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Risk management for family agriculture in LAC

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INTRODUCTION

Economic or productive activities entail risk because the future is uncertain and losses can occur unexpectedly. At the same time, the unexpected can produce gains and risk can turn into an opportunity (Lavell 2014). Unlike other economic activities, agriculture is a random variable influenced primarily by climate and its effects; moreover, demand and supply (depending on the activity) are inelastic, which makes for high price and income volatility.

Despite agriculture's greater exposure to risk, as well as efforts to increase emphasis on risk prevention and reduction, most current risk management efforts are reactive in nature, with a focus on response and reconstruction. This is because appraisals are not solidly based on potential losses, there is a lack of awareness or underestimation of risk management options, and the prevailing hope is that something bad will not happen. A great deal more needs to be done before stakeholders (households, enterprises, governments, others) will realize that risk reduction and prevention are less costly and more effective. For example, it is estimated that the cost of the risk management strategy designed for Paraguay's agricultural sector is US$223 million for a five-year period, which is much lower than the sector's annual average losses from unmitigated risks, which amount to US$237 million (see 2014 World Bank Group report).

This bulletin is the result of joint efforts by the Economic Commission for Latin America and the Caribbean (ECLAC), the United Nations Food and Agriculture Organization (FAO), and the Inter-American Institute for Cooperation on Agriculture (IICA). Its purposes are to:

- Identify the main sources of agricultural risk, with an emphasis on family farming, and document the most significant effects on the overall economy, agricultural production, nutrition and food security, incomes, and household well-being.

- Propose mitigation and adaptation strategies for reducing the likelihood and magnitude of losses and increase the potential benefits of farming activity. The intention is to foster practical solutions and human interventions in production, marketing, consumption, and environmental management that contribute to reducing production, financial, market, institutional, and human risks, bearing in mind the vulnerabilities of rural communities and areas.

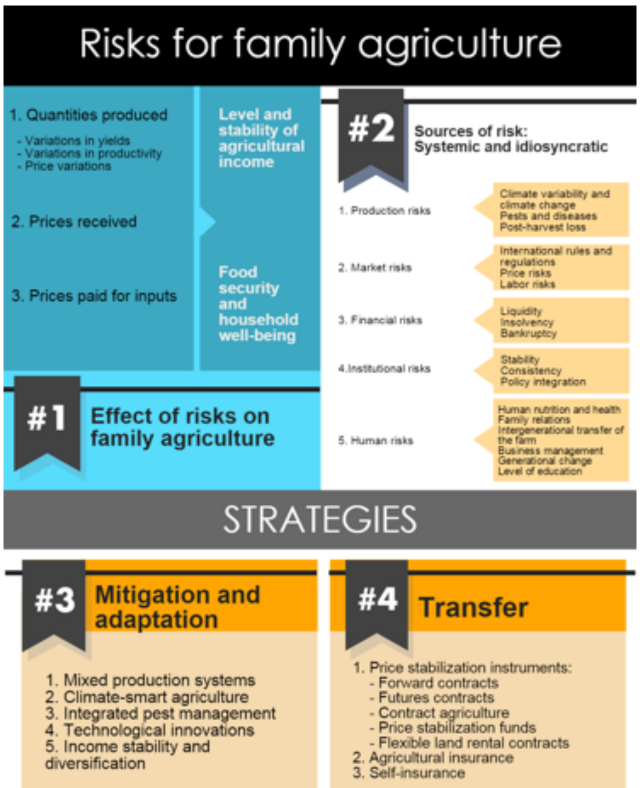
- Promote risk management efficiency so that farmers only transfer residual risk after having taken suitable measures to adapt and mitigate risks that can be anticipated, reduced, or controlled.

- Promote the inclusion of family farming in risk management, in the awareness that the smallest farms are sometimes not included at all or participate in a very limited way in risk transfer programs in the region.

This bulletin focuses on family farming not only because of its economic importance in Latin America and the Caribbean (LAC) but also because family farming reflects some of the least favorable social, economic, and production conditions in the region; for that reason, it is most vulnerable to loss. Because of its geographical scope and numerical importance, family agriculture is of critical importance for maintaining a balanced use of natural resources and ecosystem sustainability (ECLAC et al. 2014b). There are an estimated 17 million family farms in LAC, which represent around 60 million people, 80% of all farms, and 35% of the cultivated land in the region. Family farming contributes 40% of total agricultural output and generates 64% of jobs related to agriculture (GHI and IDB 2014).

1. "Family farming (which includes all family-based agricultural activities) is a means of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labor, including both women's and men's. The family and the farm are linked, co-evolve and combine economic, environmental, social and cultural functions." (FAO 2014)

Because of the economic and social conditions of family farms, basically their limited access to resources and knowledge, it is difficult to devise suitable risk mitigation or adaptation strategies for them. In Central America, for example, family farmers present a high level of illiteracy (one third of workers cannot read or write), have little access to production resources (land, water, technology) and basic services (housing, electricity) and high poverty levels (63% are poor) (ECLAC et al. 2014b).



Although risk exists for all strata of family agriculture, losses suffered by subsistence farmers as a result of any risk are usually critical because of the threat to survival. Here, risk further reduces the capacity for food consumption and access goods and basic services. The situation is aggravated by their limited access to capital goods, infrastructure, technical assistance, human and institutional resources, information, and technological and financial resources in the sector, which explains their negligible capacity to adapt and respond.

This bulletin is divided into four sections (Figure 1), which cover the following:

a) Analysis of the potential effects of risk on production, nutrition and food security, income, and the well-being of farm families.

b) Identification of production, market, financial, institutional, and human risks that affect family farms, establishing, whenever possible, the differences between subsistence, in transition, and consolidated family farms.[2]

c) Identification of differences between systemic and idiosyncratic risks. This section discusses mitigation and adaptation strategies available to farming families that will enable them to anticipate and be prepared to address the risks, reduce their losses, and even tap opportunities that may generate greater well-being for the household.

d) Description of the most important and viable risk transfer instruments that can be used in situations where risk is beyond the control of the producer or the family unit.

2. Subsistence farming produces food for on-farm consumption, with insufficient production resources and income to sustain the family, thereby creating the need to seek off-farm employment, change activities or migrate, without a change in their access to assets. Family farms in transition focus on sales and producing food for the family, with sufficient production resources to sustain the family, although with difficulties to generate sufficient surplus to invest in the farm. Consolidated family farms have land with better production potential, access to markets (technology, capital, products), and generate sufficient surplus to capitalize the farm unit. (FAO 2014, authors' translation)

1. THE EFFECT OF RISKS ON FAMILY FARMING

THE impact of risks faced by family agriculture can be visualized in terms of the changes associated with losses in agricultural output, lower household income and assets, nutrition and food security effects, and losses in the capacity to consume goods and services. However, when the risks (of disaster) are associated with natural threats, whether or not caused by climate change, the impact tends to be much more intense and broader in scope, affecting human welfare, livelihoods, and rural infrastructure.

Although it is difficult to isolate each factor that influences farm income levels and stability, the volatility of agricultural markets is one of the most important.

For farmers, income level is as important as income stability. Both are affected by a variety of factors including yields, labor and capital productivity, the amount and quality of natural resources, the share of the cost of inputs in the value of output, creditworthiness, price volatility, and government policies that support production, among other things.

The risk of price variation or volatility is one of the most influential. It is associated with low production levels and low agricultural profitability because it tends to discourage investment and innovation to increase agricultural yields and productivity. More generally, the enterprise tends to view production and commercial risks as an additional cost[3] that lowers their expectations of agricultural profitability and, linked to that, lower levels of production. This, in turn, leads to a decrease in input demand (Robison and Barry 1987; Torero 2010). In the final analysis, agricultural profitability depends on the price evolution of end products and agricultural inputs, and on how intensively inputs are used in production (Arias et al. 2011; Arias and Vargas 2010; Cafferata 2010).

In addition, climate change is associated with greater climate variability, which can give rise to pest and disease outbreaks that have a direct impact on yields and earnings.

Climate change could represent an opportunity more than a risk if farmers were able to take advantage of changes in climate intensity and patterns. For that to happen, though, the effects on farm production and economies will need to be better understood (even at the farm level), and new production options will have to be evaluated for different altitudes or ecological strata. It will not be easy to generate this kind of knowledge because changes in climate will make some areas unsuitable for certain crops while making others suitable. In addition, the effect of changes on variables associated with climate change (CO_2 fertilization, rainfall, temperature, for example) can produce opposing effects (counteracting them), making it difficult to predict impact on yields and production costs.

