RAPID AND INTEGRATED AGRICULTURE RISK MANAGEMENT REVIEW FOR BRAZIL

Towards an integrated vision

COORDINATION
Diego Arias (World Bank)
Paulo Mendes (MAPA)
Pedro Abel (Embrapa)

TEAM
Barbara Farinelli, Carla Zardo, Fatima Amazonas, Fernando Silva, Jorge Caballero, Luiz Daniel de Campos, Pablo Valdivia and Vinícius Cruvinel (World Bank); André dos Santos, Daniela Lopes, Danielle Torres, Eliana Figueredo, Geraldo Souza, Maria Quiteria Marcelino, Rosana Guiducci, Rosaura Gazzola, Sílvia Kanadani Campos and Vanessa Pereira (Embrapa); Alexandre Gedanken, Helia Lemos da Silva and Marcel Moreira Pinto (MAPA).

ACKNOWLEDGEMENTS
Special thanks to the specialists, partners, and representatives of the various institutions that collaborated in the development of the different expert panels of the technical workshops and working meetings. This report was made possible by the dedication and support of these professionals.

August 31, 2015

Coordination of the Brazil Agriculture Risk Management Series
Diego Arias (World Bank)
Paulo Mendes (MAPA)
Pedro Abel (Embrapa)

Support team of the Brazil Agriculture Risk Management Series
Carla Zardo, Vinicius Cruvinel e Wanessa de Matos (World Bank)

Graphic Artist of the Series
André Maya, Pablo Julio e Vitor Teles Ferreira / CC&D Consultoria Criativa & Design

Cover and Graphics
Pablo Julio / CC&D Consultoria Criativa & Design

Desktop Publishing
Gabriela Ribeiro / CC&D Consultoria Criativa & Design

Pictures of the Front Cover
Flavia B. Fiorini / Embrapa

Pictures
Pages 4 and 56 (Paulo Kurtz), page 6 (Luiz Henrique Magnante and Luiz Eduardo Meneguetti), pages 8 and 9 (João Costa Jr.), page 10 (Fabiano Bastos), pages 13, 20, 29 and 69 (GEOEYE/Emprapa), page 16 (Zineb Benchekchou), page 30 (Barbosa de Menezes), page 40 (Liliane Bello) and page 74 (A. L. Ferreira). All pictures are from Embrapa.

Graphics
All graphics are by Varijanta, except Fazendeiro by Iain Hector (Noun Project).
Composition and color by Pablo Julio (CC&D).

Print
Gráfica Qualytá

World Bank
SCN Quadra 2 Lote A
Ed. Corporate Financial Center, 7º andar
70712-900 — Brasília DF, Brazil
Telephone: (5561) 3329 1000
www.worldbank.org

World Bank
Rapid and Integrated Agriculture Risk Management Review for Brazil.
Towards and integrated vision — 1st Edition — Brasília — 2017
76p.

ISBN 978-85-88192-14-0

Comments and suggestions, please send to Diego Arias, darias@worldbank.org.

SUMMARY

ACRONYMS

AGR	Adjusted Gross Revenue
ANA	National Water Agency
ANATER	National Agriculture Rural Extension Agency
ATER	Rural Technical Assistance
BB	Banco do Brasil
BID	Inter American Development Bank
CBOT	Chicago Board of Trade
CEPEA	Economics Research Center at ESALQ
CNA	Agriculture Confederation of Brazi
CONAB	National Food Supply Company
CONTAG	National Confederation of Agriculture Workers
Embrapa	Brazilian Agriculture Research Company
ESALQ	Agriculture University “Luiz de Queiroz”
FAO	Food and Agriculture Organization of the United Nations
FENSEG	National Federation of General Insurance
IBGE	Brazilian Institute of Geography and Statistics
IFC	International Financial Corporation
IICA	Inter American Institute for Agriculture Cooperation
INMET	National Meteorological Institute
MAPA	Ministry of Agriculture, Livestock and Supply
MDA	Ministry of Agrarian Development
MME	Ministry of Energy and Mines
OCB	Brazilian Organization of Cooperatives
OCDE	Organization for Economic Cooperation and Development
GDP	Gross Domestic Product
PSA	Payments for Environmental Services
RRN	Renewables Natural Resources
SISDAGRO	Agriculture Decision Support System
SRB	Brazilian Rural Society
SUSEP	Superintendency of Private Insurance
USP	University of São Paulo
WB	World Bank
ZARC	Agroclimatic Risk Zoning

Preface

Colleagues,

Agribusiness, without a doubt, plays a very relevant role in Brazilian society. The sector produces more than US$7 billion in exports, representing close to 46% of the total exports of the country and, thus, contributes significantly to Brazil's trade surplus. The numbers of the agribusiness sector's contribution to the economy are notable, with close to 23% of total Gross Domestic Product (GDP) and 33% of total employment.

That contribution goes beyond the national level, contributing to supply an ever-increasing food demand globally. A practical example is that by 2050 the global population will reach 9.5 billion, or 35% more than today. In addition, agriculture production will need to increase by 80%, opening opportunities for Brazil to become the largest producer and exporter of food globally. At present, the country is the second largest exporter of food, but projections put it in first place during the coming decade.

Within the dynamism inherent to agriculture production it is impossible to avoid considering the competitiveness and challenges evermore complex, which require expertise and professionalism given the improvements in the production systems. Furthermore, actions such as the support to value chain integration, inclusion of small and medium size farmers, and establishing efficient public policies, need appropriate tools to obtain the desired outcomes.

Brazil looses approximately R$11 billion per year on average due to extreme risks, which represents 1% of Agriculture GDP. In general, hazards and risks are well known in Brazil, enabling decision makers to identify the opportunities and needed actions to mitigate, respond and/or transfer them. Agriculture risk management is seen as an urgent tool and its adoption enables the increase in efficiency of public policies and programs, and simultaneously, the planning and integration of various actions that target the stability of farmers' income.

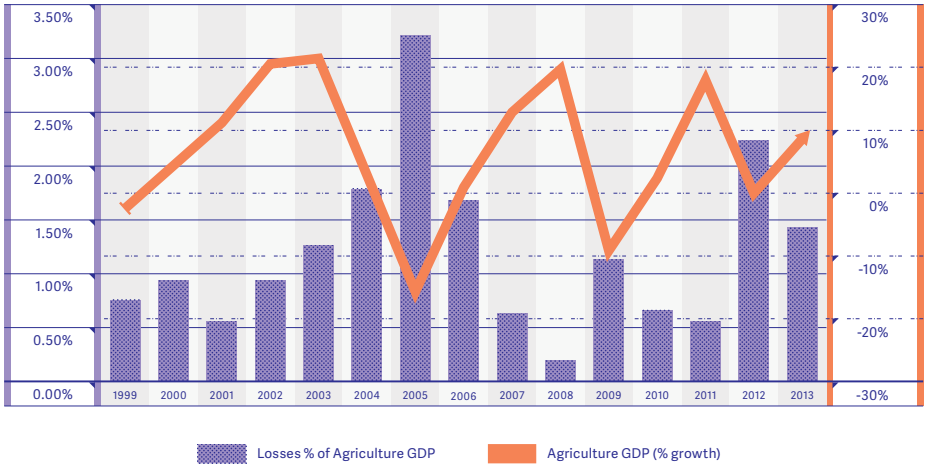
A lot already exists when identifying efforts for agriculture risk reduction in Brazil, but there is also a lot yet to be done. In the short term, the integrated management of risks in the various policies and programs can already produce an improvement in the coordination and governance processes, across ministries and institutions and across different levels of government. On the other hand, the maintenance of unwanted aspects and without a systemic vision for the actions can lead to transforming the achievements of agribusiness today into losses tomorrow, impacting the sustainability of the sector and therefore the country.

Kátia Abreu, MINISTER OF AGRICULTURE
Maurício Antônio Lopes, EMBRAPA PRESIDENT
Martin Raiser, WORLD BANK COUNTRY DIRECTOR FOR BRAZIL

Executive Summary

The World Bank, the Ministry of Agriculture, Livestock and Supply (MAPA) and Embrapa, supported by the Rural Brazilian Society, the Brazilian Organization of Cooperatives, the National Agriculture Confederation, the National Confederation of Agriculture Workers, the National Federation of General Insurance, the Banco do Brasil, the Inter American Institute for Agriculture Cooperation, the Inter American Development Bank, the Food and Agriculture Organization of the United Nations, and the National Supply Company, developed a methodology that allowed for a rapid and integrated agriculture risk management review for Brazil, in order to obtain an integrated vision of the process. This work was motivated by the economic and social importance of the agriculture sector in Brazil and by its economic volatility.

Annual extreme losses (above one standard deviation) of agriculture production in Brazil and GDP growth (%) (IBGE, 2015).



Brazil losses annually, on average, more than R$11 billion (1% of agriculture GDP) due to extreme risks that could be managed more effectively (source: IBGE, 2015). Currently (2014) the agribusiness sector represents more than 23% of total GDP, 33% of employment and 43% of Brazilian exports, representing an important share of global agriculture production (the largest producer of sugar, coffee and orange juice; the second largest producer of bovine meat and soy; the third largest producer of poultry meat and corn; and the fourth largest producer of pig meat). However, a few years ago, the agriculture GDP growth has been negative. This situation could be minimized with better management of extreme risks.

An innovative methodology was proposed to identify opportunities and challenges of the current way agriculture risks are management in Brazil. Based on expert consultations (more than 100), and consultations with representatives of public and private sectors, academia and farmers (see Annexes) and a national electronic survey, the main agriculture risks and their national economic importance were identified. Furthermore, this work was supported by an in depth agriculture risk assessment in the two States (Bahia and Paraiba) and one Municipality (Piquet Carneiro, Ceara). The results of the expert consultations and from the electronic survey where compared with a literature review of the main national public policies related to agriculture risk mitigation[1], transfer[2] and response[3]. After the preliminary results were systematized, they were presented (see Annexes) to various stakeholder institutions related to the agriculture sector and its policies (CGEE – Ministry of Science and Technology, Ministry of Transport, BNDES, CGU and TCU) for validation and improvement of the results.

1 The policies related to the prevention of extreme events with potential to impact the incomes of farmers. An example is the action of animal and plant health prevention or agriculture zoning.
2 Policies related to the sharing of farmer income losses from extreme events, like rural insurance.
3 Policies related to compensate for farmer income losses due to extreme events, such as price guarantee programs or Garantia Safra.

Ederson Jesus / Embrapa

The results show that Brazil has many and good agriculture risk management public policies and that this situation can improve, without increasing public expenditures, just by improving planning and integration among them. The results allowed to list the challenges for the management of the main agriculture risks in Brazil (eight risk dimensions where considered and grouped as follows: production risks, market risks, and enabling environment risks), identifying opportunities for improvement of ongoing public policies and programs. Beyond opportunities, the results point out to the need for an integrated agriculture risk management approach given that without an integrated management it is difficult to reduce losses of the sector in a systematic way.

RISK GROUPS	RISK	EXAMPLES OF HAZARDS
PRODUCTION RISK	Weather and Fires	Prolonged droughts, frosts, excess rain, strong winds and floods.
	Animal Health	Foot and mouth disease, BSE (mad cow disease), *Newcastle*, etc.
	Plant Health	Introduction of new pests and diseases (ex.: *lagarta Helicoverpa armigera*).
	Natural Resources and Production Management	Changes in water rights/allocation, in technical assistance, in control of regulations, in labor availability. Sudden mismanagement of natural resources (ex. drought in RS) like incorrect decisions on soil and water management.
MARKET RISK	Trade (price of inputs and outputs) and Credit	Substantial changes in output or input prices, in exchange rates, in interest rates, in credit terms.
	International Trade	Unexpected closing of export markets and changes in the access of imported inputs.
ENABLING ENVIRONMENT RISK	Infrastructure and Logistics	Strikes at the port, closing of roads, railways, waterways, and changes in the incentives for storage.
	Regulatory, Policy or Institutional Framework	Changes in laws/regulations (environmental, labor, inputs, land), changes in the approach of public institutions (MDA, MMF, ANA) or the change in interpretation of existing laws and regulations.

GEOEYE / Embrapa

The results of the risk perception from the different stakeholders from the sector show that while animal and plant health is a risk with a high potential for damage, it is relatively well addressed by public policies and programs at the federal level. On the other hand, the public policies and programs that seek to address logistics and infrastructure risks, are not yet meeting their objectives. Furthermore, the work shows that new agriculture risks, like agriculture labor and the management of natural resources, are as important as other more traditional risks, like weather. It is important to point out that a reduction in the risk of trade and credit require the management of multiple risks, while the reduction and management of weather risks and regulatory risks have the largest potential multiplier effect over the management of other agriculture risks. In order to address the enabling environment risk, a greater stability and planning of the regulatory framework surrounding the agriculture sector is needed, without necessarily creating more rules and regulations.

The agenda for the future is based on recommendations to systematically reduce agriculture losses in Brazil through a more integrated management of agriculture risks. A strategic plan for a better management of agriculture risks in Brazil must be implemented gradually, starting with the integration of some of the existing agriculture public policies and programs, which are already moving towards more coordination. That plan needs to have planning and integration as key words for the stability of farmer incomes. Finally, it is important to consider that this integration, aside from the coordination among different policies and programs, needs to account for different levels of Government (Federal, State and Municipal) and the different production systems (commercial, family and subsistence).

SIX AREAS WHERE FURTHER INTEGRATION COULD BE POSSIBLE AT THE FEDERAL LEVEL IN THE SHORT TERM WERE IDENTIFIED

Integrated agriculture risk information system

Integration of existing agroclimatic, price, animal and plant health, and credit information systems..

39% of farmers have access to the internet

Integrated system for agriculture risk management technology research and development

Prioritizing and coordinating the research and development of technologies, mainly for family farming.

656 accredited ATER institutions today (public, NGOs, private)

Integrated agriculture risk transfer system

Improving the agriculture insurance and price hedging system, with ample participation of private sector, focused on Family farming.

25% of cultivated area with insurance

Integrated agrologistics and rural infrastructure planning

Improving the system of information sharing in real time and the strategic planning of transport and storage investments.

40 millions tons of storage deficit

and **61%** of transport is by road

Integrating the agroclimatic risk management tools with the natural resources ones

Integration of the tools of natural resources management, like water rights, with agroclimatic zoning.

