RAPID AGRICULTURAL SUPPLY CHAIN RISK ASSESSMENT

Conceptual Framework and Guidelines for Application

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Executive Summary

Risk and uncertainty are ubiquitous and varied within agriculture and agricultural supply chains. This stems from a range of factors including the vagaries of weather, the unpredictable nature of biological processes, the pronounced seasonality of production and market cycles, the geographical separation of production and end uses, and the unique and uncertain political economy of food and agriculture sectors, both domestic and international.

Frequently, attention focuses on addressing one type of risk faced by particular stakeholders (e.g. weather risk facing farmers; price risk facing traders), even though supply chain actors are typically inter-dependent and need to manage several different types of risk. This paper provides a conceptual framework and set of detailed guidelines for conducting a more system-wide assessment of risk, risk management, and vulnerability within agricultural (commodity) supply chains. Such assessments would collect and compare risk factors and response opportunities involving the broad range of supply chain participants, including private and public sector support service providers, and the broader enabling environment (e.g., macroeconomic, trade and regulatory policies).

The application of such agricultural supply chain risk assessments should be valuable in multiple contexts, including: (i) as part of sub-sector/value chain competitiveness and strategy development processes; (ii) as an input into the identification/formulation of investment/capacity building projects related to agricultural commercialization, rural finance, export promotion, etc.; and (iii) as an input into sectoral policy/regulatory reform processes.

The assessment is devised as a consultative and time-bound process geared toward providing a ‘first approximation’ of key vulnerabilities and areas requiring priority attention in investment and capacity building. A combination of quantitative data and qualitative information would be sourced and analyzed, with stakeholder consultations being a key component of the exercise. Detailed guidance notes are provided to facilitate sectoral and spatial mapping exercises; risk characterization and identification and stakeholder interviews (See Volume 2). The guidelines assume a ‘rapid’ assessment process, involving a small study/industry team and spanning a period of approximately three months. The assessment tool is designed to deal with crop-based (rather than animal product) supply chains. The broad categories of risks to be investigated will include weather; price; logistics, infrastructure, sanitary/phytosanitary, environment, labor, and policy.
1. **Introduction and Rationale**

1.1 Objectives and Overview

This paper describes the methodology for a Rapid Agricultural Supply Chain Risk Assessment (RapAgRisk) developed by the Commodity Risk Management Group (CRMG) of the World Bank. The primary objective of the RapAgRisk is to help decision makers understand the risk exposure of agricultural supply chain participants and to identify improved risk management strategies for selected commodity systems. RapAgRisk provides a system wide approach to identify risks, risk exposure, the severity of potential losses, and options for risk management by either supply chain participants, (individually or collectively) or by third parties (e.g. government). The essence of the assessment is to understand the wide range of ‘bottlenecks’ and ‘choke points’ that affect different participants and functions related to a given agricultural commodity system. This includes direct supply chain participants, as well as private and public sector support service providers, and the broader enabling environment (e.g., macroeconomic, trade and regulatory policies).

The focus on risk assessment is motivated by the growing attention to agricultural risk among national governments, international agencies, financial institutions, producer organizations, consumer organizations, and other agents in the private sector. Recent food safety ‘crises’, the outbreak and spread of avian influenza, major swings in food and other commodity prices, and growing concerns about climate change are among the many shocks and/or emerging trends that are raising the profile of agricultural risk and interest in more effective and sustainable risk management strategies and approaches.

RapAgRisk is devised as a consultative and time-bound process to be carried out by a small team over an estimated three month period. The assessment will draw upon available data and collect additional data and qualitative information through stakeholder interviews and dialogue. The methodology described in this paper has been designed to collect qualitative and quantitative information for selected agricultural supply chains beginning with input supply, through to farm production, assembly, processing, logistics through to the final consumer. A set of guidelines are included in Volume 2 to facilitate the identification and characterization of different risks and to structure stakeholder exercises.

The following sections offer an operationally focused framework for undertaking assessments of risk and risk management capability within agricultural supply chains in

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1 Acknowledgments to Richard Burcroff (Consultant, World Bank) for contributions to this paper, along with helpful comments from Brian Berman, Mark Sadler, Julie Dana, Joanna Syroka and other colleagues from CRMG.