For example, it has been noted that increased rainfall in the Argentinian pampas may boost soybean, corn, wheat, and sunflower yields by 38%, 18%, and 12%, respectively (Magrin et al., cited by Vergara et al. 2014). Climate change can be beneficial if net CO_2 fertilization is positive, thereby boosting biomass production and yields (Vergara et al. 2014). However, a rise in temperature can have a negative effect. For example, higher than normal temperatures caused an 18% reduction in corn yields and a 10% decline in soybean output in

3. Because the enterprise has to provide human and financial resources to manage the risks, be it for purposes of prevention, preparation, or for dealing with them.

the summer of 2012 (Wescott and Jewison, cited by Vergara et al. 2014).

Regardless of the uncertainty of projections and impact measurements, family farms will be seriously affected by climate change, not only because of the increased frequency of extreme climate events (Vergara et al. 2014) but also because family farms are usually situated in areas that are more vulnerable from the agro-environmental standpoint. The final impact, however, will depend on the production system and practices in use, the prices of inputs and outputs, and the management characteristics of the farming activity. Zoning according to agro-climatic risk at the local level is an important strategy for making agricultural planning decisions to reduce the adverse environmental impact of the agricultural activity and to promote more efficient resource use.

Very poor rural families who live at the subsistence level or who are net food buyers are most vulnerable to income variability, largely because of price and natural disaster risks.

The possible impacts of risks on rural family well-being (measured in terms of changes in consumption, and in nutrition and food security) should take into consideration income from farm sales, off-farm earnings, and expenditures on food and other goods and services. Impact magnitude will depend on the share of agricultural sales in total income, compared to the share of food expenditures in the household's total expenditures.

It is estimated that the 2007-2008 price increases caused a 8.7% and 18.7% reduction in caloric intake for 20% of the poorest populations in Guatemala and Peru, respectively (Robles and Torero 2010). Similarly, estimates are that the poorest families in Peru most vulnerable to food insecurity would need an annual compensation of US$35 to maintain the same caloric intake level as before the 2007-2008 crisis (Zegarra and Tuesta 2008).

In addition to the impact of price volatility on a household's caloric intake, climate is expected to play an increasingly significant role in that variable. For example, it is estimated that calorie availability in developing countries in 2050 will be lower in a climate change scenario than in a non-climate change scenario, in which case child malnutrition will increase by 20% in comparison with the base year 2000 (Nelson et al. 2009).

These two scenarios are becoming critically important to family farming because producing food for on-farm consumption has declined considerably in recent decades, paralleled by a significant increase in the number of smallholders in LAC that obtain most of their food, including their staple foods of corn and beans, at market (Maletta 2011). This means that family units depend increasingly on off-farm income to purchase additional food. An estimated 30% of family farm incomes in Central America comes from non-agricultural activities (ECLAC et al. 2014b).

2. SOURCES OF RISK FOR FAMILY FARMS

THIS section provides a general description of the main sources of risk for family farming, grouped into five categories: production, market, financial, institutional, and human. First of all, a distinction should be made between systemic and idiosyncratic risk (Inset 1). In general, systemic risks can cause so much damage as to require State intervention because the private sector would be unable to cope or provide profitable protection instruments against them. Agriculture, in particular, is highly subject to systemic risk due to its exposure and vulnerability to natural disasters (droughts, excessive rain, high winds) that can affect contiguous territories or communities.

Inset 1.
Types of risk for family farms

Risk is the probability of a threat, damage, or adverse occurrence that is quantifiable, caused by external or internal vulnerabilities, and that can be avoided with preventive action (World Bank 2013)

Systemic risks are correlated or shared by a large number of entrepreneurs, producers, or economic agents.

Idiosyncratic risks are those presenting a low level of correlation among products, producers, or insurable units; in other words, they are independent of each other because they are specific to the enterprise or industry.

Although this bulletin does not ignore systemic risk, its emphasis is on idiosyncratic risk because it can be avoided through effective planning or management. Moreover, idiosyncratic risk can be covered by paying a premium that is sufficient to finance the cost of compensation without the need for State subsidies (Zulauf and Orden 2014). Fire and hail, among many other risks we will discuss in this document, are examples of idiosyncratic risk.

2.1. PRODUCTION RISKS

Given the magnitude of losses sustained in recent years, natural disaster risk is an example of a serious, high-priority systemic risk for agriculture.

In recent years, annual losses throughout the world often exceeded US$100 billion (constant 2010 dollars), which doubled in 2005 as a consequence of Hurricane Katrina in New Orleans, United States. Other recent extreme natural events include the tsunami in Asia (2004), the earthquake in Haiti (2010), the fires in Russia (2010), the earthquake in Japan (2011), and super storm Sandy in 2012. Super storm Sandy showed that devastating effects can be felt anywhere, even in one of the richest cities in the world, New York (Hallegatte 2014). It is estimated that natural disasters in LAC cause average annual losses amounting to US$3 billion (Andersen, cited by Murphy et al. 2012). For example, in the agricultural sector alone, losses in Central America associated with Hurricane Mitch amounted to close to US$2.3 billion (PAHO, cited by Murphy et al. 2012).

The magnitude of systemic risk can be so great that even governments cannot cope with them, hence the importance of international reinsurers[4] as a key financial and technical resource for any insurance program (especially catastrophic). Not only are reinsurers of critical importance for covering losses, they can also play a major role in specifying the correct information needed to assess and transfer risk (for more information, see Hatch et al. 2014 and Wehrhahn 2009).

4. Reinsurance is a financial transaction that transfers risk from an insurance company to a reinsurance company, in exchange for a payment (premium). Reinsurance companies back local or national insurance companies that provide long-term sustainability to the insurance system by limiting the maximum amount of loss assumed by the insurance company and by alleviating the effects of accumulated losses.

Although the State can transfer risk, its main role should be in the area of mitigation and adaptation. Family agriculture in particular is more vulnerable to systemic risk because of a lack of investment in public goods in rural areas.

Family agriculture tends to be much more vulnerable than commercial agriculture to changes in output caused by losses in yields and harvests, mainly because of its limited access to production assets, information services, and technical assistance.

Agricultural activity is inherently random and risky because it depends on climate, soil, and hydrology for growth and sustainability. A numbers of factors that affect agriculture are influenced by climate change including: temperature, rainfall, pests, pollinators, soil quality and erosion, water amount and quality, and extreme climate events. The individual and combined effects of these factors are variable, complex, closely intertwined, and extremely difficult to predict.

Consensus holds that climate change will extend risks and create new ones, including a higher incidence and recurrence of extreme events such as hurricanes, floods, and longer and more intense intermittent periods of rain and drought (IPCC 2014). Two significant levels of change need to be borne in mind (Lavell 2014). First, changes in climate averages[5] and the geographical and annual distribution of water associated with temperature, rainfall, and evapotranspiration. In addition, watercourse patterns change and become “stressors” or threats (bypassing at this point any mention of extreme events or climate variability), which is modifying the location, type, and conditions of agricultural production (Lavell 2014).

Even though both rural and urban activities are subject to natural risks, rural populations, especially subsistence farmers and farmers in transition, are more exposed to the effects and are more vulnerable and susceptible to direct impact on farm production than are urban populations (Lavell 2014).

Although pests and diseases are a natural part of any ecosystem, farmers fear outbreaks or epidemics that can reduce their yields.

Most pests are spread by human travel and world trade. Nonetheless, they also move to new areas as a result of rising temperatures caused by climate change (Hillel and Rosenzweig 2010; Rosenzweig et al. 2001). In fact, recent studies show that pests are already moving polewards due to warmer temperatures (Bebber et al.). Warmer temperatures also increase the risk not only of more generations of pests in a given year, but also of stronger infestations the next season if the pests survive in areas where they would normally be limited by cold weather.

The interactions among climate change, crops, and pests are complex and the effects are difficult to predict. For example, changes in temperature, humidity, and atmospheric gases increase the number of plants, insects, and fungi, which alters the relationships among these pests, their natural enemies, crops, and animals. Moreover, crops are also increasingly vulnerable to pests: severe pest epidemics have been noted after climate events such as intense rains, high relative humidity, and others.

In the broadest sense, a pest is defined as any animal species that people consider detrimental to themselves, their property, or their environment.

Epidemics have caused considerable adverse impacts on agriculture, especially on smallholders’ livelihoods; in fact, they have even impacted domestic economies and world trade (Anderson et al. 2004; Chakraborty and Newton 2011). These are reasons for the importance of strengthening epidemiological surveillance and early warning systems.