250.000 hectares are equipped with irrigation systems per year

Integration of the international trade promotion and monitoring initiatives with those for agriculture risk management

Integrate the agendas of animal and plant health with the international trade negotiations and strategies

US$ 96 billions of agroexports in 2014

79% trade surplus of Brazil

Context & Objectives

1

An integrated management of risks can result in an improvement of farmer income. The agriculture sector of Brazil faces a large number of risks linked to the productive process, which has led to substantial losses to the country in the past years. An adequate and integrated management of those risks can leave farmer incomes less exposed to losses, benefiting the sector and the country as a whole. Therefore, given the always-present resource limitation, it is important to maximize the economic returns of agriculture risk management actions. Brazil built important agriculture risk management policies and programs (Chapter III), but there are several signs that it is possible to improve their efficiency of effectiveness with more coordination and a prioritization in the treatment of gaps and opportunities.

Fabiano Bastos/ Embrapa

1.1 Objectives of the rapid review

DEFINITION OF AGRICULTURE RISK

Risk implies a quantitative knowledge about the possibility and impact of an event, while uncertainty implies results that are not yet known (Knight, 1921). In this report, the definition of agriculture risk is linked to negative and unforeseen impacts resulting from biological, weather, regulatory or market variables. These variables include natural events (for example, pests and diseases), weather events that are uncontrollable by farmers (for example, droughts and floods), and changes in the inputs and/or output prices. Furthermore, the institutional risk (the risk generated by unexpected changes in regulations that have an impact on farming) is yet another important source of uncertainty. Changes in regulations, including sanitary regulations, can have a significant impact on farmer income. This is of particular importance for import/export products and for price support and/or institutional purchasing programs. Another important consideration is the difference between a risk and a constraint. For example, in the agriculture sector, the transport of products is key for accessing markets. If a farmer does not have good logistic and infrastructure access to markets (ie. Paved roads), this is considered a constraint. However, if the farmer has good access to such logistics and infrastructure, but that unexpectedly this access (ie. Road) is closed and therefore produces losses and/or additional costs, this is considered a risk. Finally, it is important to differentiate risks from trends. For example, if within a geographic area there is a known gradual increase in the frequency and impact of droughts (due to climate change or other factors), that known trend should not be considered a risk. However, the large deviations from that trend can be considered a risk. Another example of such a trend in Brazil is the gradual reduction in rural labor availability. Only the unexpected and sudden lack of such labor (deviation from the trend) is considered a risk

The objective of this work was to undertake a rapid and integrated review of agriculture risk management in Brazil, identifying gaps and opportunities for improving current public policies and programs[4] at the federal level in the short and long term. Beyond potential improvements in specific agriculture risk management policies and programs, an improved coordination and integration of current tools can reduce the risk profile of the sector. In this context, the World Bank, Embrapa and MAPA put forward a rapid and integrated review of agriculture risk management in Brazil with the following phases: i) national electronic survey with sector stakeholders; ii) analysis of the risk perception of agriculture sector experts; iii) literature review; and iv) validation of results from stakeholder institutions. This analysis intends to build a systemic vision of agriculture risk management and had the support of different institutions linked to the agriculture sector, such as Banco do Brasil, Inter American Development Bank (BID), Agriculture Confederation of Brazi (CNA), National Confederation of Agriculture Workers (Contag), National Federation of General Insurance (Fenseg), Food and Agriculture Organization of the United Nations (FAO), Inter American Institute for Agriculture Cooperation (IICA), Brazilian Organization of Cooperatives (OCB), Brazilian Rural Society (SRB), and National Food Supply Company (CONAB).

4 The work focused on federal policies and programs (excluding State and Municipal policies/programs). However, the work listed, mapped and described only those policies and programs with a budget, even if different public policies were mentioned throughout the document.

Agriculture sector risks can be grouped by production, market and enabling environment risks. According to the typology set by the World Bank[5], production risks refer to the actual production and includes weather, fire, animal and plant health, and any unexpected change in the management of the farm and/or its natural resources (such as changes in regulation and/or technical assistance for example). Market risks include mainly significant changes in output and/or input prices, unexpected changes to access to credit, to markets, including external markets. Finally, enabling environment risks include events that change the context of policies and institutions (changes in the legal/regulatory framework, sector institutions, interpretation of laws and regulations), including logistics and infrastructure (Table 1). Chapter II presents a detailed description of the methodology used.

5 Agriculture Risk Management Framework Document: https://www.agriskmanagementforum.org/content/basic-concepts

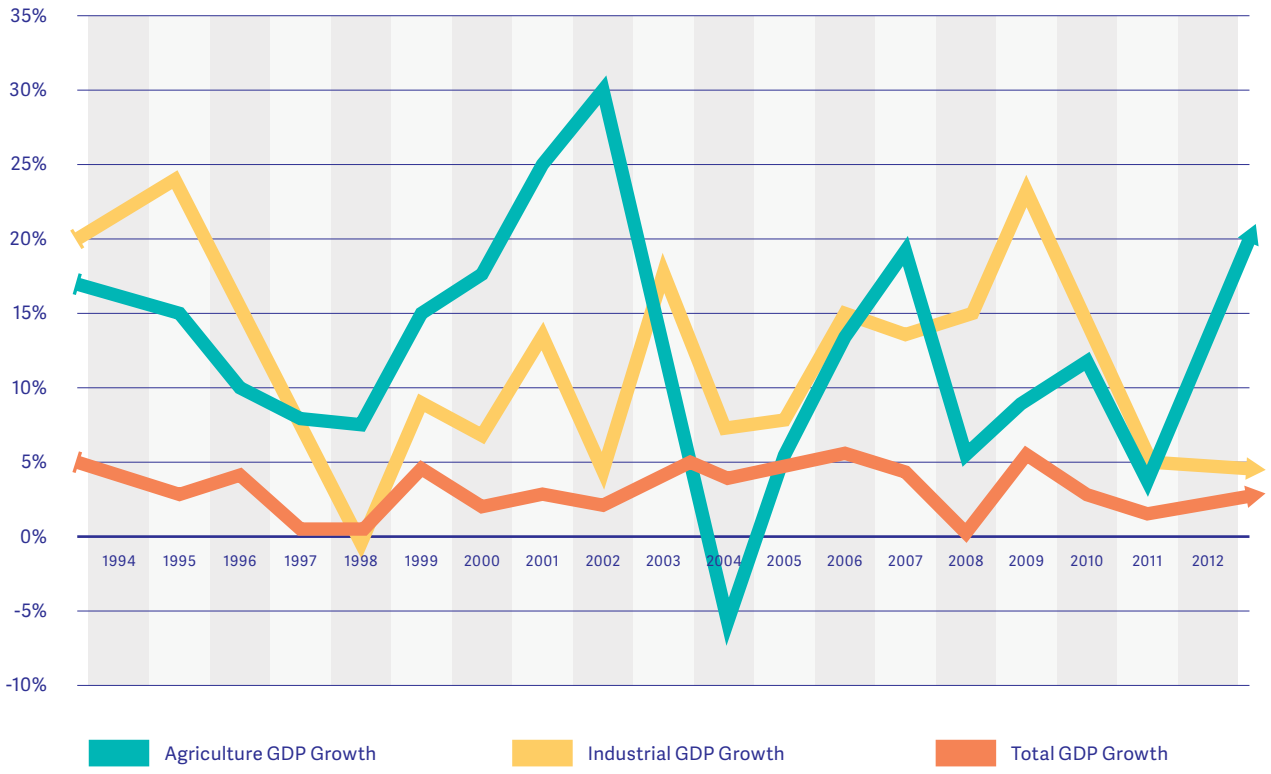
Table 1. Typology of agriculture risks in Brazil (Authors, 2015).

RISK GROUPS	RISK	EXAMPLES OF HAZARDS
PRODUCTION RISK	Weather and Fires	Prolonged droughts, frosts, excess rain, strong winds and floods.
	Animal Health	Foot and mouth disease, BSE (mad cow disease), Newcastle, etc.
	Plant Health	Introduction of new pests and diseases (ex.: *lagarta Helicoverpa armigera*).
	Natural Resources and Production Management	Changes in water rights/allocation, in technical assistance, in control of regulations, in labor availability. Sudden mismanagement of natural resources (ex. drought in RS) like incorrect decisions on soil and water management..
MARKET RISK	Trade (price of inputs and outputs) and Credit.	Substantial changes in output or input prices, in exchange rates, in interest rates, in credit terms.
	International Trade	Unexpected closing of export markets and changes in the access of imported inputs.
ENABLING ENVIRONMENT RISK	Infrastructure and Logistics	Strikes at the port, closing of roads, railways, waterways, and changes in the incentives for storage.
	Regulatory, Policy or Institutional Framework	Changes in laws/regulations (environmental, labor, inputs, land), changes in the approach of public institutions (MDA, MMF, ANA) or the change in interpretation of existing laws and regulations.

1.2 Socio-economic importance and volatility of the agriculture sector

Agriculture production is one of the main pillars of the Brazilian economy. The participation of the sector to total GDP is close to 6% in Brazil and agribusiness represents 23% of GDP, being the backbone of an important value added chain that represents 32% of total employment. Beyond the multiplier effect in income and employment generation, historically, the agriculture sector has contributed significantly to the trade balance of Brazil. In the past 10 years, the volume of agroexports grew more than 200% and the trade balance 468%, resulting in agroexports reaching US$100 billion in 2013, representing almost 42% of total exports from Brazil. Brazil is the largest exporter of coffee, sugar, orange juice and meat (cow and chicken); the second largest in maize and soy (grains, oil and flower); and being one of the leaders in pork meat and cotton among other rural products.

Graph 1. Agriculture GDP growth in Brazil (R$ constant 2000) (IBGE, 2014).



Although the agriculture sector is one of the engines of the Brazilian economy, it is also more volatile in economic terms. This volatility has impacts in the country in terms of: i) the multiplier effect and its corresponding dependency in other agriculture subsectors; ii) the importance of the sector in fiscal revenues; iii) the impact in the increase of domestic prices, in particular food products; and iv) the importance of the sector in rural incomes. Agriculture sector volatility is produced by different risk groups that can result in extreme economic losses.

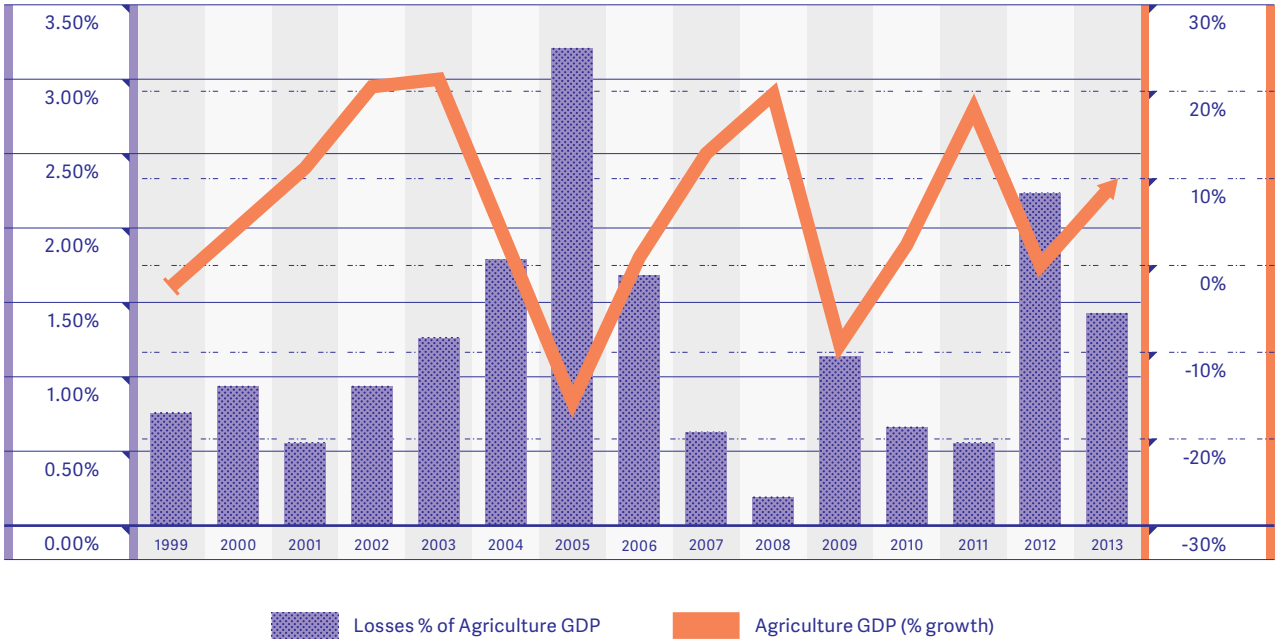
Brazil loses annually, on average, 1% of the value of agriculture production[6] due to extreme events. Following a simple methodology[7] to calculate agriculture losses as a function of extreme events, we can see (Graph 2) that extreme events do not just cause losses in agriculture production, but also, in those given years, agriculture GDP growth is negative. In the years that the largest losses have occurred, 200-2006 and 2012-2013, they had been related for severe droughts. In 2004-2006 the impact was in the South and Southeast Region of the country, while in 2012-2013 the reduction in production was related to the extreme drought in the Northeast Region. It is important to consider that these loss values from extreme losses could be higher when taking into account forgone producer income of those agriculture products and/or regions with limited or lack of access to risk mitigating mechanisms. Beyond the estimated losses due to extreme weather events, the agriculture sector of Brazil suffers other losses due to risks such as unexpected changes in the regulatory framework, in the management of production and natural resources and other risks that are difficult to quantify.

Sebastião José de Araújo / Embrapa

6 Refers only to agriculture GDP. Livestock is not consider given the more complex relationship and lags between risk events and real losses.

7 Initially weather shocks with a lower interannual variation were identified initially. The available data on real losses not always are accurate or consistent or enough to allow for a comparison and classification of the costs of these adverse events. This analysis, however, was based in estimates of the value of losses through a 15 year period (1999-2013), based on the Municipal Production Data from IBGE. A group of crops was selected in relation to their importance in the State Agriculture Value Added of 2013. The annual agriculture production loss was calculated as the deviation from the trend of real yields. A threshold of one standard deviation from this trend was defined to distinguish between losses due to extreme events and normal deviations or manageable recessions. The difference in yields in the years were the real yields were below the threshold was then multiplied by the real area of production from that year, and with the value paid to producer using as reference the year 2013, converted in US$ by the 2013 exchange rate. The loss values obtained were then compared to the agriculture GDP of that given year in order to calculate a measure of relative loss.

Graph 2. Annual agriculture production extreme losses (above one standard deviation) and agriculture GDP growth (%) (IBGE, 2015).