2 We refer to “agriculture” and “agricultural risk” in terms of the entire “farm to fork” continuum.

3 We refer to “agricultural supply chains” in this report. In the literature, similar terms and concepts are “sub-sector”, “commodity chain”, and “value-chain”. These terms and concepts are all very similar (See Box 3)
developing countries. The paper is structured as follows. Section I outlines the approach and rationale of the risk assessment. In Section II a conceptual framework is laid out, outlining the nature of agricultural supply chains, characterizing the main types of risk that are encountered by participants within those supply chains, and characterizing the range of measures that can be taken to manage such risks. Section III provides a road map and selected guidelines for conducting supply chain risk and risk management assessments. A series of annexes then provide detailed guidelines and suggestions for the conduct of field work and stakeholder interactions.

1.2 Approach and Limitations

The target audience of the risk assessment includes World Bank staff, country-level stakeholders involved in selected agricultural commodity systems, development agency decision makers, and developing country policy-makers. The RapAgRisk is devised to support broader industry/value chain strategy formulation efforts and the identification/formulation of proposals for investment, capacity building and policy/regulatory reform in relation to strategically important agricultural supply chains.

This type of analysis complements other types of risk assessments, including: (i) household or area-based risk assessments, typically focused on the vulnerability of different types of households, the application of (typically) informal risk sharing and coping mechanisms, and the need/scope for supplementary social protection measures, (ii) hazard vulnerability assessments, typically highlighting the potential exposure of national infrastructure and major population groups to natural disasters (e.g. earthquakes, hurricanes, other extreme weather events); and (iii) financial risk assessments, focused on the possible budgetary and other macroeconomic impacts of major ‘shocks’.

Agricultural supply chain risk assessment is thus an ‘intermediate’ level assessment, providing specificity to factors that could weaken the competitiveness, sustainability, and other performance results of key agricultural supply chains (or “sub-sectors”) which, in turn, could threaten the achievement of broader economic development and social stability objectives. There are various contexts in which agricultural supply chain risk assessments should add value, including (i) modules in broader sub-sector/value chain analyses and development/growth strategy processes (ii) constraint/opportunity analysis undertaken in the identification/formulation of development projects focusing on area development, agricultural commercialization, rural finance, export promotion, etc. (iii) planning, implementation, and monitoring of sectoral reform programs, including those involving shifts in the commercial, regulatory, and other roles of governments in particular sectors (iv) investment appraisals by private and development finance institutions or part of strategic assessments of the quality/risk exposure of agricultural lending portfolios; and (v) where stakeholders seek to highlight the prospective impacts

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Most traditional value chain analyses do not address the vulnerability of the chain or of individual actors to various shocks or bottlenecks nor how these affect underlying cost structures, productivity patterns, etc. The adaptability and resilience of the chain and of individual actors are core variables in their sustainability and long-term competitiveness, yet these capacities are not typically analyzed.
of particular risks or trends (e.g. specific weather events; projected climate change) and identify prospective mitigating measures, perhaps in relation to particular objectives.\(^5\)

1.3 Changing Risk Landscape

Risk and uncertainty are ubiquitous and varied within agricultural supply chains. These result from a range of factors including the vagaries of weather, the unpredictable nature of biological processes, the pronounced seasonality of production and market cycles, the geographical separation of production and end uses, and the unique and uncertain political economy of food and agriculture, both domestic and international.

Given the pervasiveness of risks, and massive structural changes in global and national agri-food systems, farmers, agribusiness firms, and governments face new challenges in the design of risk management strategies. Long-standing tools for managing ‘traditional’ risks usually included interventions from governments, such as management of strategic food reserves, the implementation of price stabilization schemes, heavily subsidized crop insurance, and credit guarantee programs (See Box 1). The effectiveness and/or financial sustainability of many interventions has been problematic and has tended to be incompatible with changing patterns in agri-food systems, highlighted for example in the World Development Report 2008 (World Bank, 2008).