5. The evidence regarding average world temperatures is stronger than that on local temperatures; on the other hand, changes in rainfall patterns are tracked more at a geographic level, with no evidence of a global trend.

Pre- and post-harvest losses cause sharp declines in food quantity and food quality, which adversely effects the earnings and livelihoods of family farmers in LAC.

In Guatemala, it is estimated that losses of basic grains (corn and beans) stored on family farms range between 40% and 45%. A similar situation exists in some Andean areas where losses of tubers, such as potatoes, are estimated to be as high as 40%. In Paraguay, unofficial data indicate that post-harvest losses of horticultural products range from 8% to 15%, while in Haiti losses of staple foods can reach 35% (IICA 2013).

Pre-harvest conditions and field actions can indirectly cause losses at later stages of production. For example, selecting low quality seed, using poor agronomic practices (i.e., nutrient, water, pest, disease management), combined with adverse environmental factors such as floods and droughts, can create problems that prevent farmers from attaining the desired harvest volumes and also produce characteristics that make the products unsuitable for market. This can increase the amount of food discarded and cause economic losses for farmers (HLPE 2014).

Family farmers are most likely to be affected by food losses because of their limited access to knowledge for use decision-making and to economic resources. Both are indispensable for investing in farm infrastructure and technology. As a result of the lack of storage infrastructure, many are obliged to sell their products immediately after the harvest, usually at low prices (IICA 2013). For these reasons, it is necessary to increase investments in public goods, provide universal access to energy and water, infrastructure (roads, cold storage chains, warehouses, etc.), information, among other things, not only at the farm level but also in all agricultural chains.

2.2. MARKET RISKS

A safer, stable, and predictable rule-based commercial system reduces family farms' exposure to nutrition and food security risks.

Because of the existence of local, regional, national, and international markets, family farms will be more or less sensitive to external impacts depending on their linkage with each type of market. Greater commercial integration has led to increasingly rapid price transmission from international markets to local markets, which affects the nutrition and food security of family agriculture. This was evident during the recent crisis when the world agricultural trade system was highly unstable.

When working efficiently, markets play a critical role by taking food and raw materials from areas of abundance to areas of scarcity at the world, regional, national, and local levels, ensuring the stability of supply, strengthening access to and affordability of food, and reducing price volatility.

The recent experience of extreme peaks and high international price volatility is perhaps the clearest indication that much still needs to be done to make markets more dependable and stable. The situation was further aggravated when some countries adopted protectionist measures in the name of national interest: because of their influence, this generated considerable instability in the international market.

It should be acknowledged, however, that significant progress has been made within the framework of the World Trade Organization (WTO) to establish rules on market access, domestic support, export subsidies, sanitary and phytosanitary measures, nontariff barriers, technical barriers to trade, and intellectual property protection, among other things. These rules seek to improve transparency and competition in international markets and ensure a better and more efficient allocation of resources worldwide. Nonetheless, countries still have considerable maneuvering room to impose restrictions on trade, which affects stability and efficiency.

While it may appear that family agriculture is relatively immune to the rules and risks of international markets, it is actually exposed and vulnerable to them, even though significant differences exist: between countries (exporter or net importer), markets (formal or informal), products (tradable or non-tradable or degree of preparation), income strata of the family farm (subsistence, in transition, consolidated), type of farm support policies (subsidies, tariffs, others), and whether the family farm is a net purchaser or seller of food.

Most farming families are net food buyers (Robles and Torero 2010) who spend a significant portion of their income on food, so they are affected by increases and volatility of domestic and international prices. When prices rise, the real income of net food-buying family farms declines, which directly impacts the quantity and quality of food consumed by the family and its nutritional status. In addition, the risk situation for family farms becomes is further complicated by the fact that most of the food consumed in the region is bought in informal markets, which are deemed inefficient, unpredictable, and having lower quality standards and requirements than formal markets (FAO 2014).

Essentially, market risk is expressed in terms of more volatile prices that expose farmers and make them vulnerable to loss, both in terms of the purchase of inputs and raw materials, and the sale of products on the market.

The period between the time a farmer decides to plant and the time he or she sells the harvest is fraught with major risks. Most farmers decide what to plant without knowing what sale price they will receive six or more months later, and a decline in prices could expose them to greater losses. The risk is much lower for a merchant whose decisions to purchase and sell are tied to shorter periods of time. For example, if corn farmers base their decision on international prices they could face price volatilities of up to 40%, while a merchant may face a volatility of less than 10% (ECLAC et al. 2014b).

Of the four variables that determine price changes (trend, seasonality, cycles, and volatility), price peaks or cycles have become in recent years –especially since the crisis of 2008– the most significant source of instability. These cycles stem from variables that have longer effects on supply and demand. Pests and diseases or geographically specific extreme climate conditions are examples of variables that would have a medium-term impact on specific crops or agricultural activities. Other variables, including macroeconomic variables (exchange rates, interest rates, recessions) and natural or political-social variables (wars, blockades, strikes), have wider-reaching, prolonged effects that affect all products (for more information, see ECLAC et al. 2014b; Irwin et al. 2009).

Market risks are generally associated with purchase and sales conditions on domestic and international markets, the form and factors that affect market operations (product, capital, and labor) and, primarily, price volatility.

Family farming and short marketing circuits (ECLAC et al. 2014b) are measures that have been promoted in LAC to address volatility. Government procurement of food from family farms is an instrument that has been used to stimulate local markets and reduce the impact of food price volatility. A fine example is Brazil's Food Procurement Program, which connects local family farm supply with public schools' demand for food.

Family farming may be considered to have fewer occupational risks because it uses family labor, which offers greater flexibility and lower labor supervision costs, unlike farms that hire their workforce (Barrett 1996).

Family agriculture makes more intensive use of locally available production factors, particularly labor, than large-scale commercial farms. In fact, family farming accounts for nearly 50% of rural employment, ranging from 36% in Costa Rica to 76% in Honduras (FAO 2014).

Although family farms face fewer labor-force risks, they still have significant limitations. Important among these is the instability of labor demand and supply. Since farmers' and agricultural workers' deal primarily with seasonal crops, there are times when they must seek off-farm employment, which sometimes involves migrating to a city with the risk of not returning.

Other causes of labor-market instability that motivate farmers to seek non-agricultural rural employment include lack of opportunities, praedial larceny (mainly in Caribbean countries, where around 70% of farmers have been affected), and low wages, which create the need for additional income to meet basic needs. This is of great importance because youths and people with better training tend to be the ones who migrate to the cities where they are more likely to find a job (ECLAC et al. 2014b). Policies are needed to promote dignified rural employment, rural youth entrepreneurship programs, family farm organization and associativity, and social protection policies that reduce labor risks in rural areas.

2.3. FINANCIAL RISKS

Financial risk exists for farmers even when they have not received loans, but the probability of the risk increases when they do since the possibility exists that they may not be able to meet their obligations.

Healthy financial indicators not only facilitate access to credit, they also reduce its cost. However, regardless of farmers' initial situation, when they obtain a loan they are exposed to factors beyond their control including rising interest rates or interest rates that are higher than the national or international standard. Financial health enables a business to absorb and recover from short-term effects, ensures a family's standard of living, and makes it possible to grow family equity, all of which is more viable if there are other sources of income (Crane et al. 2013; Herrera and Núnez 2014).

Farmers' financial risk is exacerbated by high transaction costs (high interest rates) and the initial state of development of rural financial institutions, relating to property rights and property registration (which generates legal uncertainty), few financial instruments designed for smallholders, excessive red-tape to obtain financing, and non-existent or inadequate infrastructure for reaching smaller farmers. Moreover, because of land tenure problems and because assets are not always in their name, many farmers lack the guarantees needed to obtain a loan.

> Financial risk is the probability of threats to the financial health and stability of the agricultural business, which stems from problems with liquidity, insolvency, or bankruptcy.

2.4. INSTITUTIONAL RISKS

Institutional risks have a significant impact on the expectations of family farmers, affecting their day-to-day decisions on what, how, how much, and when to produce.

A relatively unstable institutional environment tends to shorten the investment horizon because the risk makes it necessary to recover the invested capital in a shorter period of time. In the absence of risk, investments could be longer term, have broader structural impact, and have much longer lasting positive effects on family welfare. Corruption and instability in public administration can trigger such uncertainty, while constant changes in the rules of the game generate mistrust and condemn government programs to failure (Hatch et al. 2014).