The consequences from agriculture sector risks vary by Region, by type of farmer, and by value chain. Agriculture in the Northeast Region, with losses of 90% of grain production without irrigation in 2012[8], had negative growth in the last three years, with average losses of three work days/year for rural families due to low production and water shortages. Family farming, given that they have less access to financial risk transfer instruments, suffer disproportionally more from risks that affect their revenues. This has contributed towards the increase in rural poverty in the State of Sao Paulo in precisely the poorest regions of the country, as well as towards the reduction of one standard deviation in the yields of permanent and temporary crops, reducing up to an estimated 42,000 jobs[9]. Finally, certain risks can have severe consequences in entire value chains. For example, the foot and mouth disease outbreak in Mato Grosso do Sul and in Parana in 2005 closed the meat export market to Russia, which was restored only 28 months after[10]. The reduction in meat exports during that period was 1/3 of the total exported volume, having a significant impact in farmer income and in also in the competitive position of the value chain in international markets.

8 Information from CONAB presented in: http://wrld.bg/Ucabw

9 MBAgro Study, 2012. http://www.fenseg.org.br

10 Costa, R., David A. Bessler, David A. and C. Parr Rosson, C. Parr. *"The Impacts of Foot and Mouth Disease Outbreaks on the Brazilian Meat Market."* Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24-26, 2011.

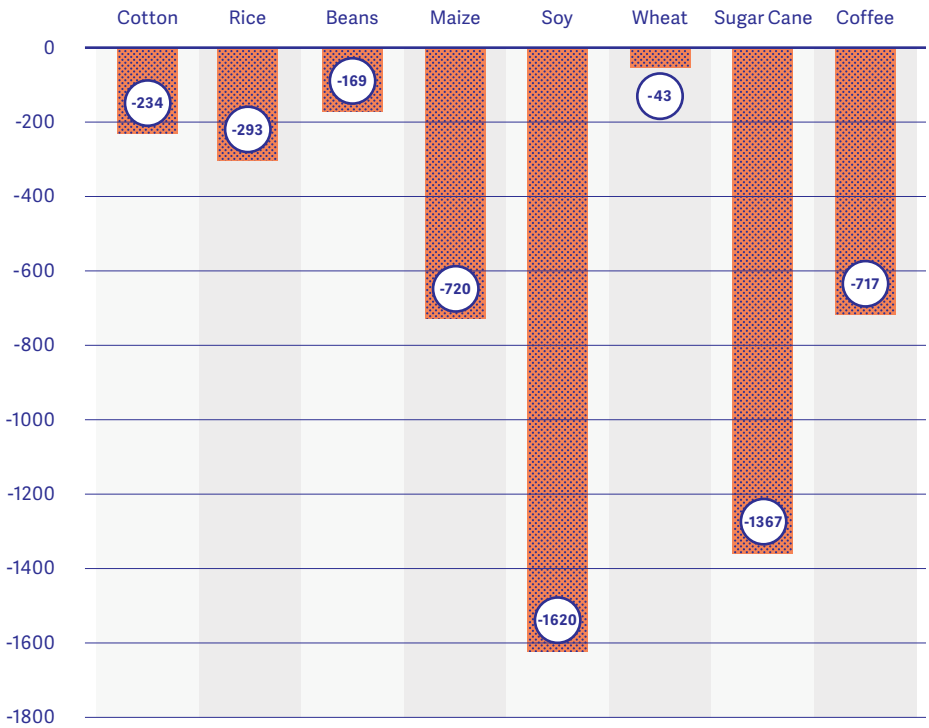
For the Federal Government, as well as for the state governments, agriculture risks imply important fiscal expenditures. From the public expenditure side, events that impact the agriculture sector income, such as natural disasters, pests and diseases, significant fluctuations in food, labor, input and energy prices, as well as agriculture production per sea, mean that agriculture emergency expenditures at all levels of government can have important impacts for the economy as a whole. The Federal Government estimates that, only for the Northeast, the response to the extreme drought of the last few years has resulted in additional public expenditures of approximately R$17 billions[11]. Even in the Northeast, the frequency of droughts increased the public expenditures to the Garantia Safra Program by approximately 50%, going from one severe drought in every six years to one in three.

The risks also have an impact in fiscal revenues. From the side of fiscal revenues, a reduction in 10% of the Brazilian production of soy can result in an annual reduction of R$1.6 billion in fiscal revenues, equivalent to 16% of the annual budget of MAPA (Graph 3). If losses would occur in various agriculture products at the same time, the fiscal impact, in revenues and expenditures, would be significant.

11 http://www.brasil.gov.br/observatoriodaseca/index.html

Alfredo do Nascimento Junior / Embrapa

Graph 3. Loss in fiscal revenues due to a reduction in 10% in agriculture production (R$ millions) (MB Agro, 2012).



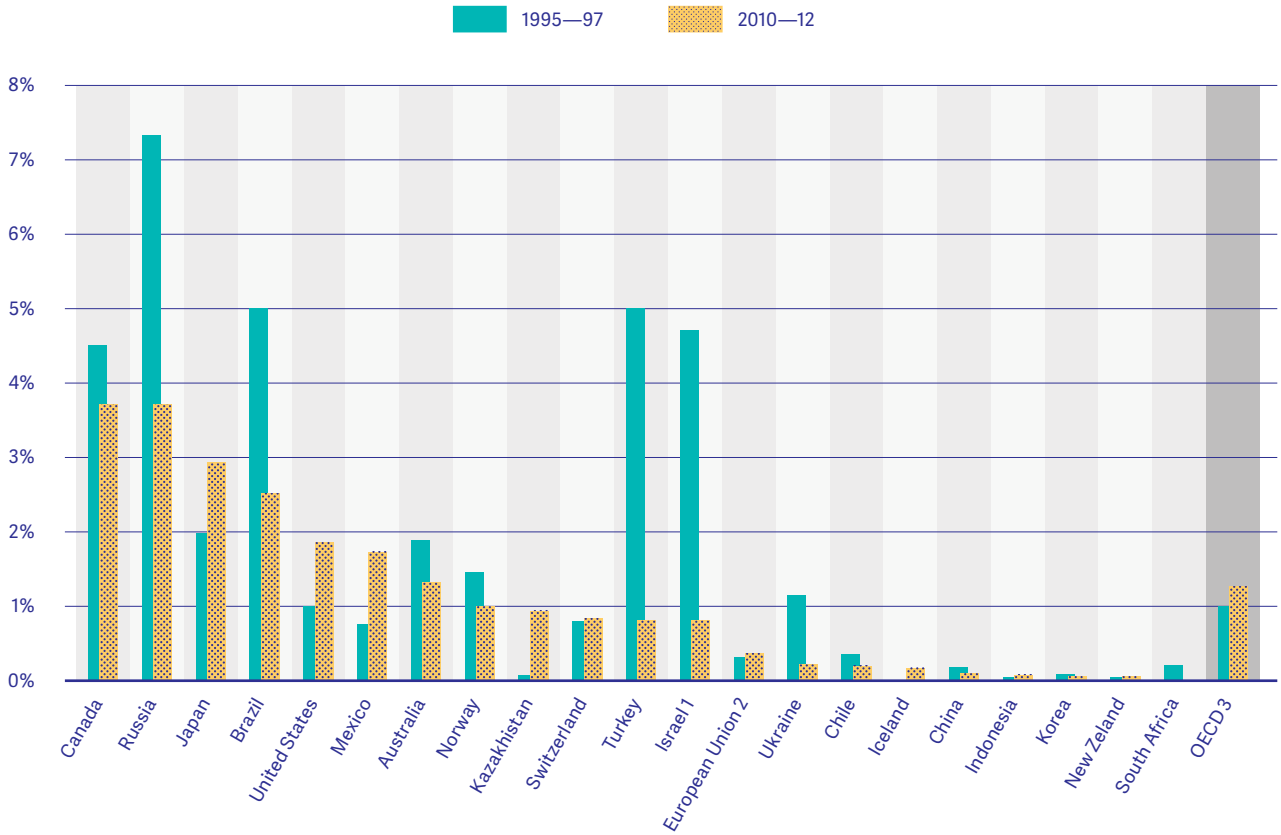
1.3 Agriculture risk management public policies and programs in Brazil

The agriculture sector of Brazil has a relatively high anticyclical support. In relation to other developing and OCDE countries, Brazil has a relatively high level of anticyclical or "variable" supports (supports that vary according to the level of production and/or income level of farmers). The anticyclical supports (variable payments) include natural disaster response policies and programs, output price compensation (guarantees), and emergency programs.

Only Japan, Russia and Canada have anticyclical support levels higher than Brazil (Graph 4). However, the anticyclical support level of Brazil has had a reduction of 50% between 1995-97 and 2010-2012 in relation to the level of total farmer income, going from 5% to 2.5% of farmer income.

12 Variable payments are farmer supports that only trigger in specific situations, generally when there are negative shocks like weather, price, crisis. Examples of such payments in Brazil include PROAGRO, Garantia Safra, Garantias de Preço Mínimo, etc.

Graph 4. Anticyclical agriculture supports (variable payments[12]) as % of farmer income excluding market price supports (*Agricultural Policy Monitoring and Evaluation* — OCDE 2013).



Kim-Ir-Sen Leal / Embrapa

Brazil has many agriculture policies and programs that have an impact in the management of sector risks in a direct or indirect manner. These policies and programs cover various dimensions of risk management, including mitigation, transfer and response[13], and also are addressed to the different actors of the sector: family farmers, medium and commercial farmers. Some of the most important federal public policies and programs are related to one of the three risk groups (production, market and business environment) are presented in Table 2. For this, 25 of the main policies were selected, following budget and coverage criteria. A description of each program/plan is presented in the Technical Annex and their mapping in relation with the risk management strategy is in Chapter III. Although the work is limited to Federal Policies, it is important to note that several State (and even municipal) public policies and program exist, with an impact on agriculture risk management, which makes the mapping of government actions a big challenge.

13 The definition of the agriculture risk management strategies is in section 2.2.

Table 2. The 25 main federal public policies and programs for Agriculture Risk Management in Brazil

RISK GROUPS	PLANS/PROGRAMS
PRODUCTION RISK	Agroclimatic Risk Zoning — ZARC
	Subsidy to Rural Insurance Premiums — PSR
	Agriculture Guarantee Program — PROAGRO
	Family Farming Agriculture Guarantee Program — PROAGRO MAIS
	Garantia Safra — GS
	Catastrophe Fund (not yet regulated)
	National Animal Health Programs
	Plant Health Programs
	National Water Resources Plan
	National Program to Combat Desertification
	Tractor Fleet Modernization and Associated Tools Program — MODERFROTA
	National Family Farming Strengthening Program — PRONAF
	National Medium Size Farmer Support Program — PRONAMP
	Sectoral Plan for Climate Change Agriculture Mitigation and Adaptation — Plano ABC
	Agriculture Modernization and Natural Resources Conservation Program — MODERAGRO
MARKET RISK	Equalization Premium Paid to Farmers — PEPRO
	Federal Government Purchases — AGF
	Option to Sell Contract — COV
	Output Price Equalization Program — PEP
	Premium for the Purchas of Agriculture Products originated in a private option-to-sell contract — PROP
	Price Guarantee Program for Family Farmers — PGPAF
	BRASIL EXPORT
BUSINESS ENVIRONMENT RISK	Logistics Investment Program — PIL
	Storage Construction and Expansion Program — PCA
	Incentive for Irrigation and Storage Program — MODERINFRA

Methodology

2

2.1 Background

There are several methodologies and approaches to doing an integrated agriculture sector risk review. In the past few years, OECD proposed a holistic conceptual framework for agriculture risk management[14] and the World Bank developed a methodology[15] for evaluating in an integrated manner the risks of agriculture supply chains. Recently, the World Bank has been using this latter methodology for an integrated assessment to support government in the prioritization of agriculture risk management public investments and actions[16]. In 2014, the World Bank, the Ministry of Agriculture (MAPA) and Embrapa opted to adopt an integrated review methodology for assessing sector risks in order to obtain quick results as a basis of the public policy sector dialogue with the new authorities at the beginning of 2015.

A rapid review methodology was developed in order to be able to map the main public policies and programs and identify the challenges and opportunities to improve agriculture risk management. Usually, the risk evaluation includes risk quantification, prioritization, analysis of capacities and the search of solutions to manage systemic risks. However, given the richness of previous information, studies and assessments before this study in Brazil, the decision was to undertake a rapid review based on consultations with more than 100 specialists and an electronic survey sent out to more than 5000 representatives of the sector, of which 10% responded. The work was backed up by an empirical evaluation of those risks in two States (Bahia and Paraiba) and in one Municipality (Piquet Carneiro, Ceara). The results of the consultations of the specialists and of the electronic survey were compared with the results of a literature review of the most recent studies in risk evaluation in the country and with the main public policies and programs, according to budget and coverage (Table 2), dedicated to mitigating, transferring and responding to agriculture risks. After they were categorized, the preliminary results were presented (see Technical Annex) to various stakeholders related to the agriculture sector of Brazil and the implementation of public policies (CGEE – Ministry of Science and Technology, BNDES, CGU and TCU) for validation and improvement of the results.

14 http://wrld.bg/UcagS
15 http://wrld.bg/Ucamb

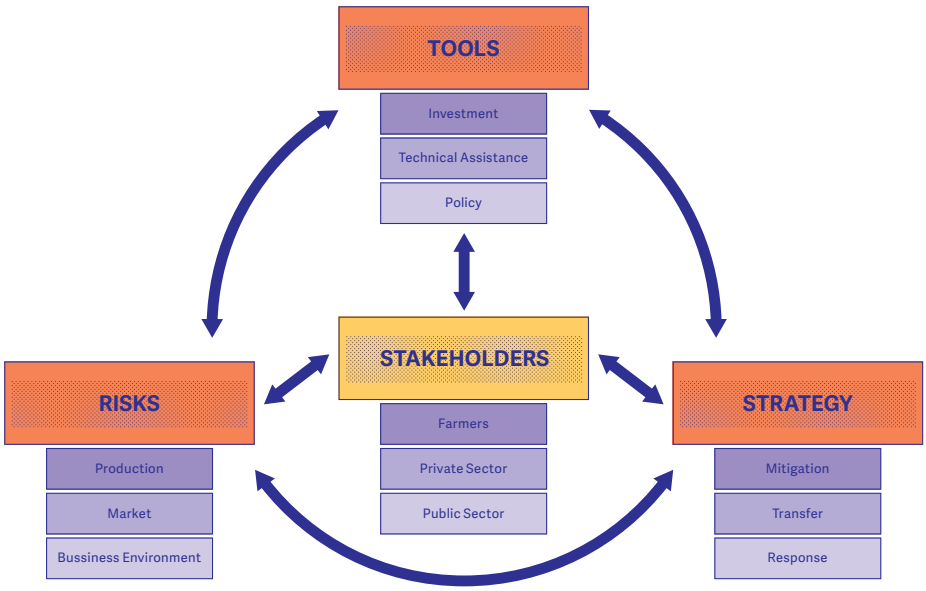
16 See recent work in Paraguay: http://wrld.bg/Ucarn

2.2 Methodological concepts

In order to reduce the complexity of the work, only events with farm-level impacts were evaluated. Although the World Bank has developed a methodology to assess risks along value added supply chains, and although risks in other parts of the supply chain can be as important as the on-farm ones, due to limited resources, in particular time, only farm-level risks were taken into account. This includes events that originate outside the farm-gate (for example, the unexpected closing of a road, changes in the regulations surrounding pesticides, etc.), as long as they have an impact in farmer income (through costs and/or sales).

