaptation measures to the effects of climate change at the time of implementation and the modification of current and future legislation and policies; (ii) Review all national strategies and programs to include sector policy change requirements; (iii) raising public awareness and developing communication to implement adaptation measures at the local level.

Furthermore, in 2008, the Ministry of Environment and Forests prepared a Guide on Adaptation to Climate Change in response to the EU Green Paper on "Adapting to Climate Change in Europe - Options for EU Actions". This guide contains recommendations and measures to reduce the risk of adverse impacts of climate change in 13 key sectors, such as agriculture, biodiversity, water resources, forests, infrastructure, urban and urban planning, transport, tourism, energy, industry, health, recreational activities and insurance.

The National Climate Change Strategy (2013-2020), which takes into account EU climate change policies and documents drawn up at European level, as well as the experience and knowledge gained from joint actions implemented in cooperation with foreign partners and institutions international, addresses the issue of reducing greenhouse gas emissions and adapting to the effects of climate change. The adaptation component aims to provide a framework for action and a guide that allows each sector to develop their own individual action plan in line with national strategic principles.

Under the EU Co-funded project "Agriculture and Climate Change: How to Reduce the Effects and Threats" in which Romania also participated, the "Code of Attitudes to Reduce the Impact of Climate Change in Agriculture" was developed. The document contains recommendations on the adaptation to climate change of agricultural technologies and the specific activities of all agricultural production

processes, as well as examples of good practices leading to the reduction of greenhouse gas emissions.

Romania has developed a Irrigation Rehabilitation and Reform Project and a new irrigation strategy to encourage economic irrigation and optimal use of available resources. In concrete terms, this strategy aims to maximize the areas where irrigations are economically viable, given the current amounts of subsidies.

8. Conclusions

The big challenge for agriculture in the context of globalization is to reconcile the need to increase production in order to contribute to economic recovery and to reduce greenhouse gas emissions. The EU agricultural sector is perfectly aware of, and responds to, the challenges of climate change.

There is a wide range of adaptation measures, ranging from technological options to improving farm management practices, as well as policy instruments.

Farmers can not cope alone with the burden of climate change. Public policy must provide the right support so that agricultural producers adapt their farming structures and production methods and continue to provide services to rural areas. The CAP already contains elements that should facilitate adaptation to climate change. Facilitating farmers' access to risk management tools, such as insurance programs, to help them cope with weather-related disasters as a result of climate change.

On the other hand, rural development policies provide opportunities for offsetting the adverse effects that climate change can cause on agricultural producers and rural economies, such as providing support for investments in more efficient irrigation equipment. Agricultural and environmental programs to encourage better management of soil and water resources by agricultural producers are also important for adaptation.

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