Countries with a weak institutional framework[6] tend to design basic or core policies that target family agriculture's main problems and circumstances, while the more advanced policies of countries with a mature institutional structure tend to include comprehensive, differentiated, and countercyclical management that shape a macro environment of much lower risk for family farming.

The largest source of institutional risk is the lack of differentiation between the policy instruments designed for commercial commodity export agriculture and the policies designed for family farms that produce basic goods for the family food basket. This creates wide gaps that give rise to inequality indicators for income and land distribution, access to production assets, and gender.

Institutional risk is the vulnerability of family farmers to the gap between the "existing" institutional framework and a "suitable" or desired institutional framework that would provide the support farmers need to cope with challenges and respond to the problems or opportunities they face on a daily basis.

In most countries of the region, government policies and not State policy are the predominating factor, making it difficult for farmers to anticipate the direction and magnitude of policy changes at the beginning of each new government administration. With an institutional environment that is not secure and stable, and not underpinned by solid broad-reaching laws consolidated over time, family farmers make decisions that are conditioned by uncertainty, and the result is a short-term perspective.

A lack of consistency in policy design and implementation signals the need to prioritize and integrate policy instruments for family agriculture that focus on governance and decision-making processes, the empowerment of family farm organizations, training, and the coordination of policies addressing production and commercial development, education, public health, food and nutrition, environment, and social protection.

2.5. HUMAN RISKS

Every day, family farms face risk situations stemming from human error, poor decisions, disagreements, or calamities (disease, accidental death) that affect farm activity, people's health, and the household's well-being.

The main risk factors related to health are equipment and machinery, installations, noise and vibration, chemical products, electricity, temperatures, and demanding physical work (Núñez and Aspitia 2013). Stress, fatigue, and lack of training increase the likelihood of these risks.

Pesticide use is one of the most frequent sources of human risk in family farming because it is difficult for farmers to obtain less toxic products (because of a lack of information or because they are more expensive) and because they do not have safe pesticide equipment. The World Health Organization (WHO) estimates that, every year, three million agricultural workers in developing countries are affected by pesticide poisoning, 18,000 of whom die as a result. Central America has one of the highest number of reported cases of agrochemical poisoning (Arbeláez 2004). According to the International Labor Office (ILO 2000), most wage-earning agricultural work is performed by day laborers, seasonal and temporary workers, in unsafe conditions, exposed to pesticides, fertilizers and other agrochemical products, and extreme temperatures. Chronic kidney disease has become an endemic public health problem in Central America (PAHO 2014) due to chronic

6. Institutional framework is understood as the set of policy practices that shape decision-making processes. These practices can be regulatory (political constitution, legitimate and permanent legal bodies), cultural (beliefs and values), formal (State organized actions) or informal (social agreements).

exposure to heavy metals (lead, cadmium, arsenic, others), agricultural chemicals, and nephrotoxic substances (aristolochic acid, found in the star fruit). According to PAHO (2014), this type of disease is responsible for ten deaths per 100,000 inhabitants in the region. While these risks affect all of agriculture, they are of more critical importance to family farms because of their greater vulnerability.

The human risks most directly related to family farming include family relationships, the transition of the business from one generation to another due to a death in the family, slow generational change in the sector, poor decisions or disagreements pertaining to planning and coordination, operational organization, communication problems, and worker control and management, all of which affect family farming activity (Bitsch et al. 2006). The risks associated with short-, medium-, and long-term decision-making are closely tied to the household's educational status and its economic, social, and cultural conditions.

Human risks are risk stem from people's participation and interactions in the agribusiness (Crane et al. 2013).

3. RISK MITIGATION AND ADAPTATION STRATEGIES

Before giving thought to transferring risk, consideration should be given to examining mitigation and adaptation strategies that farming families could adopt in order to anticipate and prepare themselves to deal with the risks, reduce losses and, in the best of cases, tap opportunities that can improve the household's well-being. Recommendations include the need for comprehensive and consistent public policies, investment in public goods, and articulation of those policies with social and environmental policies in the understanding that risk prevention and management for family farms extends considerably beyond the farm.

Family agriculture is made up of family units whose members are the main source of labor. As a result, the farm's agricultural and commercial strategies are intertwined with the household's interest in satisfying its daily consumption requirements, which explains in part the aversion to risk.[7] The combination of commercial and family interests leads family farmers to cultivate a variety of crops[8] (basic grains, vegetables, fruits, and others) and to raise livestock, which can be used both for personal consumption and for the purpose of savings (ECLAC et al. 2014b).

Following are some examples of how farmers can boost their earnings while at the same time diminishing risk by adopting different production practices, systems, and technologies, and by implementing commercial and income diversification strategies.

Mixed production systems can be used as a strategy for adapting to climate change (depending on the crop), recovering soil health or rescuing biodiversity, and for managing market risks.

For centuries, family agriculture has contributed to building more healthy ecosystems because family farms in LAC and other parts of the world farm a variety of crops. In this connection, see the examples of smallholders in Ecuador (Anzules-Sánchez et al. 2005).

Contrary to widespread belief, family farms can be highly productive and sustainable. One study reviewed 286 projects in 57 countries (Pretty et al. 2006), which accounted for a total of 37 million hectares. The study found that, by including some technological improvements and good farming practices, family farmers could significantly boost crop productivity, increase the efficiency of water use and carbon sequestration, and reduce pesticide use. These technologies and practices included integrated pest management and integrated nutrient management (balancing nitrogen fixation, introducing organic and inorganic nutrients, and erosion control), conservation tillage (moderate to zero tillage), forest farming, and silvopasture systems. According to the study, adoption of these measures increased average yields by 79%, including increases in more than a dozen crops and various animal products. The higher yields not only strengthened food security and boosted household incomes, they also realized savings through reduced fertilizer and pesticide use. While on average the gains in carbon sequestration were 0.35 tons/hectare (t/ha), but attained 14.9 t/ha of carbon in zero tillage systems in South America. In Brazil, every eight hectares cultivated by smallholders in mixed

7. Some studies have shown that the higher the aversion to risk, the lower the level of production: hence its importance in agricultural planning (Hazell et al. 1983). Risk aversion should also be considered in order to better understand farmers' responses and practices in situations of uncertainty. When uncertainty is high, aversion to risk prevents farmers from adopting new technologies and affects medium- and long-term investments (IPCC 2014).

8. Risk aversion also explains why family farms rotate their crops more and use less fertilizers, for example (Livingston et al. 2014).

production systems generated one job while large-scale mechanized monocultures generate one job per 67 hectares.

The aim of climate-smart agriculture is to promote food security and development through sustainable intensification of production, increased biophysical and socioeconomic resilience, and net reduction of greenhouse gas emissions (GGE) from agriculture.

Although the concept of "climate-smart agriculture" is still evolving, there appears to be agreement on four of its components:

a) Identify the origin and causes of unsustainability and GGE emissions, as well as possible intervention measures, such as diversification of production and sources of income, and strengthening of biodiversity.

b) Strengthen the institutions and infrastructure that support sustainable agricultural practices (for example, cooperatives or organized communities), efficiency and equity in agricultural chains, and governance systems for managing resources of common interest, land tenure, and ecosystemic services.

c) Establish a strategic coordinating framework for key stakeholders (ministries, local governments, farmers, agribusinesses, international agencies) for the design and implementation of market policies and measures that encourage climate-smart agriculture (CSA) and reduce or address natural disaster risks (Inset 2).

d) Strengthen multi-scale capacities for the development of information systems, including research and development (i.e., climate and vulnerable populations), advisory services (including risk assessment), information and communication technologies, and monitoring and evaluation mechanisms (Negra 2014). For further information on the implementation of this type of strategy, see the examples of Brazil, Ethiopia, and New Zealand (Negra 2014).

Inset 2.
Climate-smart agriculture (CSA)

This concept, first proposed by FAO in 2010 and later promoted by several multilateral agencies (within the framework of the Global Alliance for Climate-Smart Agriculture), is an inherently multisectoral approach that seeks to synergistically achieve climate change adaptation, mitigation, and food security, while reducing possible adverse effects to a minimum (Negra 2014).

Beyond the sustainable intensification of agriculture, described as the optimization of resource use, it is necessary to promote an ecological approach to production systems that takes into account the ecological, social, cultural, environmental, and production dynamics of family farms.

Pests pose risks that call for a holistic approach, and that should include not only integrated pest management (IPM) strategies and the use of agrobiodiversity, but also early warning systems.