Considering that the agriculture sector has cyclical variations, this work only considered the risk associated with extreme and systemic events that affect farmer incomes. The extreme and systemic events were defined as those that produce more than one standard deviation from the average or the historical trend. Income reductions less than one standard deviation (around 10%) were not considered. Catastrophic losses, regionally concentrated, also were not considered if they do not have a national impact. For example, the droughts in the Northeast or in the South/Southeast, although it is (for the most part) concentrated in that Region, was considered as it has clearly had an impact in the overall agriculture sector of Brazil. The fact that smaller scale events were not considered, such as weather and sanitary outbreaks, do not mean that they are less important. Thus, limitations of this methodology include: (i) not evaluating impacts across the supply chain (only on-farm); (ii) it is influenced by recent events (drought, road closures) that are more clear in the memory of the stakeholders, specialist and survey responders, versus events that have happened in the longer past; and (iii) not being able to ensure the correct interpretation by participants of the definition of risk, therefore referring to structural limitations (and not to unexpected adverse events).

Figure 1. Integrated vision for Agriculture Risk Management (World Bank, 2014).



The management of agriculture risks require different strategies, instruments, and has to acknowledge the differences in risks and stakeholders – Figure 1. In order to reduce sector losses in an aggregate way, all risks (weather, animal and plant health, management of production and natural resources, credit, markets, trade, logistics and infrastructure, and the regulatory and institutional framework) must be considered (see Chapter I for a typology and grouping of risks) using different risk management strategies and instruments. The main management instruments available for the public sector can be summarized in investments, technical assistance and public policy actions. The different agriculture risk management actions can be grouped in the following broad strategic pillars.

MITIGATION: actions that happen before the event (ex-ante) to prevent, reduce or eliminate the occurrence of events or their negative economic impact on agriculture production, markets or enabling environment, such as infrastructure, animal and plant

health, agroclimatic information systems (zoning, early warning systems), drainage, production diversification, preventive genetic improvement, adoption of improved agriculture practices and systems more adapted and conservationist, etc.

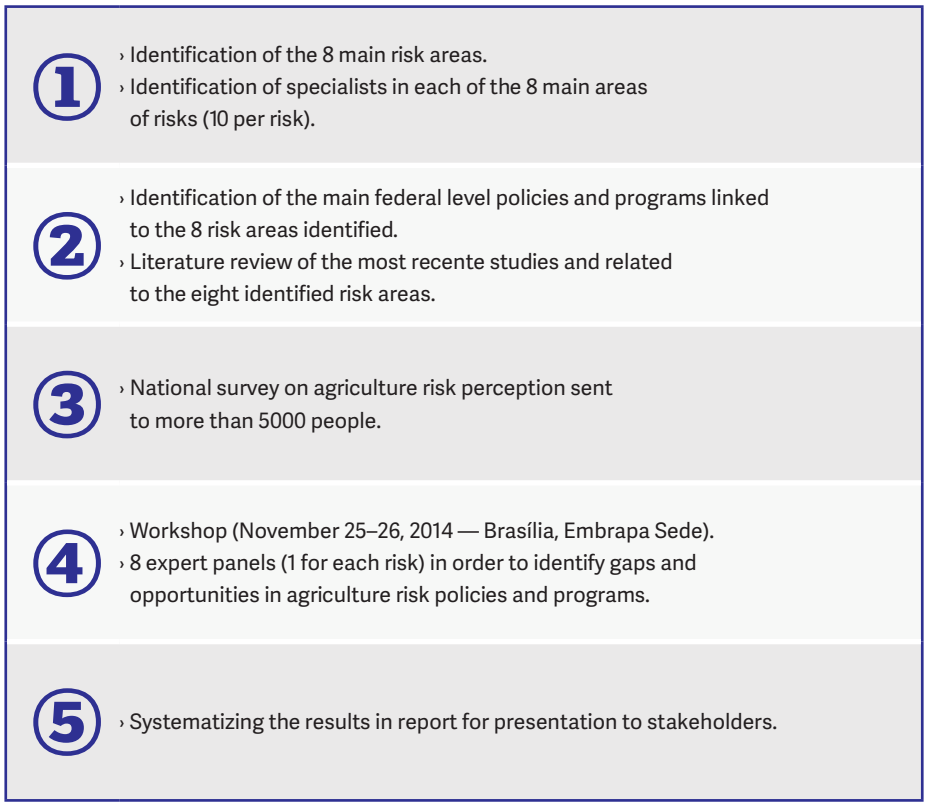
TRANSFER: actions to transfer risks to a third party, by paying a cost (premium). Examples include financial instruments such as insurance, reinsurance, derivatives, etc.

RESPONSE: actions that happen during or after an event (expost), geared towards rebuilding or compensating for losses caused by the event. Examples include emergency assistance to farmers, debt restructuring, infrastructure or transport reconstruction, etc. An important response action that occurs ex-ante is the strategic planning or contingency planning, where response mechanisms are designed a priori in order to respond more effectively and efficiently after the event (ex: contingency plans for combating fires or for the control of disease outbreaks).

2.3 Stages of the work

The rapid review of agriculture risk management policies and programs was divided in five stages, which occurred over a period of 7 months. The Stages (Figure 2) include: (i) the identification of the main risks and the specialists to be consulted, (ii) the literature review of recent studies on risks and the related federal-level public policies and programs; (iii) undertaking a national survey on agriculture risk perception from the sector; (iv) undertaking an event to consult with sector specialists (identified in Stage 1); and (v) systematizing the results.

Figure 2. Stages of the rapid review of Agriculture Risk Management in Brazil



STAGE 1. IDENTIFICATION OF THE MAIN RISK AREAS AND THE ASSOCIATED SPECIALISTS

The basic premise of this first stage was that given the limited time to do the review, the consultations with specialist could be assumed to substitute, even with limitations, the empirical research on losses caused by the different risks on farmer income. Therefore, based on the previous work done by Embrapa with the Sector Groups of MAPA and the known impacts on farmer income, eight risk areas (Table 3) were established, grouped in three risk dimensions (production, market and business environment risk).

Table 3. Risk groups, sector specialists (institutions), and moderator.

RISK PANEL	INSTITUTIONS REPRESENTED BY IDENTIFIED SPECIALISTS	MODERATOR INST.
Extreme weather events and fires	UDOP, Apassul, FUNCEME, Embrapa, MAPA, UNICAMP, ESSOR, SWISS RE, CORSO, Clone, ESALQ/USP, FAEP	WB
Animal healthl	OCEPAR, ABIEC, Instituto Pensar Agro, Embrapa, CNA, UNB, MAPA	WB
Plant health	IMA-APROSOJA, Embrapa, MAPA, Multiplanta, Agropec	WB
Natural Resources and Production Management	FGV/AGRO, ABRASS, ANDA, ESALQ/USP, UFSCAR, FAPCEN, Embrapa, OCB, CNA	IICA
Market — credit and marketing	Aprosoja/MT, FAEG, Rabobank, Banco do Brasil, Ministério da Fazenda, Sicredi, MAPA, UNB, COCAMAR, COOXUPÉ, IBRAF, OCB, FAEP; CONAB	IFC
International trade	MAPA, Instituto Pensar Agro, MRE, CNA, FGV/AGRO	BID
Infrastructure and logistics	UNICAMP, CGEE, IPEA, Ministério dos Transportes, OCEPAR, ESALQ/USP, COMIGO	WB
Regulatory framework and interest groups	CNA, CT — AGRO, Inst. Pesq. Pernambuco, BB Mapfre Seguradora, SRB, USP, Instituto Pensar Agro, Embrapa ABRAPA, FAEP, OCB, BNDES	WB

STAGE 2. LITERATURE REVIEW AND IDENTIFICATION OF FEDERAL PUBLIC POLICIES AND PROGRAMS

In parallel with the expert consultations, the 25 main policies and programs were identified using the literature review and based on public expenditure and coverage, following the eight risk areas (see Technical Annex)[17].

17 The identification of the programs and the literature review can be accessed in the website: https://www.embrapa.br/eventos/avaliacao-de-riscos-agropecuarios

STAGE 3. ELECTRONIC SURVEY RELATED TO THE RISK PERCEPTION OF THE SECTOR

On top of the expert consultation, a national level electronic survey [18] was sent to more than 5 thousand representatives of the agriculture sector. The survey had as an objective to capture the risk perception regarding the severity and frequency of these events associated to each of the 8 risk areas. The responses were obtained and statistically analyzed, in order to allow for ordering risk according to the perceptions of the sector, controlling for regional and sector bias. It is important to note that the survey asked respondents to provide a national view, suppressing regional aspects; but since participants had to identify themselves per region of the country, their main activity (farmer, industry, logistics, researcher, etc.), and supply chain (grains, fruits, meat, etc.), it was possible to apply a psychometric analysis to identify potential regional or sector bias from the type of agriculture production or level in the supply chain (See Technical Annex).

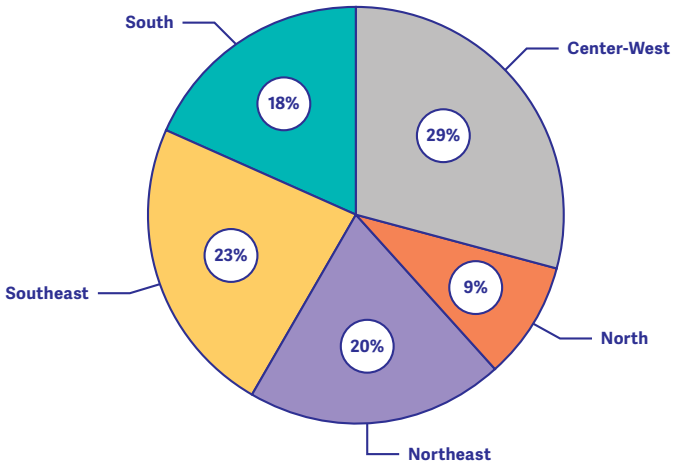
18 The survey form can be accessed at: http://wrld.bg/Ucaxf

More than 700 responses were received (from a total of more than 5 thousand) representing all regions of the country (Graph 5). The survey was composed of questions relative to each of the risk areas, using an intensity scale for the losses suffered and the frequency of the events, being 1=very low; 2=low; 3=medium; 4=high; and 5=very high. Based on this information, the average impact and frequency was calculated for each event, as well as the categorization of the responses by region.

$$\text{Impact of the event X} = \frac{\sum \text{impact of the event X}}{(\text{N}^{\text{o}} \text{ of responses})}$$

$$\text{Frequency of the event X} = \frac{\sum \text{frequency of the event X}}{(\text{N}^{\text{o}} \text{ of responses})}$$

Graph 5. Responses to the electronic survey on agriculture risk perception by Region of Brazill



STAGE 4. CONSULTATION WITH SPECIALISTS

A technical workshop was held with the presence of more than 100 specialists identified in Stage 1 and representing various stakeholders of the sector. Following a series of keynote speakers, the specialists of each risk area (approximately 10 per group) met. The selection of specialists was done in consultation with representative institutions of different sector actors, ensuring that each group had representatives from different stakeholder groups: public institutions, private sector (agribusiness), academia, producers, financial, and research institutions. The basic principle adopted was that these specialists had great knowledge about each risk area and that, once stimulated to participate in a collaborative process, they could jointly identify the main challenges and opportunities for managing agriculture sector risks. Each group had an independent moderator (staff from IICA, BID, IFC, or World Bank) and a note taker (researchers from Embrapa). A standard set of questions was given to the moderator to guide the discussion with the specialists in each group in order to assess the literature review undertaken, the results from the survey and identified challenges and opportunities of that specific risk. The groups debated the sector risk perceptions, looking to arrive (as much as possible) to group conclusions and recommendations.

Some questions to guide the work were sent to all specialists in advance of the workshop in order to accelerate the discussion and structure the participation of each group member. The responses that were sent in writing in advance and by those who could not participate, were analyzed and considered in the present work. Among the questions sent in advance, two of them were recorded statistically: i) what are the main interactions that exist between the risk that the group was considering and other risks?; and ii) identify two or three of the main risks within the group that the specialist was participating.

The results of the groups were presented to all workshop participants in plenary sessions where opinions from other groups were heard (see Technical Annex). This workshop allowed for a very important interaction among participants, ensuring representation and balanced views from all stakeholders represented: private sector, farmers, civil society, government and academia. During the plenary sessions, several themes were raised by specific groups, and then confirmed by all, which ensured the legitimacy of the results. Those themes that were not subject of consensus and/or that generated resistance from some sectors were eliminated.

After the event, minutes were written of each group and were sent by the moderators to the participants of each group for comments and validation. The specialists commented and contributed to the final reports of each panel, which can be find in the Technical Annex.

STAGE 5. VALIDATION OF RESULTS

After the results were compiled and systematized, the output from the electronic survey and of the technical workshop were presented (Annex) to various stakeholders of the agriculture sector linked to federal level policy making (CGEE — Ministry of Science and Technology, BNDES, CGU, TCU, PGU, ESALQ, UFSCAR, MDA and Ministry of Transport), resulting in the final output reflecting a synthesis of the survey, the workshop and validation. Beyond validating the results, several suggestions were obtained for improving existing public policies as well as the need for new policies.

Results

3

The final results were a synthesis of the survey, of the workshop and the validation. After the validation with different institutions, the results were systematized in order to obtain a synthesis of the perceptions. The divergent results, when consensus did not happen, were eliminated. That synthesis of results, in particular during the workshop and validation, took into consideration the review of the 25 main public policies and programs.

