Given the pervasiveness of risks and recent structural changes in global and national agri-food systems, farmers, agribusiness, and governments face new challenges in the design of risk management strategies. A Rapid Agricultural Supply Chain Risk Assessment, recently developed by the World Bank, constitutes a useful tool for a system-wide approach to identify risks, risk exposure, the severity of potential losses, and options for risk management either by supply chain participants (individually or collectively) or by third parties (government).

Supply chain risk management is the systematic process of managing the most damaging events that can negatively affect the supply chain, and their likely incidence and impact(s). The proposed unit of analysis for risk and risk management assessment is the supply chain, consisting of all the functions, players, and relations associated with the production, transformation, and distribution of a given food or agricultural product. Figure 1 presents a simple schematic description of an agricultural supply chain.

Modern agricultural supply chains are networks that typically support three major flows:

- **Physical product flows**: The physical product movements from input suppliers to producers to buyers to final customers;
- **Financial flows**: The credit terms and lending, payment schedules and repayments, savings, and insurance arrangements;
- **Information flows**: Flows that coordinate the physical product and financial flows.

---

Logistics and communications are embedded in all these flows, and poor logistics and communications are often a major source of risk facing an agricultural supply chain. The agri-food system also includes farmers and a diverse range of firms, including backward-linked input suppliers and forward-linked intermediaries, processors, exporters, wholesalers, and retailers. The main activities for direct supply chain entities are as follows:

- **Input supply**: The production and distribution of material inputs—such as fertilizer, seeds, packaging, and such needs—utilized in the primary production, processing, and trade of the finished commodity.

- **Farm production**: The primary agricultural production through the sale of a raw commodity at the farm gate—either at literally the farm gate or at some other point where the farmer hands over ownership of the product to the next supply chain participant. Depending on the crop, some type of primary processing, such as the shelling or bagging of dry grain, may take place at the farm level.

- **Processing**: The transformation of agricultural raw materials into one or more finished goods—through drying, canning, freezing, or many other methods. Raw commodities, of course, are also traded and distributed; thus, this stage may not apply to every crop.

- **Domestic and international logistics**: The delivery of marketed commodities to their final market destination.

Figure 1 also maps out private and public sector entities that provide support services, such as finance and insurance, advisory services, and logistics and information. Conditioning the entire supply chain are the domestic and international enabling environments. Domestic conditioning includes fiscal and financial sector policies, pricing and investment incentives and institutions, the regulatory and legal framework, and the like. The international, or global, enabling environment includes international trade regulations and agreements, other international protocols, and the policies or regulations of nations and trading blocs from whom the focal supply chain sources and to whom it sells inputs or products.

The basic sequence for a rapid agricultural supply chain risk assessment can be sub-divided into four major components:

**Component 1—Supply chain situation analysis:** Secondary data related to the supply chain structure, conduct, and performance are gathered and analyzed. The assessment team gathers baseline and contextual information, maps the supply chain according to its sectoral and spatial dimensions, and, where possible, gathers cost structure information. The early stages of analysis may identify a number of priority (tentative) risks for further investigation.

**Component 2—Risk analysis:** Various risk events related to weather, price, food safety, policy, labor, environment, logistics, and other factors are identified, characterized, and, where possible, quantified. The assessment team assesses the risk exposure of supply chain participants (examining the probability and potential severity of different risk events), thus estimating the expected losses arising from different risks for individual supply chain entities and for the supply chain as a whole.

**Component 3—Risk management and vulnerability assessment.** Risk management capacities—existing risk management instruments and their evident effectiveness and sustainability—are assessed. Combining this assessment with information on expected losses, the assessment team is then able to identify areas of residual (high and low) vulnerability.

**Component 4—Recommendations and suggested follow-up actions.** The team identifies recommendations and suggested actions for follow-up based on the conclusions of the rapid agricultural supply chain risk assessment. This component includes suggestions in areas where additional information and analyses are needed and recommendations regarding priority areas for investment and capacity building.

**The Case of the Haiti Coffee Supply Chain Risk Assessment**

A coffee supply chain risk assessment was conducted in Haiti in order to identify specific production constraints in the coffee sector and to develop a work plan to improve the financial management of systemic weather and price risks. Based on the four components of the basic sequence, the assessment developed the following work plan:
Component 1—Supply chain situation analysis. The Haitian coffee industry has been constrained by systemic production problems that have contributed to its decline over the years. These problems are related to the particular structure of the “creole garden,” which contributes to low on-farm coffee productivity and a land tenure system which inhibits long-term investments. Additional factors include: poor infrastructure, limited access to credit, aging coffee trees, an aging farmer population, waning government interest in the support for the coffee sub-sector, and a lack of (international and domestic) promotion of the Haitian coffee industry. Environmental degradation and an increase in annual infestation rates have also contributed to the rapid decline in production and yields.

Component 2—Risk analysis. The assessment identified multiple risks within the Haitian supply chain. These included production, market, political, and other risks.

Component 3—Risk management and vulnerability assessment. Figure 2 summarizes the supply chain’s vulnerabilities and Haiti’s ability to manage the different levels of risks. The report also describes the risks affecting the existing supply chain and prioritizes the areas requiring attention for risk management, investment, and capacity building. Risks considered are evaluated along five dominant supply chains: (i) artisanal coffee supply chain for domestic consumption (58 percent of total volume); (ii) commercial/industrial coffee supply chain for domestic consumption (6 percent of total volume); (iii) “café pile” supply chain for export (6 percent of total volume); (iv) coffee supply chain for informal trade with the Dominican Republic (28 percent of total volume); and (v) gourmet, fair trade, and other coffee supply chain for export (2 percent of total volume). The analysis reviewed and rated from 1 (low capacity) to 5 (high capacity) the effectiveness and capacity for managing risks. The resulting matrix provides five tiers of vulnerability (T1 to T5) to the identified risks in terms of their priorities: from risks with the highest vulnerability (T1), to risks with the lowest vulnerability (T5).