IPM is an ecological approach for reducing or eliminating the use of pesticides and minimizing impact on the environment; it makes use of a wide variety of complementary methods, including physical, mechanical, chemical, biological, genetic, legal, and cultural. The methods are applied in three stages: prevention, observation, and application. A noteworthy reference are the IPM farmer field schools (FFS) in the Caribbean, which have contributed to reducing pesticide use and production costs and, often, to boosting yields (López and Ramroop 2014).

With regard to biodiversity, family agriculture offers great potential for conserving cultivated species and their wild relatives. This rich genetic diversity performs a critical function in increasing and maintaining production levels and nutritional diversity under all agroecological conditions. Moreover, new markets are opening up for new products from many of the varieties traditionally cultivated by farmers (Devaux et al. 2007). This gives new value to agrobiodiversity and can contribute to boosting family farm incomes.

Technology plays a key role in reducing agricultural risks

For example, technologies and innovations that make effective use of drainage water reduce the risk of losses during droughts, which increases net agricultural yields. Efficient drainage systems[9] can improve yields and agricultural profit margins, reduce runoff, soil erosion, and nutrient loss and, in general, reduce farmers' exposure to risk (Skaggs et al. 2012).

In a scenario of great uncertainty for agriculture, biotechnology plays an important role in climate change mitigation and adaptation. Biotechnological crops have contributed to mitigation: it has helped maintain forest lands,[10] reduce fossil fuel consumption, and promote conservation tillage which, combined, affect the amount of carbon dioxide (Massey 2013). With regard to the first point mentioned above, thanks to biotechnology, canola, corn, soybeans, and cotton require less land for production. This has represented a 13 million additional hectares, which contributes to maintaining forested areas.

Regarding fossil fuel consumption, due to the reduction in insecticide and herbicide use, and the smaller amount of land under cultivation, it is estimated that biotechnology reduced fossil biofuel consumption by 1.2 billion gallons during the 1996-2010 period (Barfool and Brookes, cited by Massey 2013).

Finally, concerning agricultural practices, the introduction of herbicide-tolerant crops has increased zero tillage systems by 69%, making it possible for larger amounts of carbon to remain in the soils. It is estimated that, in 2010, the combined effect of lower fuel consumption and carbon remaining in the soil was equivalent to removing 8.6 million cars from the roads that year.

It is important to promote the coexistence of different production systems, as well as farmers' right to select the production option that best suits them, be it conventional, organic, transgenic, or non-transgenic. The coexistence of production systems should not be based on a search for differences but rather on the provision of solutions and services by the State to develop such coexistence, so as to be able to respond to different market demands.[11] The biggest difficulty is that technological options are not always available to or affordable for farmers, so the State should take it upon itself to disseminate the technology and adapt it to the circumstances of family farms.

Diversifying production and sources of off-farm income contribute to reducing risk and stabilizing family farm incomes.

The impact of a decline in the sale price of one product can be offset by an increase in the price of another. This is how agricultural diversification, or mixed production systems, help reduce a farm's exposure to price variation risk.[12] Vertical integration of production can also reduce risks. Indeed, the volatility of farm earnings will be

9. The main idea is to drain only what is needed for farming purposes (Skaggs et al. 2012).
10. Higher yields means that more is produced on a smaller area, which relieves pressure on forests.
11. See examples of coexistence of production systems promoted in the United States (USDA n.d.).
12. Provided the prices of the agricultural commodity basket have low or negative correlations, which reduces total price variation risk.

lower for producers engaged in two or more production processes so long as the prices are not perfectly correlated. Moreover, income volatility will be lower if the price volatility of the end product is sufficiently below the price of the intermediate products.

Another key income diversification strategy is to combine farm activities with off-farm activities, which requires diversification of non-farming activities in rural areas. Such diversification is increasingly evident in rural LAC; off-farm employment (either independent or salaried) is surging at the same time that migration is increasing, making remittances an important source of income for many households (Maletta 2011).

4. RISK TRANSFER

The decision to transfer risk should be taken only when the risk is beyond the control of the farmer or the family unit, that is, when losses cannot be prevented even when measures are taken to avoid them. Risk is transferred to other people or companies through market strategies such as hedging in futures markets against price changes, crop insurance, income protection insurance, or risk reduction or risk protection programs, such as counter-cyclical payments based on prices and yields, or instruments such as contract farming.

Risk transfer is efficient and viable when set within a comprehensive management strategy that takes into account, before transfer, the measures adopted for preparing, anticipating, adapting, and protecting against risk discussed throughout this bulletin. This will reduce residual risk. When risk transfer instruments are used in isolation, that is a clear indication of mismanagement; it will lead to inefficient interventions that are unsustainable economically for the private sector and for governments (Hatch et al. 2014).

Since prices and yields are the two sources of farm income variability (usually correlated), they are emphasized in this section in order to discuss the most important price stabilization instruments and insurance for covering harvest losses or low yields. The greatest challenge is to make these instruments accessible, affordable, and acceptable to family farmers. In addition, efforts are needed to design an optimal combination of instruments that protect against risks, reduce insurance costs, and ensure better well-being for farmers.

Price setting is being used less and less because of its adverse impact on optimal resource allocation; what is needed are more efficient market and public policy instruments for reducing risk.

This includes instruments that are designed for different users, impacts, and with different implementation costs, and differ from instruments traded and used in the market and from government policy instruments. Some market instruments include inventory management, stabilization funds, futures, contract farming, and flexible land rental contracts. Forward contracts require that signers purchase or sell the product on a specified future date at a given price, while futures contracts –which are more detailed and standardized– reduce the possibility of receiving lower prices but also make it possible to take advantage of higher prices. The possibility also exists of using options as a supplement by paying a premium; they can protect producers from expected movements or movements that run contrary to those set out in the futures contract.

Contract farming can be defined as agricultural production carried out according to an agreement between a buyer and farmers, which establishes the conditions for the production and marketing of a farm product or products (FAO 2013).

Another instrument is contract farming, which has had a positive impact on production, production chain efficiency, and farmer well-being (Wang et al. 2014). These contracts tend to be a good choice for smallholders who have limited education and technological know-how, and who live where transportation, cold-storage, and information channel infrastructure are less developed. Contract farming with larger agribusinesses can be one of the few options available to small family farms for accessing markets and earning better incomes (Barrett, cited by Wang et al. 2014). Contract farming can also provide a more consistent and stable supply for supermarkets and consumers with lower transaction costs and products that meet traceability requirements.

When introducing these types of instruments, efforts should be made to avoid the risk of social exclusion by working only with the agro-production chain approach. Organizations of family farmers, especially cooperative systems and inclusive management models, should be included. In short, the collective economy can play a critical role when supported by social protection policies, universal access to protection systems, and fair rural employment.

Price stabilization funds are another instrument used in countries including Costa Rica and Colombia. Since 1992, the Coffee Institute of Costa Rica has operated a National Coffee Stabilization Fund, the objective of which is "to balance the weighted average price of the final payment to coffee farmers relative to the agricultural production costs determined by the Coffee Institute of Costa Rica for the corresponding harvest year." (La Gaceta de Costa Rica, Ley 7301). For its part, Colombia has price stabilization funds for heart of palm, palm oil, sugar, meat, among other products.

In addition, flexible land rental contracts are a new instrument developed in the United States according to which earnings are not determined until after harvest (Paulson and Sherrick 2009); their advantage is that the earnings fluctuate according to prices and yields so risk is shared by the landowner and the lessee.

As mentioned earlier, in addition to the market instruments, governments have policy mechanisms to stabilize prices or income, including counter-cyclical payments, tariff quotas or contingents, special agricultural safeguards (which function as a price band), specific tariffs (very much in use in the European Union), and cash transfers. The U.S. Farm Bill contains reference to these types of policy instruments (Arias et al. 2014).

In times of crisis caused by price increases, loss of employment, or lower remittances, social security policies have played a critical role in protecting food consumption for the poorest strata (World Bank 2013). In El Salvador, conditioned cash transfers, pensions, and school meal programs are instruments that have been considered successful. Solidary rural communities provide short-term assistance to the poorest as well as incentives to invest in human capital, combining conditioned cash transfers with the delivery of basic services (water, sanitation, electricity, health, nutrition).

> Price stabilization arrangements are funded by members' contributions and ensure a minimum price for their products.

Agricultural insurance is a growing business worldwide but has made very little headway in LAC, particularly in the family farm sector.