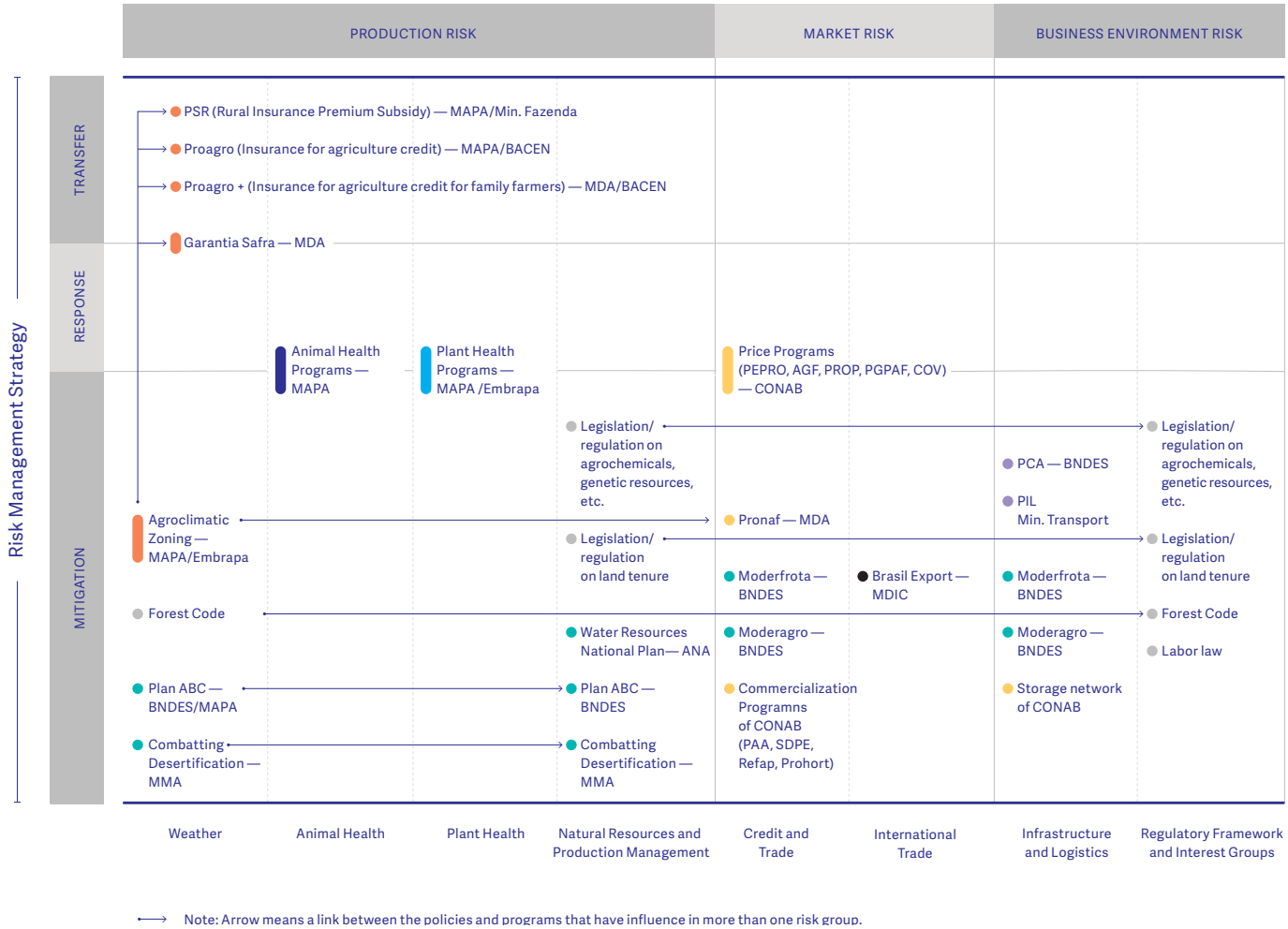
3.1 Main public policy and program mapping

Although there is a great number of public policies and programs in Brazil, there are gaps and opportunities. The mitigation strategy (Figure 3) is the most representative in terms of number of public policies and programs. The predominance of mitigation is aligned with any risk management strategy. However, there are many important opportunities in the transfer and response strategies. In the case of response, specifically in cases of low frequency and high impact risks, such as sanitary problems not yet present in Brazil, the country has a relatively low number of contingency plans. Furthermore, considering that not all agriculture risk can be transferred, there are opportunities in the production and market risk, such as price future markets. This reality is an excellent opportunity for the generation of fiscal revenues of 'new' business, such as financial and technical assistance services, as well as for the reduction of fiscal expenditures through the simple integration of existing strategies. It is important to highlight that the implementation of this integration does not require a significant amount of additional public resources.

The public policies and programs mapped do not cover all losses from small and medium size farmers in an integrated manner. Larger commercial farmers have access to sophisticated financial instruments to cover price and insurance that small and medium size farmers don't. Family farmers depend on programs like Garantia Safra, where farmers receive income compensation for losses above 50% of expected yields, and even then,

they do not get to cover all farm-level losses. Other programs such as Proagro only cover the cost of credit, but do not compensate for the farmer income loss. In a similar situation the same happens with market and logistics risks.

Figure 3. Main agriculture risk management policies and programs in Brazil

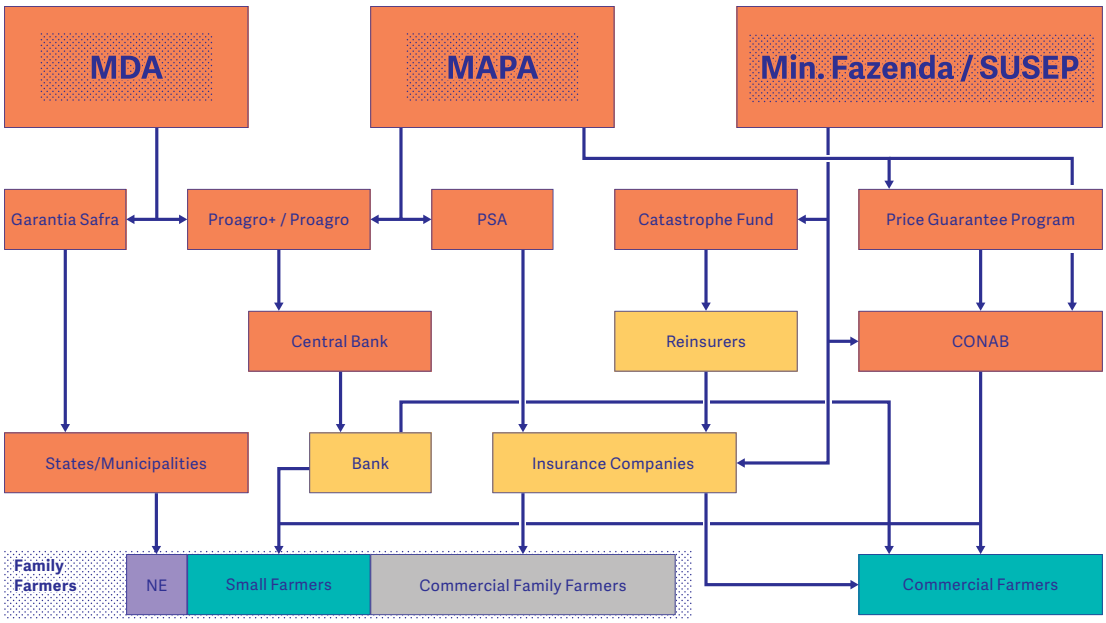


⟷ Note: Arrow means a link between the policies and programs that have influence in more than one risk group.

The operation of programs is complex and needs more coordination. The integration of the price risk programs with the insurance programs can and should result in the protection of farmers' income. However, as seen in

Figure 4, the programs depend on different institutions, and are implemented by different intermediaries, arriving through different vehicles to farmers. In order to avoid duplication of actions – and looking to maximize services and coverage to improve farmers' income - , an inter institutional coordination among the different programs is key to achieve more efficiency and effectiveness in the operation.

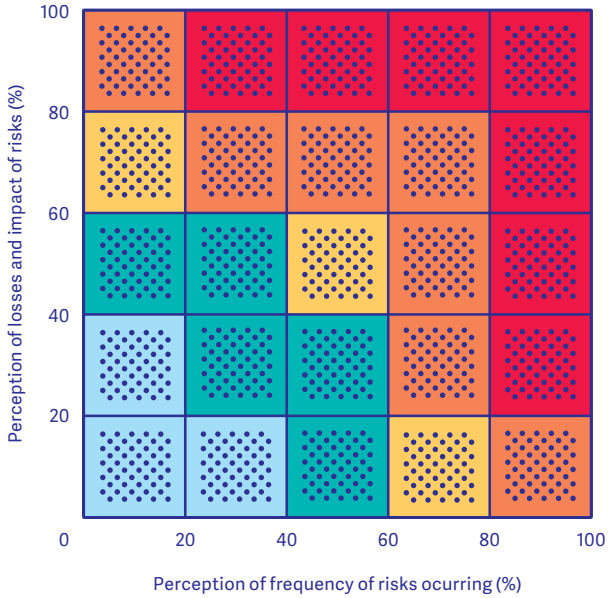
Figure 4. Agriculture insurance system and price guarantees



3.2 Summary of risk perception

Risks linked to production management (such as the unexpected low quality or lack of property plans or projects, the unavailability of labor, farmer training and technical assistance) can be as important as other more "traditional" agriculture risks, like weather and sanitary issues. Even though quantifying the risks linked to production management is difficult in Brazil, the perceived economic impact linked to these risks (see Graph 6) on the income of rural

Graph 6. Perception of the impact and frequency (severity level) of agriculture risks (electronic survey, 2014.)



Severity Level

VERY LOW	Hail Frost Wing	Changes in measurement standards Changes in trade promotion		
LOW	Excess Rain Flood Fire Brucellosis/Tuberculosis Newcastle Nematodes Invasive Plants	Lack of Machinery Inadequate Machinery Access to Inputs Quality of Inputs Delay in Payment of Min. Prices Changes in Taxes and Tariffs Lack of Payment from Buyer	Change in Strat. of Intermediaries Access and Terms of Credit Increase in Imports Anti-dumping/Safeguards Signing of Trade Agreements Interruption of Train Interruption of Air/Waterways	
MEDIUM	FMD BSE Avian Flu Swine Flu	Lack of Labor Exchange Rate Changes Sanitary Harmonization Changes in Burocracy	Changes in Labor Laws/Reg. Disputes Between Public Policy Inst. Changes in control agencies Lack of Clarity in Regulatory Framework	
HIGH	Pests Diseases Managerial Capacity Quality of Labor Inappropriate Technology	Lack of Tech. Assistance Inappropriate Water Mgmt. Inappropriate Soil Mgmt. Inappropriate Management of Agriculture Inputs	Drop in Prices Increase Credit Supply during Inappropriate Period Changes in Boarder Measures (Tariff and Non-Tariff Barriers)	Change in Environmental Reg. Strike in Ports/Truck Drivers Blockage of Roads Energy Supply Changes Changes in Storage Availability
VERY HIGH	Drought			

producers has been increasing in the Brazilian media (see Technical Annex). Furthermore, the results point out that the sector has given more importance to a systemic and integrated vision of agriculture risks, without focusing in the most traditional risks such as weather, animal and plant health, or price.

Risks associated to infrastructure and logistics are a priority. The sectoral vision shows that infrastructure and logistics risks have a relatively larger impact in the economy and a relatively lower level of public policy support in relation to other risks considered (Graph 6 and Table 4). However, it has been noted that this perception could be biased given the recent news and problems related to agrologistics in Brazil. Nevertheless, the risks associated to extreme weather events were considered as the second most important by specialists, receiving a classification of "very high", as well as the credit and commercialization risks.

Table 4. Perception of specialists regarding the risk dimensions addressed in the study and their degree of support from current federal-level public policies. (Technical workshop, 2014).

PUBLIC POLICY SUPPORT	IMPACT OF RISKS		
	BAIXO	MODERADO	ALTO
HIGH		› Internation trade › Credit	
MEDIUM		› Reg. framework › Nat. resources and production mgmt. › Market	› Animal health › Plant Health
LOW		› Weather	› Infrastructure and logistics

For all the agriculture risk dimensions, opportunities were identified in order to improve current federal-level public policies and programs. In particular, the workshop and validation sessions had some divergent points

João Costa / Embrapa

regarding challenges and opportunities for improving current federal-level public policies and programs for agriculture risk management (see Technical Annex with more details on each panel). However, a consensus was formed on the need to implement an Integrated Agriculture Risk Management System. Table 5 shows a summary of the results of each risk panel, including the results of each report, the inputs sent by specialists that did not participate in the panel and the validation of results.

Integration was the main subject of the discussions. An important conclusion, backed by specialists, was that, although gaps exist, Brazil currently has a series of good risk mitigation mechanisms, average risk transfer mechanisms, and a lack of risk response mechanisms – however, not being able to address each one of them in an isolated fashion. For example, in the international trade panel, the need for addressing the subject in an integrated and coordinated manner was made clear as it relates to managing agriculture risks, in particular plant and health risks. Another example were the recommendations coming out of the natural resources panel the incorporation of tools for managing weather risks in the sector.

Table 5. Summary of the challenges and opportunities for improving current federal-level policies and programs identified by the specialists in each panel (Technical workshop, 2014).

MAIN CHALLENGES IN AGRICULTURE RISK MANAGEMENT	OPPORTUNITIES (ACTIONS) FOR IMPROVING CURRENT PUBLIC POLICIES AND PROGRAMS
WEATHER RISKS	
Inadequate strategic planning related to weather risks	› Development of a Multiannual Agriculture Plan. To structure such plan, information need to be analyzed, integrated and include the current level of development of the supply chains and the future impact of risks
Lack of coordination and integration among several levels of government	› Design/implement coordination/integration mechanisms between public sector institutions to coordinate at the Federal Level the monitoring and management of weather and price risks in order to offer information of easy access.
Extreme Droughts	› Need to move towards a global climate forecasting system based on numeric modelling of climate.
Lack of knowledge of farmers about the weather and crop forecasting tools	› Prioritize the dissemination of existing tools for an integrated monitoring of weather and crop forecast and promote mechanisms/ instruments to increase knowledge on risk management for farmers.
Lack of quantification of the impacts of weather risks on supply chains	› Quantification of losses in order to serve as inputs to the different institutions of the Federal Government in charge of planning and risk management, in particular public-private actions.
ANIMAL HEALTH RISKS	
Group of Zoonosis with a tendency to increase in coming years. Ex.: brucellosis, tuberculosis, cysticercoids, and rabies	› Implement a Sanitary Education Program at the national level to revert the tendency for outbreaks.
Increase the number of researchers and specialists in exotic and emerging diseases	› Constitute and consolidate groups trained in zoosanitary emergencies, as well as exotic diseases.
Improve the consistency of sanitary and epidemiological monitoring	› Improve the Agriculture Sanitary System with monitoring mechanisms related to weather forecasting and increasing controls. Increase and qualify boarder measures; › Integrate in an effective way the information from customs and agriculture health departments; › Improve the sanitary integration with neighboring countries.