**Box 1: Finding Space for Market-based Risk Management Solutions**

Among developing countries, long-standing tools for managing ‘traditional’ risks usually included interventions from governments, such as management of strategic food reserves, the implementation of price stabilization schemes, heavily subsidized crop insurance, and credit guarantee programs. The effectiveness and/or financial sustainability of many interventions have been problematic, plus they tend not to be compatible with emerging strategies for factor and output market liberalization. Although often initiated with a pro-poor bias, in many cases the poor have not been the primary beneficiaries. The quest to develop and apply more market-based risk management solutions was a primary objective behind the creation of the Commodity Risk Management Group (CRMG) in 1999, located in the World Bank’s Agriculture and Rural Development Department (ARD) since 2001.

CRMG/ARD’s work initially focused on diagnosing impacts of price volatility on producers in specific commodities and countries. This was followed by feasibility studies and pilot projects to assist farmers and farmer groups to adopt price risk management measures. Various constraints were faced and CRMG/ARD shifted its focus to providing technical assistance at the ‘meso’ (e.g., banks; commodity traders) and ‘macro’ (local and national) levels for price risk management. In parallel, CRMG/ARD began to address weather risks, pursuing an innovative index-based approach to insurance (based upon use of rainfall data and crop production models) to facilitate compensation for yield losses and linking this with finance by banks and/or traders (see World Bank, 2005). Various pilot projects have demonstrated the potential and limitations of applying this approach, while parallel work has explored new applications of index insurance products and non-financial instruments (e.g., warehouse receipts).

\(^5\) See, for example, Benson (2007) for an analysis of climate-related risks affecting the rice supply chain of the Philippines. See Jaffee et al (2006) for an analysis of the food safety and agricultural health risks associated with several of Uganda’s food/agricultural export supply chains.
In its on-going work, the CRMG/ARD has become increasingly aware of the multiplicity of risks facing agricultural supply chain participants, the inter-dependence these players (and their respective actions), the covariant impact of risk, and, thus, the limitations of ‘silver bullet’ or “one-size-fits-all” solutions. There is an urgent need to better understand underlying conditions including incentives, capacities, and opportunities for the management of risks throughout the supply chain.

Broad structural, demographic and institutional changes, some associated with globalization and the uptake of new technologies, will continue to alter the risk landscape, risk management practices, and their efficacy for different agri-food supply chains. Major changes underway include:

- Rapid urbanization and growth of domestic food markets, with this growth frequently outpacing service infrastructure and the need for market- and health-related regulatory frameworks and enforcement capacities.
- The liberalization of domestic and global factor and product markets, opening up new opportunities for market entry and supply chain relationships, yet exposing farmers and firms to new risks, while forcing them to shoulder the burden of risks previously ameliorated through government programs.
- Major scale back and/or disengagement of public sector funding and involvement in the provision of technical, financial and logistical support services, resulting in changes in the supply for such services, and increased need for proactive actions by the public sector to guarantee availability of affordable access by small farms and firms.
- Changes in demographics, incomes, tastes and preferences, consumer demand and patterns of world trade which present major opportunities for market-oriented production and marketing activity, yet also increase concerns and oversight for managing production and market related risks along with food safety and agricultural health risks. Parallel trends are taking place within developing countries themselves, especially those with burgeoning middle class populations.
- Changes in technology, with some increasing productivity and lowering costs and reducing production risks, yet themselves generating new concerns and potential commercial risks (e.g., GMOs; food irradiation) and their adoption increasing the financial risk of the users.
- Shifts in the competitive structure of markets, with increased concentration in processing, retailing and food service industries and the emergence of global supply chains that depend on more effective production control and logistics management as well as compliance with a broader array of ‘gatekeeper’ requirements. These trends further erode the bargaining power of primary producers.
- Increased competitive advantage for production and marketing that can take advantage of economies of scale and agglomeration, but which also might result in biases toward larger enterprises and more advantaged areas/regions, with huge policy implications for rural development and rural poverty reduction if these areas cannot be successfully integrated in the agri-food monetized markets.
Emerging trends of climate change, which make weather forecasting more complex and prone to inaccuracies, necessitating reactive and adaptive risk management strategies by many players and, over the longer term, shifting patterns of comparative advantage.