Most agricultural insurance programs target large commercial producers and therefore fail not only to meet the needs of family farms but also to cover risk throughout the agricultural chain (Hatch et al. 2012; Murphy et al. 2012). A few exceptions do exist, however. The success of Chile's insurance program is attributed to a State subsidy supplemented by production and financial development programs offered by the Agricultural Development Institute (INDAP) (Agroseguros 2015), which serves more than 80,000 small farmers. Another example is Mexico's CAT Bond program, a risk financing initiative that seeks to strengthen disaster and agricultural risk management, and includes recent efforts to create a standard platform that opens the market for a variety of smaller-scale risks (Murphy et al. 2012). Technological and management innovations (automatic teller machines, cell phones) should be used to reduce the transaction costs of administering insurance programs that target small farmers scattered throughout remote areas.

Another example are Mexico's insurance funds, which are associative, not-for-profit, mutual aid organizations of farmers governed by their own law. They collect premiums, cover their operating expenses, and create reserves for the payment of compensations. Mexico's catastrophic climate risk management strategy for the agricultural sector has made significant progress, and now covers 65.8% of the 22.3 million hectares planted annually in the country, 70% of the pastures used for open range livestock activity, practically the entire population of the main livestock species used for food, except poultry, as well as a portion of the national herd. Its success is essentially due to the use of indexed insurance promoted by the National Disasters and Emergencies Assistance Committee (CADENA), with the backing of the international reinsurance market (for further details see Celaya et al. 2014)

Although agricultural insurance solutions vary from country to country, most receive government support because of concerns for food security, the high cost of premiums for farmers, and because market flaws often prevent private insurance companies from offering suitable risk management instruments for family farms. Government support for agricultural insurance varies widely and can include the promotion of insurance legislation, subsidies for premiums, administrative and operating costs, and the assessment of losses. Governments can also act as reinsurers, invest in research and development, and provide training. Low-income and medium-to-low income countries lag furthest behind in terms of agricultural insurance legislation.

So-called self-insurance tends to be a more economical and efficient way to administer the consequences of less frequent and less severe risks. Self-insurance includes savings mechanisms, rural microfinance, ownership and sale of assets –i.e., machinery, land, and animals– and shared risk strategies (Murphy et al. 2012)

Uruguay, for example, has created mutuas [mutual aid societies][13] to provide protection against losses caused by hail to vertically integrated crops (mainly rice and barley) (Methol 2008). Producers sign a contract that defines the damage and contribution for compensating a producer who has suffered a loss. Farmers' contributions are deducted from the payment they receive for grain delivered to the mill. Unlike the regulations that govern the country's insurance companies, these mutual aid arrangements are not required to have technical reserves or solvency guarantees nor do they pay taxes, which lowers the cost of their insurance.

In Peru, which received the best overall score for the microfinance environment from the Global Microscope on the Microfinance Business Environment 2013 (EIU 2013), microfinance is regulated by the Banking, Insurance, and Pension Fund Authority (AFP), which has contributed to the development of a competitive financial market. Fifty-four percent (54%) of all microfinance institutions have some percentage of their portfolios in rural areas. This includes commercial banking, among which MiBanco is the most representative, as well as the Rural Savings and Loan Fund, the Municipal Savings and Loan Fund, among others (Caro 2003).

Rural microfinance can play a more significant role as a less costly distribution channel for agricultural insurance for family farms (World Bank 2013). In Mexico, agricultural and rural insurance funds (which include a contingency fund and self-insurance) are being used by farmers' associations to offer mutual aid protection to their members through insurance and coinsurance operations. These funds operate within a legal framework established by the government, and farmers' premiums are subsidized by government funds, which are also used to provide training on the administration of the funds (SHCP n.d.). In Honduras, "cajas rurales" [rural funds] include contingency mechanisms[14] for health, education, and food security and provide farmers with help, donations, or loans in times of emergency (for further information see Torres 2012).

Family farms have very limited negotiating capacity in commodity, financial, and risk markets, which makes them much more vulnerable to economic and climate impacts.

13. "Mutuas" are arrangements among farmers whereby they sign a contract that defines the damage and contribution for compensating farmers who have suffered a loss.
14. The funds are known as "emergency funds," "solidarity funds," "assistance funds," or "petty cash."

Unfortunately for family farms, empirical studies show that large agricultural enterprises are more frequently offered contracts and insurance simply because transaction costs are lower than if the insurers had to deal with many smallholders. This, despite the fact that family farms have the greatest potential to benefit from this type of arrangement and from the possibility of obtaining agricultural loans at favorable interest rates. Given this type of market flaw, the State should intervene by introducing the necessary incentives.

It is true that the millions of producers and companies in LAC that have no risk protection speculate with prices, assuming all the risks of the chain, not only production risks but also the risks associated with marketing, processing, and all other processes involved in getting the product to the consumer's table. For example, family agriculture is much less likely to participate in futures markets because of the high fixed cost of participation and the initial stage of development of agricultural exchanges in LAC (Arias and Ferreira-Lamas 2012; Rojas and Abreu 2008). A recent case worth noting is promoted by the Nicaraguan Association of Producers and Exporters, and the Nicaraguan Agricultural Exchange (BOLSAGRO) which, with the support of the World Bank and Japan's Social Development Fund, provides training to producers to help them understand price variations for beans, vegetables, and coffee, and to enable them to make efficient use of BOLSAGRO's mechanisms, such as crop purchase agreements (World Bank 2015).

CONCLUSIONS AND RECOMMENDATIONS

Agriculture is unique because production is a random variable influenced by climate and its effects. Moreover, supply and demand for agricultural products and food are inelastic, making prices and incomes highly volatile. Climate change has a multiplier effect that will exacerbate almost all existing risks so it is critical to prepare risk management actions.

LAC is still faced with the task of making risk management an integral part of agricultural planning, with a view to correcting, anticipating, and preventing possible economic and environmental impacts and strengthening agricultural resilience. Efforts in this direction should consider both the factors that increase family farm vulnerability (farm size, low use of technology, and low capitalization, among other stressors) and factors that contribute to family farm resilience (family labor, diversified production and income, traditional and ancestral knowledge).

Risk management does not eliminate the possibility of adverse events but it can significantly reduce losses and negative impact through a combination of capacities that help deal with present risks, recover from them, and thus gain the experience needed to cope with similar situations in the future.

What prevails is inaction, passivity, and the hope that bad things won't occur, based on ill-founded assessments of potential loss, and lack of awareness or underestimation of the options available for self-protection, risk transfer, and obtaining State support.

The recommendations found throughout this document can contribute to the creation of comprehensive and effective risk management systems that include assessing the sources of risk, purchasing protection to reduce the likelihood and magnitude of loss, transferring residual risks through insurance instruments or other mechanisms, and adopting measures for recovering from and adapting to a risk that has materialized.

It is important to emphasize that risk transfer will be efficient and viable only within the framework of a comprehensive management strategy that includes the measures discussed throughout this document for preparing, anticipating, adapting, and protecting against risks. When risk transfer instruments are used in isolation, that is a clear indication of poor risk management; it will produce inefficient interventions that are economically untenable for the private sector and unsustainable for governments.

There is sufficient documentation to show that larger farms are approached more often with offers of risk management instruments simply because transaction costs are lower than having to deal with small farmers, who are usually spread out geographically and more numerous.

Family agriculture, however, is more exposed and more vulnerable or susceptible than large-scale commercial agriculture to direct impacts on production and income. In addition, it should be borne in mind that the risks discussed (systemic, market, production, human, institutional, financial) affect family agriculture in differentiated ways, depending on whether they are small-scale subsistence farms, farms in transition, and farms with stronger market ties.

Regarding the possibility of family farms adopting risk management tools, it is important to recognize that they have very limited access to and negotiating capacity in commodity, financial, and risk markets. The situation is further complicated by a lack of access to information and to tools for making optimal production, economic, financial, and risk management decisions.

Technological and management innovations are needed to reduce the transaction costs of administering risk management programs and instruments designed for family agriculture, due to their dispersion in remote areas. The availability and quality of local information must also be improved, for performing probabilistic risk analyses, monitoring and evaluating programs, and designing farmer support programs that facilitate adoption and acceptance.

In addition, commercial banking, development banking, and the private sector need appropriate infrastructure if they are to serve family farms. Here, governments can play a key role by providing data infrastructure (speed, reliability/quality and transparency); making education, training, and skills development services available; allocating resources for technical support for the design of risk management products; creating effective legal and regulatory frameworks; and articulating policy instruments, especially for programs that support financing, associativity, production development, and risk transfer. As mentioned at the beginning of this bulletin, emphasis should be placed on the important role of reinsurers so that local insurers and the government itself do not assume all the losses, especially in the case of systemic risks (economic or environmental).