(continues)

(from previous page)

MAIN CHALLENGES IN AGRICULTURE RISK MANAGEMENT	OPPORTUNITIES (ACTIONS) FOR IMPROVING CURRENT PUBLIC POLICIES AND PROGRAMS
ANIMAL HEALTH RISKS (from previous page)	
Increase the participation of the private sector in sanitary controls	› Farmers must find a favorable and secure environment to contribute with their information.
Lack of a national agenda for reaching new markets, based on sanitary status	› It is important to maintain and expand the appropriate sanitary status, adding value to national production and creating a national agenda for reaching new markets.
PLANT HEALTH RISKS	
The resistance of pests and diseases to agrochemicals and GMOs is intensifying	› In order to reduce the resistance of agrochemicals, it is important to implement a 'new' industry of plant protection based on biological controls, biodiversity molecules, 'new' machines and equipment; structuring rural extension services and a sanitation education program to adopt good pest and disease management and control practices.
Regulatory process for sanitary protection is complex and delayed	› Expand the interaction and integration between the actors of the registry process: unify the requirement for registering sanitary protection products in order to reduce processing times.
Entering of pests, diseases and invasive plant species absent in the country	› Reinforce the Agriculture Sanitary structure at the northern border and include the sanitary impact studies in the logistics projects (roads, ports, airports, etc.); strengthen the development of contingency plans for quarantine pests that are absent in the country; › Implement a preventive genetic improvement program; phytosanitary management policies at the landscape level (example of the sanitary vaccum, management of fruit fly with the release of sterile males).
Increasing gap between reality and the pragmatic demands of the public sector related to sanitary issues	› Provide logic in understanding the reality in relation to the demands, expanding staff assigned to sanitary issues in border regions and in the production-intensive and expansion areas.
Sudden retreat of agrochemical products from the market without availability of effective substitutes.	› Improve the strategy for taking agrochemical products off the Market, including better planning and availability of information regarding alternative products that have been validated with at least two to three advance warning.

(continues)

(from previous page)

MAIN CHALLENGES IN AGRICULTURE RISK MANAGEMENT	OPPORTUNITIES (ACTIONS) FOR IMPROVING CURRENT PUBLIC POLICIES AND PROGRAMS
PRODUCTION AND NATURAL RESOURCE MANAGEMENT RISKS	
Operational and interpretative capacity constraints in the area of licensing related to natural resources in rural areasl	› Create operational and interpretational capacity, undertaking continuous training and capacity building related to federal, state, and municipal legislation.
Deficiencies in the rural property management processes among small and medium size farmers.	› Improve the management capacity of small and medium size farmers, with emphasis in the training of multipliers and distributors qualified for the dissemination of technology for rural property management.
Diversify and intensify land use. Soy, maize (1st and 2nd Harvest), and sugar cane represent 75% of cultivated area.	› Advanced and validated research show that crops with production diversification potential and for increasing the period of land use exist, especially in the Cerrado Region.
The States apply differentiated policies that interfere in agroindustry	› Adopt regional coherent policies for agroindustry, such as the unification of the agroindustry incentive policies through a regulatory framework.
Lack of integration among public policies and programs related to property and natural resources management with the private sector	› Integrate public and private sector actions related to sustainability and value added for farmers income Ex: Algodão Brasileiro Responsável (ABR).
CREDIT AND TRADE RISKS	
Lack of access to agriculture credit policies that are more structured, with more stable rules	› Provide more structured support and funding to access agriculture credit policies, increasing the predictability of public programs, ensuring future operations and thus, leveraging more private sector funding, reducing "new" public sector budget to the sector; › Undertake an ample review of the Rural Credit Manual, consolidating a medium to long term approach for agriculture financing; › Make financial resources available in the appropriate amount and at the appropriate time in order to enable agriculture trade support.
The data registered y the Risk Unit of the Central Bank is always delayed with respect with the agriculture calendar	› Update the Statistics Report data of the Central Bank until achieving monthly updates. Make data available from the Systematic Agriculture Production Survey (LSPA) from IBGE and from the harvest surveys from CONAB in an integrated and simultaneous manner

(continues)

(from previous page)

MAIN CHALLENGES IN AGRICULTURE RISK MANAGEMENT	OPPORTUNITIES (ACTIONS) FOR IMPROVING CURRENT PUBLIC POLICIES AND PROGRAMS
CREDIT AND TRADE RISKS (from previous page)	
In the "green soy" barter operations, small and medium size farmers are more exposed to risks	› Make agriculture output, input and other information available to farmers to reduce the risks of "green soy" barter operations; › Create mechanisms, with the subsidy of the PSR, to provide incentives for small and medium size farmers to access new operations, such as futures markets.
Link storage infrastructure credit with credit for storage and/or export	› Improve credit tools that support specific supply chains. Example of this are the financing needs of the coffee farmers are different than the needs of the soy farmers.
Large part of the available financing through Pronaf is still done for physical people	› Expand Pronaf operations for farmer associations and cooperatives, looking to strengthen farmer groups, seeking to increase the competitiveness of family farming.
Price hedging instruments are not very well known by small and mediums size farmers	› Search for options to promote price hedging instruments, such as futures and options.
INTERNATIONAL TRADE RISKS	
Animal and plant health has different monitoring and control structures for managing risks, leaving Brazil more exposed than its competitors	› Make the monitoring and control structures related to animal and plant health compatible to manage risks with other countries in order to reduce the exposure to non-tariff measures. There is a need for a specific structure that unifies the three risk pillars like in the European Union, United States and Australia.
Exports are generally conditions to quotas, having difficulty of access to markets when good trade agreements are not reached.	› It is necessary that Brazil intensifies negotiations of new agriculture trade agreements and to promote exports with new mechanisms or other means than just good trade agreements.
The occurrence of foot and mouth disease outbreaks	› Sanitary risk monitoring for international trade must be consolidated.
Brazil is highly dependent of imports of some agriculture inputs (wheat)	› Implement strategic and coordinated planning, seeking to reduce the dependency and impact of imports of agriculture inputs and outputs. Undertake trade agreements with the countries that have a complementary economy, for example the producers of fertilizers. Improve the coordination among the authorities on imports (wheat), reducing taxes in order not to have a negative impact in national production.

(continues)

(from previous page)

MAIN CHALLENGES IN AGRICULTURE RISK MANAGEMENT	OPPORTUNITIES (ACTIONS) FOR IMPROVING CURRENT PUBLIC POLICIES AND PROGRAMS
INTERNATIONAL TRADE RISKS (from previous page)	
Knowledge gaps of rural producers about international trade policies	› Increase knowledge of rural producers about international trade public policies. Some successful examples of companies and cooperatives in Brazil can be improved and disseminated.
INFRASTRUCTURE AND LOGISTICS RISKS	
The regulatory framework for investments in infrastructure and logistics needs to be improved	› Review and improve the legal framework that underpins contracts, such as Law 8666/93 (Procurement Law), that can choose the lowest price, but not the best quality.
The storage capacity level of some regions and supply chains cause losses to the sector	› Development of regional and supply chain storage plans to identify the financing need for the construction of new storage structure, with investments in delivery systems (roads, railroads, ports, and rivers), especially grains; and the long term promotion of the improvement and expansion of the storage capacity in Brazil through stable credit lines, seeking to adapt the structures to the market regulations. Implement incentives for on-farm storage. Reform the public storage network. Improve the capacity of the labor force working on storage facilities. Eliminate the legal barrier for individual people to act as storage service providers, increasing the static capacity available for third parties. Standardize the legislations related to environmental and fire prevention issues, which creates difficulties in the implementation of storage projects.
The rural producer is the most disadvantaged stakeholder when improving logistics, as it is often delinked from the supply chain	› Make information available to farmers about the availability of storage credit, which can lead to benefits, especially in off-season selling.
Interruptions in the flow of road transport	› Short-term actions are the monitoring and dissemination of information on roadblocks, in critical periods when the harvest is being sold – medium to long-term actions include the diversification into other transport modalities, using train and waterways.

(continues)

(from previous page)

MAIN CHALLENGES IN AGRICULTURE RISK MANAGEMENT	OPPORTUNITIES (ACTIONS) FOR IMPROVING CURRENT PUBLIC POLICIES AND PROGRAMS
INFRASTRUCTURE AND LOGISTICS RISKS (from previous page)	
Irregular energy supply	› The energy matrix must consider the demand for agriculture and agroindustry in high production regions, at competitive costs.
Strikes at the ports	› Provide continuity for improving infrastructure and labor relations at the port. Some short term actions have provided positive results, such as the online scheduling of truck arrivals.
REGULATORY FRAMEWORK, POLICIES AND INTEREST GROUP RISKS	
Unclear roles and responsibilities regarding the current land tenure legislation	› Integrate and standardize the land governance and strengthen the responsible institutions for implementing such legislation.
Sanitary legislation presents inconsistencies and contradictions in relation to new technologies	› Update and implement the animal and plant health system, considering new available technologies, in particular information technologies
Slowness in the adaptation of legislation. Brazilian institutions are not prepared to undertake the necessary updates at the same speed of social, environmental and technological changes in the sector	› Reduce the delay in improving legal frameworks, reducing legal insecurity and allowing to attract investments.
Conflict among interest groups	› Improve communication between the rural sector and urban society, based in scientific data. Demonstrate, for example, that the rural area can contribute for a sustainable management of water resources.
Large part of the legislation that supports trade, storage, and logistics operations are outdated, as they were established a long time in a different reality of the sector l	› Diagnose and update the legislation on trade support instruments for agriculture products.
Integrated risk management requires coordination and improvement in regulatory frameworks	› Provide coordination and integration in the research and innovation system (continuous management strategy), focusing on rural sustainable development and in the integration of agriculture best practices to the sector's regulatory framework.

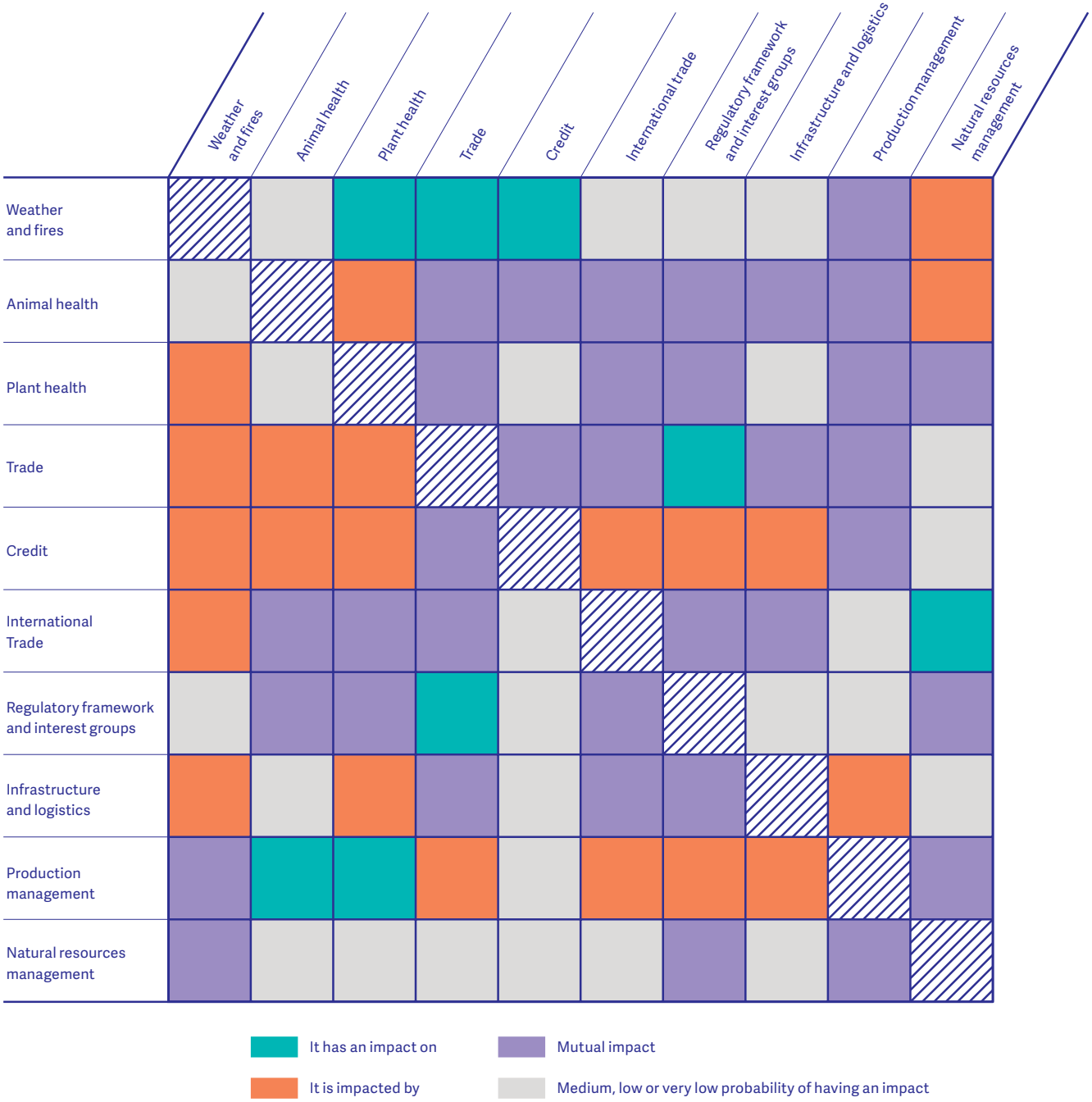
3.3 Perception of the relationship among risks

According to the specialists who attended the workshop, all agriculture risks are interrelated. During the workshop, the relationships among risks were identified (Graph 7), including the intensity and the direction of these existing relationships (influences) among risks (weather, animal and plant health, production and natural resources management, credit and trade, international trade, logistics and regulatory framework and interest groups). It is clear (column) that the credit risk is influenced by most other risks. Therefore, credit can serve as a tool to promote the integrated management of other risks, promoting/incentivizing farmers to adopt best practices and technologies to reduce the probability of future loses.

Weather risks have an impact on other risks, and therefore, deserve special attention. From consultations with specialists, it was clear that weather risks do not only impact agriculture production, but also risks related to animal and plant health, logistics and the property and natural resource management. These other risks can also influence the trade risk (through prices and/or food quality). Another example presented by specialist was the impact of weather risks in the transmission of animal and plant pests and diseases and in the logistics, requiring alternative routes for delivery agriculture output. Thus, the combination of weather risks with animal and plant health and logistics risks can contribute to the unintended and unexpected dissemination of sanitary outbreaks in regions that today are free of those potential diseases.

Changes in the regulatory framework have an impact on other risks, as well as on the same public policies and programs that support the management of those same risks. For example, unexpected changes in the Forest Code, in the agroclimatic zoning, or in sanitary controls can have direct impacts on the management of weather, credit, animal and plant health, property and natural resource management, trade, and infrastructure and logistics risks.