The RapAgRisk brings together these structural changes to consider the changing distribution of risks and returns within agri-food systems. The poverty dimension within agri-food systems is of particular significance since changes are typically not to the benefit of smaller producers and firms. The achievement of governmental objectives—say, related to inflation, economic growth, trade, social stability, etc.—may, oftentimes be ‘at risk’ due to the incidence of major shocks or bottlenecks in important food or commodity export sectors. To address these issues the approach of the RapAgRisk assessment is to essentially ask “what can and will go wrong?” In answering that question, the unit of analysis proposed here 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 for a given food/agricultural product (e.g. the corn/maize supply chain includes input suppliers, producers, buyers, processors, etc. all the way to the final consumers of tortillas or breakfast cereals).

Box 2: Selective Management of Risks, Not Management of All Risks

Supply chain risk management is the systematic (i.e. planned) process of managing the most damaging events that can negatively affect the supply chain, and their likely incidence and impact(s). One can adopt a systems-wide perspective; or adopt the perspective of one or more participants inside the supply chain (or ‘external’ players such as financial and other institutions that provide services to supply chain participants). It is very difficult to ‘manage’ risks in a supply chain as no one actor is in full control. An actor can try to understand, mitigate, and perhaps transfer risks to which it is exposed, but to achieve that for the whole chain requires collective action.

A sine qua non of effective risk management is that “You can not protect against every risk --- nor should you try. But, if you can be quick to identify a potential problem, and have thought about the risk and possible risk responses -- in advance, then you can mobilize options if it makes sense. The essence of risk management boils down to adequately appreciating the risks that a {farm or firm} is exposed to for different activities, and identifying the key “choke points” along the supply chain that would completely harm a business and the supply chain if disruption occurs. Identify the correct set of ex-ante measures to allow for protection, remembering to periodically reviewing and assessing what’s happening.” (The Wharton School, 2006)

2 Conceptual Framework

2.1 Agricultural Supply Chains
“Supply chain thinking encourages a system-wide view of the chain – focusing as much on the linkages between technologically separable segments as on the management of processes within those segments (King and Venturini, 2005, p.19).” Thus, an agricultural supply chain encompasses all the input supply, production, post-harvest, storage, processing, marketing and distribution, food service and consumption functions along the “farm-to-fork” continuum for a given product (be it consumed fresh, processed and/or from a food service provider), including the external enabling environment. These functions typically span other supply chains, geographic and political boundaries and often involve a wide range of public and private sector institutions and organizations.

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

- **physical product flows**, which are the physical product movements from input suppliers to producers to buyers to final customers;
- **financial flows**, which are the credit terms and lending, payment schedules and repayments, savings, and insurance arrangements, and
- **information flows**, which coordinate the physical product and financial flows.

Logistics and communications are embedded in all of these flows, and poor logistics and communications are often a major source of risk facing an agricultural supply chain. The underlying objective of agricultural supply chain management is to provide the right products (quantity and quality), in the right amounts, to the right place, at the right time, and at a competitive cost—and to earn money doing so. For governments, there may be broader objectives involved, especially where the supply chain is especially strategic for trade or critical in the domestic food system. These broader objectives might relate to maintaining low inflation, maintaining social stability, sub regional development etc. Agricultural supply chain risk assessments should be designed to illuminate the risks that can endanger achievement of these (and other) performance objectives by farms, firms and the supply chain as a whole.

Supply chain participants can be located domestically or outside national borders. Even within national borders, supply chain participants and activities can be spatially dispersed. Some participants and services are specialized, while others are involved in several different supply chains. Support service providers can be from both the public and private sectors. Logistical support services include transport and communication and information technology. Technical support includes a range of research and business development services, but also technical assistance and financial services. In the global economy, support service providers and the services themselves can easily cross national borders. Figure 1 presents a simple schematic description of an agricultural supply chain.

**Figure 1: Agri Food Supply Chain Framework**
As outlined in Figure 1 the agri-food system includes farmers and a diverse range of firms, including backward-linked input suppliers and forward-linked intermediaries, processors, traders, wholesalers and retailers. The main activities for direct supply chain entities are as follows:

- **Input supply.** This includes the production and distribution of material inputs—such as fertilizer, seeds, packaging, etc.—utilized in the primary production, processing and/or trade of the focal commodity.