Some structural aspects of technology increase risks for family farming. These include low public investment in research and innovation, the dismantling of public technical assistance and extension systems, the little value attributed to traditional knowledge of environmental and biological cycles and articulation of this knowledge with research and development strategies, and essential elements of family farm risk management that are beyond the control of farmers or family units. In light of this, it is urgent to focus attention on improving access to knowledge and technology in order to strengthen social innovation processes that take into account the ecosystems of the family farms. Actions should extend beyond the agricultural sector, focusing on livelihood resilience and the articulation of agricultural, social, and environmental policies with a sustainable approach to territorial development.

It is extremely important that responses to the problems facing family agriculture include the co-design and co-management of public policies. If policies are designed without taking family farmers' opinions into consideration and without assessing fairly what they really need, the type of instruments designed may be inappropriate and translate into greater risks. It is recommended that opportunities be created, and channels of information and communication be established, to provide suitable institutional and market signs to family farms, as they are of key importance for reducing risk.

With regard to family agriculture itself, associative arrangements with a market and business management approach are the best option for risk management. It is the most effective and least costly way to access information, production alternatives, and services (credit, training, specialized technical assistance). It facilitates the implementation of good agricultural practices, selection of crops and varieties best suited to changes in climate, and reduction of vulnerability through crop diversification, integrated pest control, or the adoption of self-insurance. Organization gives farmers negotiating power, reduces costs, and improves marketing margins and sale prices. Working together in concerted action will facilitate family farmer access to and reduce the cost of participating and acquiring the risk management tools offered by agricultural exchanges, the financial market, and the insurance market.

Finally, and no less importantly, associative arrangements can minimize risks associated with decision-making and avoid improvisations that can affect performance, through the use of tools for keeping financial records and maintaining a suitable level of liquidity and caution as key elements for managing financial risk in agriculture.

REFERENCES

Anderson, P; Cunningham, A; Patel, N.G; Morales, F.J; Epstein, P.R; Daszak, P. 2004. Emerging infectious diseases of plants: pathogen pollution, climate change and agrotechnology drivers. Trends in Ecology & Evolution 19(10):535–44. Disponible en *http://bit.ly/1g64wts*

Anzules-Sánchez, A; Maurilio-Castro, J.M; Chica, E; Díaz-Miranda,C; Espinel,R; Hartmann, M; Jiménez, E; Peña,J; Quilambaqui,M; Royce,F; Stonerook, E. 2005. Sondeo de los pequeños productores en la zona de influencia de la Estación Experimental Tropical Pichilingue del INIAP. Quito, EC. Disponible en *http://bit.ly/1g64rpL*

Arbeláez, MP. 2004. Vigilancia sanitaria de plaguicidas: experiencias de PLAGSALUD en Centroamérica. Washington, DC, OPS. Consultado 8 jul. 2015. Disponible en *http://bit.ly/1g64qlE*

Arias, D; Ferreira-Lamas, A. 2012. Las bolsas agropecuarias de América Latina: su rol y situación actual. Revista de la Bolsa de Comercio de Rosario (1517):22-28.

Arias, J; Ángela, D; Cuartas, M.C; Molina, J.P; Peña, Y; Rivera, J; Rodríguez, M.I; Santana, N. 2011. Efectos del aumento de los precios internacionales de los alimentos y las materias primas sobre los ingresos netos agrícolas y la seguridad alimentaria en Colombia. Bogotá, CO, IICA-PMA.

Arias, J; Chavarría, H; Ávalos, I; Campos, A; Trejos, R. 2014. Possible Impact of the U. S. on the Agricultural Sector in LAC Agricultural Act of 2014. San José, CR. Disponible en *http://repiica.iica.int/docs/b3336i/b3336i.pdf*

Arias, J; Vargas, C. 2010. La variación de precios y su impacto sobre los ingresos y el acceso a los alimentos de pequeños productores agrarios en el Perú. Lima, IICA. Disponible en *http://repiica.iica.int/docs/B2176E/B2176E.PDF*

Banco Mundial. 2013. World Development Report 2014: Risk and Opportunity - Managing Risk for Development. Washington, DC, Banco Mundial. Disponible en *http://bit.ly/1g64n9m*

________. 2015. Nicaragua: Small Farmers Reach Wall Street. Consultado 29 jun. 2015. Disponible en *http://bit.ly/1g64j9I*

Barrett, C. 1996. On price risk and the inverse farm size-productivity relationship. Development Economics 51(2):193–215. Disponible en *http://bit.ly/1g64im4*

Bebber, D; Ramotowski, M; Gurr, S. 2013. Crop pests and pathogens move polewards in a warming world. Nature Climate Change 3(11):985–88. Disponible en *http://www.nature.com/doifinder/10.1038/nclimate1990*

BIRF (Banco Interamericano de Reconstrucción y Fomento). 2014. análisis de riesgo del sector agropecuario en Paraguay: identificación y priorización de los riesgos agropecuarios. Consultado 30 jun. 2015. Disponible en *http://bit.ly/1g647al*

Bitsch, V; Abate-Kassa, G; Harsh, S; Mugera, A. 2006. Human resource management risks: sources and control strategies based on dairy farmer focus groups. Agricultural and Applied Economics 38(1):123-36.

Cafferata, J. 2010. Efectos del alza de los precios internacionales en los ingresos de los productores agropecuarios en América Latina. San José, CR, IICA.

Caro, JC. 2003. La dimensión de las microfinanzas rurales en América Latina: un análisis comparativo de cuatro países. Santiago, CL. Disponible en *http://bit.ly/1g644LW*

Celaya, V; Hernández, E; Cabestany, J; Delalande, L. 2014. La gestión de riesgos climáticos catastróficos para el sector agropecuario en México: caso del componente de atención de desastres naturales para el sector agropecuario. In Agricultura familiar en América Latina y el Caribe: recomendaciones de política. Eds. S Salcedo; L Guzmán. Santiago, CL, FAO, p. 293-316. Disponible en *http://www.fao.org/docrep/019/i3788s/i3788s.pdf*

CEPAL (Comisión Económica para América Latina y el Caribe); FAO (Organización de las Naciones Unidas para la Alimentación y la Agricultura); IICA (Instituto Interamericano de Cooperación para la Agricultura). 2014b. Perspectivas de la agricultura y del desarrollo rural en las Américas: Una mirada hacia América Latina y el Caribe. Eds. M. Rodríguez; J. Arias-Segura; Trejos; T. Díaz; J. Meza; A. Flores; A. Rodríguez; I. Ávalos; S. Salcedo; H. Chavarría; O. Sotomayor. IICA. Disponible en *http://repiica.iica.int/docs/b3165e/b3165e.pdf*

Chakraborty, S; Newton, A. 2011. Climate change, plant diseases and food security: an overview. Plant Pathology 60(1):2-14. *Disponible en http://bit.ly/1g6426C*

Crane, L. Gantz, G; Isaacs, S; Doug, J; Sharp, R. 2013. Introduction to risk management: Understanding agricultural risk. 2 ed. Extension Risk, Management Education, and Risk Management Agency. Disponible en *http://bit.ly/1g63Xjh*

Devaux, A; Velasco, C; López, G; Bernet, T; Ordinola, M; Pico, H; Thiele, G; Horton, D. 2007. CAPRI Working paper collective action for innovation and small farmer market access: the papa andina experience. Disponible en *http://bit.ly/1g63Wfh*

EIU (Economist Intelligence Unit). 2013. Microscopio global sobre el entorno de negocios para las microfinanzas 2013. Consultado 29 jun. 2015. Disponible en *http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38098134*

FAO (Organización de las Naciones Unidas para la Alimentación y la Agricultura). 2014. Agricultura familiar en América Latina y el Caribe. Recomendaciones de política. Eds. S Salcedo; L Guzmán. Santiago, CL. Disponible en *http://www.fao.org/docrep/019/i3788s/i3788s.pdf*

________. 2013. Contract Farming for Inclusive Market Access. Eds. C, a Silva; M Rankin. Rome, IT. Disponible en *http://www.fao.org/3/a-i3526e.pdf*

GHI (Global Harvest Initiative); BID (Banco Interamericano de Desarrollo). 2014. La próxima despensa global: cómo América Latina puede alimentar al mundo. Eds. G Truitt-Nakata; M Zeigler. Washington, DC, BID.