Graph 7. Relationships among the different agriculture risk dimensions in Brazil (Technical workshop, 2014).



Zineb Benchekchou / Embrapa

It is important to note that beyond the direct impact established by the specialists, the relationships among these risks can create feedback loops in the system, resulting in several orders of impacts beyond the initial one. The work done did not identify such possible feedback loops in the risks interrelationships, but it was clear that they do exist.

The reduction in the credit and trade risks require the management of multiple agriculture risks. The relationships among agriculture risks (Graph 7) show that credit and trade risks (price) have a high dependency on other risks. For example, an increase in extreme weather events in one region can increase the credit default rate of the entire sector. An example includes the positive impact on credit in the case of sugar cane, where an improvement in the management of weather risks (through agroclimatic zoning) and the promotion of bioelectricity, had a positive effect on investors, resulting in a positive change in the terms of and access to credit to the sector. On the other hand, a case of negative impact includes the changes in the macroeconomic policy when the reduction in the inflation had an adverse effect on credit to the sector.

Agenda for the Future

Recommendations for an integrated management of agriculture risks in Brazil

4

4.1 Basic issues for an integrated management of agriculture risks in Brazil

Brazil has several successful agriculture risk management public policies and programs. The country has a great diversity of policies and programs that support the agriculture sector in a counter-cyclical fashion, some of them being international success cases for both developing and developed countries. However, it is clear that there are several opportunities to improve the existing policies and programs, in particular in relation to their integration, which will not necessarily produce additional public spending, but can result in a better enabling environment for agriculture production, ensuring a more robust and sustainable sector growth.

According to the agriculture risk policies and program mapping, there are gaps in the management of risks, in particular the lack of availability of contingency planning. In order to be able to manage risks in an integrated manner, the set of public policies and programs must consider mitigation, response and transfer strategies. Studies show that although mitigation strategies, on average, have a higher economic return than transfer or response strategies (for each R$1 invested in mitigation, this saves up to R$7 in emergency response)[19], there are cases in which mitigation and transfer are not optimal strategies. In Brazil, there are risks and events (for example the sanitary events that occur in neighboring countries) that are not well known, but that have a potential for large economic losses for farmers. Although the mapping of those events and the adoption of mitigation actions could be recommended, it is always essential to adopt contingency plans. The actions of some of the Northeastern States (Pernambuco and Ceará) in the preparation of State-level agriculture preparation plans for droughts are examples of such contingency planning in order to avoid future losses in the sector.

19 *"Natural Disasters: Counting the Cost"* March 2, 2004. World Bank.

AGRICULTURE MUNICIPAL PLAN FOR DROUGHT PREPARATION AND RESPONSE, MUNICIPALITY OF PIQUET CARNEIRO, CEARÁ

In the last decade, extreme drought events have been observed with a higher frequency in the Northeast Region of Brazil. These events have had a negative impact in the economy of the States and the Municipalities that make up this region, in particular those that rely most on agriculture. In this context, the Municipality of Piquet Carneiro joined effort with State and National institutions to strengthen the management of agriculture risks in its territory. This effort sought to look for complementarities of the actions being undertaken at the different administrative levels of the country in order to reduce the vulnerability of the population of the Northeast during drought events. This would only be possible through the undertaking of drought response actions, but also drought preparation, mitigation and transfer. Conscious of the socioeconomic importance of the agriculture sector in Piquet Carneiro, the Municipality developed and Agriculture Drought Preparation and Response Plan (2015-2018). This document comprises strategies and actions agreed among stake-holders of civil society and public institutions to reduce the vulnerability of farmers and reduce the impact of extreme droughts in the sector. Furthermore, the plan identified a series of recommendations of mitigation, transfer, and response actions that State and Federal authorities should take into account to support the plan.
The methodology used to build the plan included the development of working tools (ex. Charts, presentations) and a review of the legal, institutional, and operational aspects that have an impact on the management of droughts in the Municipality of Piquet Carneiro. As part of this process, the main barriers to an effective and efficient management of drought risk in the agriculture sector of the Municipality was developed. The institutions that participated included:

- Ceara State Secretariat of Agriculture (SDA);
- Ceara's Technical Assistance and Rural Extension Company (EMATERCE);
- Integrated Drought Management Committee;
- State's Civil Defense System (SEDC);
- Ceara's Meterology and Water Resources Foundation (FUNCEME);
- São José III Project;
- Federal University of Ceara (UFC);
- Association of Municipalities of the State of Ceara (APRECE);
- World Bank

There is an insufficient level of support from public policies and programs for the management of risks such as: i) logistics and infrastructure; and ii) property and natural resources management. Logistics and infrastructure risks (storage and transport) were identified with the largest relative priority and with an insufficient level of support from public policies and programs. An agenda for the future needs to include the management of logistics and infrastructure risks and property and natural resources management risks (mitigation and adaptation actions) in order to reduce losses and the uncertainty of the sector. The challenge in the management of these risks is improving the interinstitutional coordination among different public sector actors (Ministry of Transport, ANA, Ministry of Environment, Ministry of Agriculture, Ministry of Agrarian Development, Central Bank, BNDES, Banco do Brasil, among other financial institutions) that play a role in this area. The creation of an environment and discussion forums among the various stakeholders will enable a qualitative leap towards an integrated management of those risks.

In order to respond to regulatory framework risks, more stability and transparency of regulations is needed to produce a favorable business environment without requiring more public funding. The regulatory framework risks were identified as the ones with the largest potential to influence other risks. In order to reduce these risks (and/or the risk perception), it is necessary to reduce the uncertainty surrounding changes to regulations, being more transparent about possible modifications. During the technical workshop and the validation sessions, several examples of the Forest Code and the Labor Laws were mentioned. The Forest Code continues to raise a perception of legal insecurity within the sector. Given its systemic approach (environment, economy, technology and social, among others), the code has a large potential for reducing agriculture risks, guiding national agriculture production towards sustainability, as well as being a powerful instrument for agriculture production from Brazil at the international level. Another example are the labor contracts as a source of uncertainty that can have an adverse impact in the income of farmers, given that certain aspects of labor laws do not take into account the harvest periods.

RR Rufino / Embrapa

An integrated management of risks by the government requires not only coordination among the different policies and programs, but also among the different levels of government. The current work focused on federal-level public policies and programs, but the coordination of federal actions with State and Municipal agriculture risk initiatives is key, such as the coordination among Ministries and Agencies. The need for MAPA and other decentralized institutions was identified, but also a larger presence of federal institutions related to the management of agriculture risks in regions were agriculture is expanding (largest national impact on agriculture risks) and were family farming is mostly present (largest impact on poverty). In this work it was not possible to map subnational initiatives, but initiatives such as the state-level agriculture insurance premium subsidy that complements the federal-level subsidy and the preparation of municipal and state-level agriculture risk management plans (such as the experience of Pernambuco and Ceara) should be part of an agenda for the future.

Investments in public goods and services (research, technology transfer, infrastructure and logistics, information, animal and plant health, among others) have largest economic returns than direct supports [20]. Beyond investments in public goods and services, the participation of the private sector, in the rural insurance for example, can leverage private resources for risk management, reducing the pressure on public funds. These approaches, beyond reducing the pressure on public funds, generate 'new' business opportunities, such as technical assistance and insurance adjusters, thus contributing to fiscal revenues.

20 Lopez, Ramón. *Why governaments should stop non-social subsidies*. University of Maryland, College Park. 2004.

4.2 Proposed strategic plan for greater integration of public policies and programs

A basic component for an appropriate management of risks is to have policies and programs within a long-term strategic planning context. In the weather risk panel, although being mainly a technical group, the importance of multiannual agriculture plans for agriculture risk management strategic planning (Technical Annex and Table 5) was discussed. This issue was also backed up during the plenary sessions with specialists, as well as highlighted in all the validation meetings. Furthermore, in most validation meetings the recommendation extended beyond risk management, being clear the need of an Agriculture Law (as the Farm Bill of the United States), with a minimum horizon of five years, integrating issues related to the eight risk areas of this work, as well as other rural development and social mobility issues of the agriculture sector.

A better integration among agriculture risk management public policies and programs can allow the public sector to prioritize actions, investing where the economic and social return is higher. An integrated management of risks, more than just technical decisions, require political decisions, which in turn must be part of an agenda for the future of Brazilian agriculture. Brazil has several examples or integration of public policies and programs (Brazil without Misery, Unified Health System, and the Unified Education System) at different levels, but with a common objective, which can serve as an example for implementing an integrated agriculture risk management system.

International examples for integration in the management of agriculture risks can be useful for the future agenda for Brazil. To coordinate rural insurance actions, maximizing financial coverage and instruments, Spain created a company, Agroseguro, composed of insurance companies, government and rural producers. The Government of Chile created a rural insurance committee to coordinate public-private actions. In order to share agroclimatic information, Argentina created the Oficina de Riesgo Agropecuario (ORA)[21], which collects, analyzes and disseminates information and analysis of the

21 See: http://www.ora.gov.ar

impact of agriculture risks such as weather, yields, production costs and variability in prices for different users (insurance companies, banks, producers, public sector and companies).

International experience and the number and diversity of existing public policies and programs in Brazil show that integration needs to happen gradually. Usually, in other countries, risks are managed in an integrated way by the private sector. As with most OECD countries, risk management policies and programs: i) focus on farmers' income as a final objective; ii) seek market solutions with public-private partnerships to adapt to producer demands and leverage private financing for risk management; and iii) focus on coordination and information sharing among different participating institutions based on rural producers. Several risks and their management are transversal to agriculture issues, with intersectoral policy and economic implications, resulting in a more complex implementation of a completely integrated policy for agriculture risk management. Therefore, it is recommended that an agriculture risk management policy be implemented gradually, while the relationships between agriculture sector institutions and between the agriculture sector and other segments of society are being consolidated. The management of certain risks and the integration of a number of policies and programs is possible and advisable given the natural interrelationship that exist among them at the sector level, but in particular, at the farm-level.

According to the specialists who participated in the workshop and the validation meetings, there are opportunities for a long-term management of risks. In order to promote and implement a long-term integrated management of risks, it is recommended to establish a risk management unit with the qualified staff and a national plan that would give sustainability for a permanent integrated vision. That agriculture risk management unit must be geared towards implementing a national multiannual plan, which can begin by the implementation of the six macro-objectives identified in this work and listed below.

A. AN INTEGRATED AGRICULTURE RISK MANAGEMENT INFORMATION SYSTEM

Brazil already has several agriculture risk management information systems, some of them already integrating information on several risks. Embrapa, the National Meteorological Institute (INMET), and the Climate Forecasting and Studies Center (CPTEC/INPE) have information systems and probabilistic analysis about weather risks at the municipal scale, such as Agritempo[22] and SISDAGRO[23], which are not being utilized to the fullest by farmers. These systems, beyond their main objective which is to support farmers production decisions in relation to the weather, they could be more integrated with other existing systems that are not yet geared towards risk management, such as market information, natural resources management, animal and plant health, and logistics. Therefore, going back to the case of the Oficina de Riesgo Agropecuario of Argentina, Brazil could have an information system integrated to a single database, compiling and making available information and analytics tools from different risks. Some of the risk information that could be integrated include:

i **CLIMATE**, systematically sharing information about weather (up to 15 days) and climate (beyond 15 days) and their impact on agriculture activities, considering different production structures. In this situation, the CPTEC/INPE has climate forecasts of up to 140 days and good accuracy in several regions of Brazil, including phenomena like El Niño, which can be treated as a focus of the impacts of the agriculture system by Agritempo and the tools of INMET.

ii **ANIMAL AND PLANT HEALTH**, considering the presence/absence of trigger agents and climatic conditions, among other epidemiological issues, and their impacts on agriculture activities and in different crops and livestock. In this case, the Early Warning Systems developed by Embrapa, among other research institutions, for soy rust, apple and potato rust, are examples to be taken into consideration.

22 http://www.agritempo.gov.br/agritempo/index.jsp
23 http://sisdagro.inmet.gov.br/sisdagro/app/index

iii **MARKET**, considering supply, demand, storage, prices, and main global agriculture commodity market trends. In this case, economic information from the Applied Economic Studies Center (CEPEA) of ESALQ/USP regarding several agriculture commodities can be the basis for a risk analysis system of international and national markets, including up-to-date information regarding trade options for the agriculture sector.

iv **CREDIT** and **INSURANCE**, although there is no examples in Brazil, the availability and dissemination of credit and insurance information, up-to-date information on credit options and insurance indicators (premiums, conditions, etc.) for the agriculture sector would be useful.

v **LOGISTICS**, the initiative on advanced scheduling of trucks at the ports is an example of potential gains in the sharing of information between the transport, storage and infrastructure situation of each agriculture supply chain for different regions. Applications for information sharing by the same users of the logistics system could be useful to reduce the associated logistics risks of the sector. Furthermore, the need to undertake studies that would consider the growth in agriculture production in relation to the logistics needs is clear, highlighting economic, social and environmental issues for the implementation of the necessary logistics infrastructure.

vi **CENSUS**, the Agriculture Census done by IBGE, which had its last edition in 2006 and an uncertain frequency of 10 years, is an important source of historical information at the municipal level. Due to the dynamics and the strategic importance of the agriculture sector in the country, it is highly important that the Agriculture Census be done with a higher frequency and certainty.

B. INTEGRATED TECHNOLOGY DEVELOPMENT AND TRANSFER SYSTEM FOR RISK MANAGEMENT

The adoption of loss reduction technologies depend on the innovation and transfer capacity and the integration in the management of multiple risks. Today, in Brazil, the agriculture technology research and development system does not have tools for analyzing risks in an integrated way (see point A above), nor the capacity to interact with farmers for an integrated management of risks, in particular with family farmers.

It is necessary to seek the structuring of rural technical assistance ATERs, in particular in the North and Northeast Regions, promoting qualified staff, as well as the integrated approach towards managing risks in the sector. Although in Brazil there are some systems dedicated to technology transfer, such as the Information Technology Agency of Embrapa (Ageitec[24]), it is not integrated and could be better utilized.

There are initiatives within Brazil that could be used as reference for integrating risk management issues in the agriculture technology development and transfer. An example are the Technology Innovation and Reference Territorial Nucleus[25] (NUTIR), proposed by Embrapa[26], which can be complemented by the Reference Units[27]. The issue of the nucleus and the reference units highlights the regionalization and typology of production systems and technological standards, having as an objective the adaptation of agroeco-logical zoning that consider, for example, socioeconomic and environmental aspects, beyond the climate and technological ones available today.

24 http://wrld.bg/UcaAK

25 Grouping of public and/or private cooperation looking for institutional integration and capillarity in the innovation process, which must flow towards farmers. These nucleus must operate towards the regionalization of integrated production systems.