- **Farm production.** This stage is concerned with primary agriculture production and ends with the sale of a raw commodity at the farm gate. These transactions may occur literally at 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 processing stage involves the transformation of agriculture 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 and thus this stage may not apply to every crop.

- **Domestic and international logistics.** The logistics stage is concerned with 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. From a domestic perspective this includes: fiscal and financial sector policies, pricing and investment incentives and institutions, the regulatory and legal framework etc. From an international perspective, the enabling environment includes international trade regulations and agreements, other international protocols, and the policies/regulations of nations and trading blocs with whom the focal supply chain sources and sells inputs or products.

It should be noted that the framework is necessarily simplified. In reality, supply chains are more complex, with many participants, with product, finance and information flows often traversing large geographical / international areas and with distinct intra- and inter-seasonal dimensions. Supply chains may also be divided into an array of sub-supply chains, traversing the farm-to-fork continuum (i.e. production to consumption) for specific commodities (or closely associated commodities). It is therefore important to focus on key supply chain participants, flows, and transaction points, and to identify appropriate levels of analysis. Supply chain analyses can be carried out at different levels of analysis (Croom, Romano, and Giannakis, 2000) including : (i) dyadic level: which considers the two party relationship, such as between input supplier producer, producer and buyer, producer and financial institution; (ii) sub-chain level: which encompasses a set of dyadic relationships, such as input supplier and producer, and buyer, and (iii) chain/network level: which is concerned with the entire supply chain and network of operations (backward and forward linkages, horizontal linkages and enabling environment). By sub-dividing the supply chain into dyadic and sub-chain components it might be easier to identify joint interests and potential synergies for risk management, and for finance.
Box 3: Incorporating Risk into Supply Chain Analysis

In recent years there have been numerous assessments made of individual supply (or value) chains in developing country agriculture, frequently as antecedents to investments by governments, donor agencies, or private enterprises. In a developing country context, supply (or value) chain analysis is typically motivated by diverse objectives. In some instances, the central purpose is to promote growth by understanding the competitiveness of the overall supply chain. A method of doing so is to identify existing gaps or inefficiencies, primarily by analyzing the cost structure of the system and perhaps indicators of productivity at different levels. The diagnosis then seeks ways to reduce those costs and/or raise productivity. A second, complementary purpose of supply (value) chain analysis is to understand and improve the position of certain stakeholders within the chain, typically smallholder farmers or SMEs. Interventions would then be targeted at those players or their interfaces with others. Still other approaches emphasis unlocking additional ‘value’ for the entire chain or for individual players, say by achieving better differentiation of the chain’s products or via vertical integration into processing, downstream marketing, and other activities.⁶

In supply chain analyses, “success” is measured in terms of the supply chain’s performance - the ability to deliver a product or service to end markets. This “success”, in turn, depends on access to critical support services; the ways in which firms are organized vertically and horizontally and the structure of relationships among firms; the ways in which firms access information, learning and increased benefit flows, and the power over the terms and conditions of transactions, and the business enabling environment. This is different than the focus on small farmers and household well-being (e.g., poverty analyses) in the 1990s and early 2000s.

Interestingly, conventional analysis seeks to highlight modal or representative cost and productivity indicators, rather than variances over time or between different locales and players. It has not directly addressed the incidence, allocation, and implications of risk nor how incentives to add value amongst, say, smallholders and SMEs might explicitly alter the patterns of risk – which can be substantial, especially when specialization and differentiation are being promoted. Without considering risk, much conventional supply chain analysis does not effectively examine the vulnerability and potential sustainability of existing operations, relationships and positions of competitiveness.