Hallegatte, S. 2014. Natural disasters and climate change. Cham: Springer International Publishing. Disponible en *http://link.springer.com/10.1007/978-3-319-08933-1*

Hatch, D; Núñez, M; Vila, F; Stephenson, K. 2012. Los seguros agropecuarios en las Américas: un instrumento para la gestión del riesgo. IICA. Disponible en: *http://bit.ly/1AFWXmj*

Hatch, D; García, M; Núnez, M. 2014. Elaboración de programas de seguros agrícolas exitosos y sostenibles. San José, CR. Disponible en *http://repiica.iica.int/docs/B3117E/B3117E.PDF*

Hazell, P; Parthasarathy, M; Pomareda, C. 1983. The importance of risk in agricultural planning models. The Book of CHAC: Programming studies of Mexican Agriculture. p. 225-249.

Herrera, D; Núnez, M. 2014. Cadenas agroproductivas: marco orientador para la toma de decisiones sobre su funcionamiento. San José, CR, IICA.

Hillel, D; Rosenzweig, C. (Eds). 2010. Handbook of climate change and agroecosystems: impacts, adaptation, and mitigation. ICP Series on Climate Change Impacts, Adaptation, and Mitigation v. 1. Imperial College Press. Consultado 29 jun. 2015. Disponible en *http://www.worldscientific.com/worldscibooks/10.1142/p755#t=toc*

HLPE (High Level Panel of Experts on Food Secruity and Nutrition). 2014. High Level Panel of Experts on Food Security and Nutrition. Extract from the Report: Food Losses and Waste in the Context of Sustainable Food Systems. Roma, IT.

IICA. 2013. Post-Harvest Losses in Latin America and the Caribbean: Challenges and Opportunities for Collaboration. San José, CR. Disponible en *http://bit.ly/1g63NbS*

IPCC (Intergovernmental Panel on Climate Change). 2014. Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the IPCC. Eds.O Edenhofer *et al.* US, Cambridge University Press. Disponible en *http://report.mitigation2014.org/spm/ipcc_wg3_ar5_summary-for-policymakers_approved.pdf*

Irwin, S.; Sanders, D; Merrin, R. 2009. Devil or angel?

The role of speculation in the recent commodity price boom (and Bust). Agricultural and Applied Economics 2(2): 377–91. Disponible en *http://www.agecon.uga.edu/~jaae/jaae.htm*

Lavell, A. 2014. Sector agropecuario: sector estratégico para la gestión de riesgos de desastre. San José, CR. Disponible en *http://bit.ly/1g63JZx*

Livingston, M., Roberts, M; Zhang, Y. 2014. Optimal sequential plantings of corn and soybeans under price uncertainty. American Journal of Agricultural Economics 97(3):855-78. Disponible en *http://ajae.oxfordjournals.org/cgi/doi/10.1093/ajae/aau055*

Lopez, V; Ramroop, D. 2014. Escuelas de campo de agricultores en el Caribe. In Agricultura familiar en América Latina y el Caribe: recomendaciones de política. Eds. S Salcedo; L Guzman. Santiago, CL, FAO, p. 233-270. Disponible en *www.fao.org/publications*

Maletta, H. 2011. Tendencias y perspectivas de la agricultura familiar en América Latina. Disponible en *http://bit.ly/1g63Fcg*

Massey, A. 2013. Crop adaptation in a changing climate and biotechnology's role: drought tolerant varieties. USDA Agricultural Outlook Forum. Consultado 24 jun. 2015. Disponible en *http://1.usa.gov/1g63DRN*

Methol, M. 2008. Situación del mercado de seguros agrícolas en Uruguay. 29 jun. 2015. Disponible en *http://www.espectador.com/documentos/mercado.pdf*

Murphy, A; Hartell, J; Cárdenas, V; Skees, J. 2012. Risk Management Instruments for Food Price Volatility and Weather Risk in Latin America and the Caribbean. Washington, DC.

Negra, C. 2014. Integrated National Policy Approaches to Climate-Smart Agriculture: Insights from Brazil, Ethiopia and New Zealand. Copenhagen: CGIAR Research Program on CCAFS. Disponible en *www.ccafs.cgiar.org*

Nelson, G.C; Rosegrant, M; Koo, J; Robertson, R; Sulser, T; Zhu, T; Msangi, S; Ringler, C; Palazzo, A; Batka, M; Magalhaes, M; Lee, D; 2009. Food Policy Climate Change: Impact on Agriculture and Costs of Adaptation. Washington, DC. Disponible en *http://bit.ly/1g63zS2*

Núñez, M; Aspitia, M. 2013. Manual para desarrollar capacidades institucionales en la gestión del riesgo agroempresarial. San José, CR, IICA.

OIT (Oficina Internacional del Trabajo). 2000. Seguridad y salud en la agricultura. Ginebra, Suiza: SafeWork, OIT. Consultado 9 jun. 2015. Disponible en http://bit.ly/1g63xth

OPS (Organización Panamericana de la Salud). 2014. Abordaje integral para la prevención y atención de la enfermedad crónica de las comunidades agrícolas de Centroamérica. Consultado 9 jul. 2015. http://bit.ly/1g63spt

Paulson, N; Sherrick, B. 2009. Impacts of the financial crisis on risk capacity and exposure in agriculture. American Journal of Agricultural Economics 91(5):1414-1421.

Pretty, J. N; Noble, A. D; Bossio, D; Dixon, J; Hine, R. E; Penning de Vries, F. W. T; Morison, J. I. L. 2006. Resource-conserving agriculture increases yields in developing countries. Environmental Science & Technology 40(4):1114-1119. Disponible en *http://pubs.acs.org/doi/abs/10.1021/es051670d*

Robison, J; Barry, P. 1987. The Competitive Firm's Response to Risk. Nueva York: Macmillan; London, Collier Macmillan.

Robles, M; Torero, M. 2010. Understanding the impact of high food prices in Latin America. Economía, LACAE 10(2):117-159.

Rojas, D; Abreu, J. 2008. Mercado de futuros, alternativa de protección de precios para los industriales transformadores del grano de trigo en México. International Journal of Good Conscience 3(2):105-144. Disponible en *http://bit.ly/1wJUR30*

Rosenzweig, C; Iglesius, A; Yang, X. B; Epstein, P.R; Chivian, E. 2001. NASA Climate Change and Extreme Weather Events - Implications for Food Production, Plant Diseases, and Pests. Nebraska, Lincoln. Consultado 29 jun. 2015. Disponible en *http://bit.ly/1g63kqa*

SHCP (Secretaría de Hacienda y Crédito Público). AGROASEMEX. Secretaría de Hacienda y Crédito Público. Consultado 29 jun. 2015. Disponible en *http://agroasemex.gob.mx/*

Skaggs, W; Fausey, N. Evans, R. 2012. Drainage water management. Soil and Water Conservation 67(6): 167A-172A. Disponible en *http://bit.ly/1g63hue*

Torero, M. 2010. The Benefits of Reduced Price Volatility for Agriculturaal Commodities. In Agricultural Price Volatility: Prospects, Challenges and Possible Solutions, Barcelona.

Consultado 23 jun. 2015. Disponible en *http://bit.ly/1g63aPz*

Torres Calderón, M. 2012. Estudio de casos: Honduras, Las cajas rurales, mecanismos sociales de contingencia y apoyo económico. FAO. Disponible en: *http://bit.ly/1g62v0i*

USDA (Departamento de Agricultura de los Estados Unidos). Coexistence Factsheets | USDA. Consultado 25 jun. 2015. Disponible en *http://1.usa.gov/1g62rhg*

Wang, H; Wang, Y; Delgado, M. 2014. The transition to modern agriculture: contract farming in developing economies. American Journal of Agricultural Economics 96(5):1-15. Disponible en *http://ajae.oxfordjournals.org/cgi/doi/10.1093/ajae/aau036*

Wehrhahn, R. 2009. Introduction to Reinsurance. Premier Series on Insurance (2):1-38. Banco Mundial. Washington D.C. Disponible en: *www.worldbank.org/nbfi.*

Zegarra, E; Tuesta, J. 2008. Shock de precios y vulnerabilidad alimentaria de los hogares peruanos. Grade. Documento de Trabajo No. 55. Lima. Disponible en *http://bit.ly/1g62k5c*

Zulauf, C; Orden. D. 2014. The US Agricultural Act of 2014 Overview and Analysis. Washington, DC.