Component 4—Recommendations and suggested follow-up actions: The report provides a detailed description of possible measures for risk management based on the diagram above. Potential high priority policies include:

**Improve government and on-farm management practices to reduce annual infestation rates.**

The reduction in yields and quality can be attributed to the increased incidence of diseases and lack of investments. In particular, Scolyte infestation (coffee berry borer, an insect that damages the coffee bean by boring holes in the cherries) has affected production and yields with annual infestation rates ranging from 20 to 50 percent and production losses between 15 and 20 percent. Programs to eradicate this infestation have been cut over the years, including the government agricultural services. In order to control this type of pest a consistent program based on a triple action approach is needed, including cultural, biological, and ecological controls. By adopting all three consistently and rigorously the infection can be greatly reduced.

**Improve capacity of exporters, in particular cooperatives.**

Managerial problems among exporters can affect trade destinations and production. Failures of coffee exporting cooperatives due to managerial, operational and financial problems have affected the volume in the cross-border trade with the Dominican Republic. This risk is considered high since current exports to the Dominican Republic represent 28 percent of Haitian total coffee production and Dominican traders help to set the Haitian coffee price (“café pile”). So any decrease in demand from Dominican traders can lead to a decline in prices paid to farmers since they have no alternative markets but to sell domestically at lower prices.

**The Case of the Guyana Rice Supply Chain Risk Assessment**

Figure 3 summarizes a supply chain risk assessment conducted for Guyana’s rice sector. Agricultural risk management challenges include:

Component 1—Supply chain situation analysis. The number of participants in the supply chain has dropped sharply over the past 30 years due to production consolidations. The number of farmers has dropped from 12,600 in 1978 to approximately 8,000. The number of millers declined from 96 in 2000 to 69 in 2009. Currently, the supply chain of rice is primarily geared towards the export market. Approximately 70 percent of the total rice production is exported. Until 2010, the two major export markets for rice were the European Union (52 percent of total exports) and the CARICOM countries (34 percent). Since 2010, when Guyana’s preferential market access to the European Union was suspended, export destinations have shifted to Jamaica, Trinidad, and Haiti, which currently represent 90 percent of Guyanese rice exports.

Component 2—Risk analysis. Identification and ranking of major risks is based on frequency and impact. The assessment also
evaluates risks for the three actors in the supply chain: farmers, processors (millers), and exporters.

Component 3—Risk management and vulnerability assessment. The assessment identified and classified risks in four categories—production, market, political, and other—and then by levels (high, medium, and low). The resulting matrix classifies vulnerabilities from the highest (T1) to the lowest (T5). The importance of this matrix is that, through a process of prioritization, it is possible to identify those risks in T1 and T2 that are mainly responsible for causing volatility of earnings. Managing these risks will, to a large extent, reduce vulnerability of the rice industry.

Component 4—Recommendations and suggested follow-up actions. The report provides a detailed description of possible measures for risk management based on the risk assessment.

Increase public sector support for flood management.
The increased frequency of severe rainfall events exceeds current capabilities. Greater public sector coordination is needed to support a stronger flood management structure, including additional investments in new infrastructure and in new drainage equipment. Flooding is one of the main causes for rice paddy crop losses. Paddy production is heavily reliant on the effective operation of drainage systems, which are a complex network of canals and secondary canals, many of which are outdated and require major rehabilitation work.

Improve water management at the farm level.
Additional support to farmers is needed to improve operations of the water management system. Improved water management at the farm level can help to solve two vulnerabilities at the same time. First, it will help to reduce the lack of irrigation during rainfall shortages. During dry periods, farmers can pump as much water as they want from the water streams in the irrigation canals; as a consequence, farmers who are located downstream do not have water for irrigation. The government does not have any mechanism to solve this problem. Secondly, improved water management during seasons of excessive rain can help improve crop yields and the management of pest diseases. Excess rain exposes the crop to pests such as rodents and birds increasing the risks of lodging and grain shattering and affecting the final quality.

Improve mapping and targeting of infected regions, especially for red rice infestations.
Sources of red rice are contaminated rice seeds, the existence of red rice seeds in soil, and poor weed management. The incidence of red rice leads to considerable volume and quality losses. An estimated 10 percent infection of red rice weeds reduces yield by 25 percent and crop losses could be as high as 60 percent in heavy field infestation. In 1998, 46 percent of the planted area experienced light red rice infestation, 15 percent experience moderate infestation, and 5 percent experienced high infestation.

Going forward
As the two cases show, in order to improve the competitiveness of agricultural supply chains, it is important not only to look at value added opportunities, but at the improvement in the management of risks that can significantly set back returns from investments. The Rapid Agricultural Supply Chain Risk Assessment methodology is a useful tool, which, complemented with other value chain analyses, can provide the public and private sector with a prioritization of investments and a sense of the magnitude of the potential damage and frequency of various hazards.

Bibliography

About the Authors
Diego Arias Carballo is Senior Agriculture Economist and Laura dos Reis is a Consultant, both in the Agriculture and Rural Development Department (LCSAR)