26 Lopes, M.A. Agriculture Innovation Alliances in Brazil: proposals for the improvement of the agriculture research and innovation system. Presentation to the Minister of Agriculture in April 2015

27 Private agriculture production units, systematically supported by a specialist, where available technologies are applied with emphasis in integrated production based on regional characteristics, looking to validate, demonstrate, and transfer technologies generated, adapted, and/or recommended by the Units of the agriculture innovation system.

Guadalupe Noriega / Embrapa

Another example are the condominiums adopted in the grains and apple production[28] in Parana and Santa Catarina States. In these cases, there is a public program at the State level that provides technical assistance subsidies, similar to the agriculture insurance premium subsidies, where a group of rural producers hires a specialist dedicated to the integrated management of agriculture risks. This specialist is trained for the integrated management of agriculture risks and has its work partly subsidized by the State Government.

Another opportunity to achieve an increased integrated risk management in technology development and transfer is the recent creation of ANATER. ANATER's objective is to contribute to the adaptation of technology transfer with positive impacts on productivity, and thus, on agriculture income, focusing on small and medium size farmers. An integrated management of risks at the farm-level would be a key piece to achieve ANATER's mandate. It is important to highlight that this would require qualified, motivated specialists (extension agents), with the adequate infrastructure in order to allow for qualified and sufficient information to reach farmers and ensure 'ample access' to markets and, thus, to the development of entrepreneurship.

28 For details, see: Cruz, M.R.; Camargo, M.E.; Malafaia, G.C.; Zanadrea, G. Produção integrada de maçã (PIM) — innovative process of the Brazilian apple supply chain. Revista de Administração e Inovação, São Paulo, v. 9, n. 3, p. 213–230, 2012.

C. INTEGRATED AGRICULTURE RISK TRANSFER SYSTEM

There is an opportunity in Brazil to transfer a higher level of production risks through public-private partnerships. Agriculture insurance coverage provided by private insurances reaches 8% of cultivated area. However, the public insurance and income compensation programs (Proagro and Garantia Safra) represent more than double of that covered by private insurance firms. The Proagro and Garantia Safra programs do not transfer risks outside the public sector nor outside the country. The Federal Government absorb 100% of the risks of catastrophic events, given that the premiums paid by beneficiaries are not enough to cover the payouts (the cost of the programs are paid in large part by the Federal, State and Municipal Governments[29]). In order to attract the private insurance sector to offer coverage to smaller farmer segments, the government could transfer part of the catastrophic risk of the public programs to international markets through the private sector (insurers and reinsurers), increasing the financial sustainability of those programs and improving the efficiency of public expenditure in years of catastrophic events. In cases like Peru and Mexico[30], public programs of catastrophic coverage bought by the government from private insurers provide incentives for the participation of insurance companies in the agriculture insurance sector.

The rural insurance and price guarantee systems could be linked to offer an income insurance product to the farmer. The rural insurance system in Brazil is divided in silos of different programs: i) the rural insurance premium subsidy (PSR); ii) the family farming credit insurance (Proagro Mais); and iii) the income compensation for extreme weather events (drought or excess rain) for family farmers of the Northeast (Garantia Safra). The risks linked to price and pest/disease outbreaks are excluded from insurance programs and have particular policies and programs (administrated by Conab, in the case of price guarantees, and by the Animal and Plant Health Secretariat of MAPA, for sanitary issues). The specialists who were consulted identified an opportunity to coordinate the insurance, price and animal and plant health programs to allow to have income insurance products for farmers.

29 In those programs, the fee paid by the farmers is not considered insurance. Premiums have another component that is the government subsidy. In the case of Proagro, there is no formal estimation of the premium. The premium is implicitly calculated when BACEN estimates the public budget necessary for the subsidy of the program. The 'premium' is equal to the value collected by farmers plus the value of the federal government's budget for the Proagro subsidy. This 'premium' has been enough to cover indemnity payments. It is rarely necessary to request additional budget. In the last years since the 2004-05 harvest, this value has been enough.

30 For more details about the agriculture insurance system of Mexico see: http://wrld.bg/UcaGE

INCOME INSURANCE IN THE UNITED STATES

There are four types of income insurance promoted by risk management public policies and programs in the United States:

A. Income Protection

It is a multiperil plan that guarantees farmer incomes based on productivity and projected price of the commodity. The level of coverage varies between 50% and 80% of historical income. The projected price guaranteed is based on CBOT future contracts, which varies from one year to the next, estimated based on the closing price at the time of the purchase of the insurance, with futures contracts expiring one month after harvest. The insurance unit available for this type of program is the enterprise, which refers to the entire cultivated area for a given commodity in a Municipality. Indemnity payments are done when the income is lower than the guaranteed level, and equals to the difference among them.

B. Revenue Assurance

Similar to IP, revenue assurance also guarantees farmer income based on productivity and projected prices. This program differentiates the type of insured unit, which could be four: i) Basic: Unit that includes all the land belonging or rented by farmers in the Municipality and the effective productivity is registered for each unit, independently of others, with the possibility of generating different policies and coverage levels, and thus, different payouts; ii) Optional: includes all the properties belonging or rented by farmers and situated in different areas of a given district. In this type of unit the different production technologies are included; iii) Enterprise: the entire area cultivated in a given crop in a Municipality, independent of the number of owners involved; iv) Whole Farm: This type of unit is composed of the area with all crops planted by the farmer. The indemnity payment also pays when the revenue is below the guaranteed level, and equaling to the difference among them.

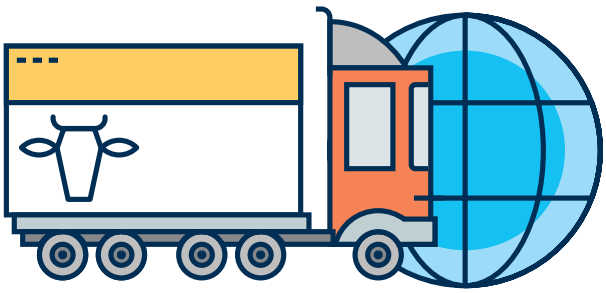
c. Crop Revenue Coverage

It is an insurance that also covers farmers' income when there are variations in productivity, or in the price, or in both. The level of coverage is between 50% to 85% and includes coverage for preventive planting, late planting and replanting. The guaranteed value is the level of productivity (APH) multiplied by the level of coverage, multiplied by the largest value between projected price and the harvest price, times the area insured. The projected price, as in the case of the RA and IP insurance is estimated based on the closing prices at the time of contracting of the futures contracts. The premium is based on the base price, independently of the harvest price. The available insurance units for this type of insurance is Basic, Optional and Enterprise.

d. Adjusted Gross Revenue

It is a multiperil plan that guarantees the gross income adjusted for the entire rural poverty and not by insured crop. The program covers a percentage of the gross income from all activities undertaken within the property. The estimate revenue is based on historical income informed in the income tax returns related to agriculture production, or in the projected income, informed in the annual agriculture report (AFR). In order to purchase an AGR insurance contract the farmer must have declared at least 5 consecutive years of income tax and not exceed the US$6.5 million. The guaranteed yield is the gross income (adjusted) multiplied by the coverage level. If there is a loss of income below the forecasted factors, the indemnity payout is the guaranteed yield minus the accounted income times the payout rate. The basic plan has a level of coverage/payout of 65%/75%, but there are also options 65/90; 75/75; 75/90; 80/75; and 80/90.

Source: http://wrld.bg/UcaLy



D. INTEGRATED AGRICULTURE LOGISTICS AND RURAL INFRASTRUCTURE PLANNING

The expansion of the agrologistics system in Brazil lacks planning and integration. The current logistics investments in Brazil take into account a short-term horizon and a restricted spatial and production coverage. Although this issues does not represent a risk according to the definition adopted for this work, it is important to highlight that the current investments are focused on grains, fibers and meats in the Cerrado Region and do not consider other production regions and production diversification, such as aquaculture and the production of dende in the Northern Region. Furthermore, investments can be distorted for not adequately considering environmental and infrastructure issues among others. For example, most of the financing for the National Storage Plan have been for the South and Southeast Region, which already benefit from good infrastructure and a good legal environmental framework, in contrast with other frontier regions like the North.

The agrologistics and infrastructure system of Brazil suffers from risks that could be reduced by the sharing of information and by the coordination with the management of other risks. These risks cause on-farm losses, increasing the cost of transport and logistics, especially for farmers that do not have storage capacity. There is also risks along the supply chain given the uncertainty and seasonality of logistics costs, in particular transport. The bottlenecks in the logistics system (roads, ports and waterways) that generate uncertainties regarding time and transport and storage costs are well known. Therefore, with the sharing of information between the logistics and the planning of harvests and trades could reduce the uncertainty for the

farmer. A recent experience that can be used as an example of better and more integration of the logistic risks with the trade and production management risks is the advance scheduling of truck arrivals at the ports[31].

The actions for the reduction of logistic risks must consider their impact on other agriculture risks, in particular those related to animal and plant health. The opening of new and better roads, railways or waterways can reduce the logistics risks, but could also increase the risks of spreading of pests and diseases, exposing regions to more pressure over their natural resources. Therefore, a better coordination between the public policies on agrologistics with those of regional planning and technology transfer, in particular in the Northern Region of the country, could be very strategic for the reduction of potential agriculture losses and the adaptation to climate change.

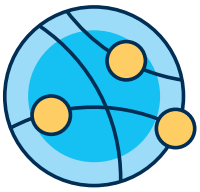
31 http://wrld.bg/UcaQV

Olímpio Filho / Embrapa

E. INTEGRATING WEATHER RISK MANAGEMENT TOOLS TO NATURAL RESOURCES MANAGEMENT

There is an opportunity in the short term to reduce the natural resources management risk, in particular water resources and drought risk, using existing weather risk management tools in the water allocation decisions. A better coordination between ANA and MAPA would be key to prevent future water shortages for the agriculture sector (and even for human consumption) and optimize the allocation of on-farm productive resources. Challenges with water management in Brazil are long-standing, as the droughts in the Northeast Region, and increasing, as the recent uncommon drought in the Southeast and the Centerwest Regions. Beyond the climatic risk, which depends on the management of an efficient and accessible information system, the risk of natural resources management persists given that the water allocation system do not use risk analysis tools such as the Agroclimatic Risk Zoning (ZARC) and the climate change models in decision making.

ZARC could have a larger impact in reducing losses if more detailed soil data was included. More disaggregated soil and land use information are available at the State level, but ZARC has a national coverage. There is an opportunity for ZARC to be more effective, integrating more detailed information at the microwatershed and State level in order to provide better zoning information, reducing sector losses. Therefore, it is recommended that ZARC be used at the microwatershed level by State Governments, in order to offer a better tool for the financing and the management of agriculture risks.



F. INTEGRATING AGRICULTURE RISK MANAGEMENT INTO INTERNATIONAL TRADE PROMOTION AND MONITORING

International agriculture trade policies in Brazil are not very well integrated to the agriculture risk management policies and programs. In particular, there are short term opportunities for more and better integration of animal and plant health policies with those of international trade, facilitating initiatives such as regional sanitary certification and their recognition in markets. There are also opportunities to reduce farmer losses due to the closing of international markets, coordinating international trade with trade risk management programs (price guarantees) and production (insurance). These agriculture risk management integration measures, along with international trade policies, could result in a more assertive participation of Brazil in international trade negotiation forums. In other words, Brazil could change its current position as a rule taker for rule maker in the international stage and a better management of agriculture risks can change that position.

Final Considerations

5

The importance of the agriculture sector of Brazil require important definitions. This importance goes beyond socioeconomic aspects. Currently, the agriculture sector contributes to the environment, as evidenced by the important gains in the direct planting technology for carbon sequestration and for water supply. Although this importance is given for lack of better terms, this work suggest that the agriculture sector is the most economically volatile (Graph 2), showing negative growth in some periods. This work has also identified that the sector volatility has a direct relationship with weather events, particularly droughts, and therefore, risk management actions would have an important return for the country on several dimensions, at least economically, socially and environmentally. Beyond identifying the importance of 'traditional' risks, such as drought and animal and plant health, the work identified an increasing importance of 'new' risks, such as property management, in particular labor risks and the management of natural resources (Table 4 and Graph 6).

Gaps were identified in the main public policies and programs, not allowing for the ample management of agriculture risks. When assessed, the majority of the main public policies geared towards the management of the eight risk areas considered (weather, animal and plant health, trade and credit, international trade, logistics and infrastructure, and regulatory framework) are based solely on risk mitigation, with little participation of risk transfer and risk response strategies (Figure 3). It was also clear the complexity and the potential for more coordination in the management of these policies (Figure 4). If on one hand both issues (diversification of management strategies and the management complexity) are a limitation for the development of the sector, and thus, for the country; on the other hand, they represent an opportunity that goes beyond the agriculture sector and into the development of 'new' business. These 'new' business, in particular under a risk transfer strategy with positive impact in the service sector (such as technical assistance, loss adjustment, and information technology), beyond contributing to reducing sector's volatility and losses, they also contribute to the fiscal revenues. Furthermore, in relation to the risk management strategies, the work identified some potential risks for the countries, mainly sanitary, that do not have effective mitigation actions (an example is the case of preventive genetic improvement) and which do not currently have contingency plans.

The work also pointed out to the importance of strategic planning, of a national plan and of an Agriculture Law ensuring a long-term vision of the risk management actions. This rapid review suggests that actions that seek the implementation of an integrated agriculture risk management vision are supported by society at large and by the public sector's interest. Furthermore, this work also suggests that the integrated management of risks should be implemented gradually, starting with: i) agriculture risk management technology development and transfer; ii) agriculture risk transfer; iii) integrated agriculture logistics and rural infrastructure investment planning; iv) integrating weather risk management tools into natural resources management; v) integrated agriculture risk management information systems; and vi) integrating agriculture risk management into international trade monitoring and promotion initiatives. As these initial measures are implemented, it then becomes possible to explore **more complex solutions**, such as the development of the agriculture insurance market towards income insurance for farmers and an agrologistics system that can go beyond current production, and include other areas such as aquaculture, dende, in other regions like the Northern Region. These medium to long term measures require **planning**, which calls for a better implementation of laws and of the Government's bureaucratic apparatus, promoting a **prosperous business environment**. Finally, planning requires the need for a **stable institutional framework**, which calls for a National Plan and an **Agriculture Law**, with at least a five-year horizon and that must consider not only the agriculture risk management issues, but also rural development ones.

TECHNICAL ANNEXES

The technical annexes and bibliography can be found in the following website: www.embrapa.br/eventos/avaliacao-de-riscos-agropecuarios