In the face of multiple potential risks, the resilience of primary producers, agribusiness entities, and institutions for collective action, supply chain coordination, and public-private cooperation is a critical consideration. One cannot understand current competitiveness and future potential of a sector without understanding the ability of the players to anticipate and respond to shocks. A commodity sub-sectoral developmental strategy that ignores considerations of risk and risk management will be indeed incomplete. The approach proposed in this paper essentially asks “what can and will go wrong?” In answering that question, one can consider the adequacy of existing risk management measures and supplemental measures and capacity-building needs. Supply chain risk assessments are thus useful supplements to conventional value chain analysis, and modules on this theme should be incorporated as a routine feature.⁷

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⁶ For general information on supply chain analyses and template and case studies, see [http://www.microlinks.org/ev_en.php?ID=9652_201&ID2=DO_TOPIC#vc](http://www.microlinks.org/ev_en.php?ID=9652_201&ID2=DO_TOPIC#vc)

⁷ There are some interesting nascent attempts to formally incorporate risks and risk management into supply chain analyses, with a focus on finance. In USAID (2005c) and USAID (2006), the authors use case studies to focus attention on transactions points among different supply chain participants, and try to identify risks and opportunities.
2.2 Major Risks

An agricultural supply chain may be subjected to or experience multiple risks, with farmers and firms facing risks from different sources. Table 1 portrays different types of risk that may be encountered.

**Box 4: Risk and Uncertainty: Similar Concepts but Different**

The terms risk and uncertainty are both associated with exposure to events that can result in losses. Risk can be defined as imperfect knowledge where the probabilities are known, and uncertainty exists when these probabilities are not known – though the terms are often used interchangeably (see Siegel, 2005). Many of the expected losses from the risks facing modern agri-food systems are really related to uncertain events for which there are no known probabilities, although subjective probabilities can be conjured by expert opinion. So, even if the terms risk and uncertainty are used interchangeably, it is critical to consider whether or not subjective perceptions of probabilities of events taking place are based on risky or uncertain events. For example, only under very restrictive conditions, where information is available on probabilities of events and expected losses are measurable, unwanted events might also be “insurable risks”.

As the discussion which follows indicates, such risks can impact the reliability, costs and efficiency of production, processing and marketing activities. In addition we highlight where particular risks are generally idiosyncratic or covariate for the supply chain.

**Table 1: Categories of Major Risks Facing Agricultural Supply Chains**

<table>
<thead>
<tr>
<th>Type of Risk</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weather Related Risks</strong></td>
<td>Periodic deficit and/or excess rainfall or temperature, hail storms, strong winds</td>
</tr>
<tr>
<td><strong>Natural Disasters</strong></td>
<td>Major floods and droughts, hurricanes, cyclones, typhoons, earthquakes, volcanic activity</td>
</tr>
<tr>
<td><strong>Biology and Environmental Risks</strong></td>
<td>Crop and livestock pests and diseases, contamination related to poor sanitation, human contamination and illnesses, contamination affecting food safety, contamination and degradation of natural resources and environment, contamination and degradation of production and processing processes</td>
</tr>
<tr>
<td><strong>Market Related Risks</strong></td>
<td>Changes in supply and/or demand that impact domestic and/or international prices of inputs and/or outputs, changes in market demands for quantity and/or quality attributes, changes in food safety requirements, changes in market demands for timing of product delivery, changes in enterprise/supply chain reputation and dependability</td>
</tr>
<tr>
<td><strong>Logistical &amp; Infrastructural Risks</strong></td>
<td>Changes in transport, communication, energy costs, degraded and/or undependable transport, communication, energy infrastructure, physical destruction, conflicts, labor disputes affecting transport, communications, energy infrastructure and services</td>
</tr>
<tr>
<td><strong>Management and Operational Risks</strong></td>
<td>Poor management decisions in asset allocation and livelihood/enterprise selection, poor decision making in use of inputs, poor quality control, forecast and planning errors, breakdowns in farm or firm equipment, use of outdated seeds, not prepared to change product, process, markets, inability to adapt to changes in cash and labor flows, etc.</td>
</tr>
<tr>
<td><strong>Policy and Institutional Risks</strong></td>
<td>Changing and/or uncertain monetary, fiscal and tax policies, changing and/or uncertain financial (credit, savings, insurance) policies, changing and/or uncertain regulatory and legal policies, and enforcement, changing and/or uncertain trade and market policies, changing and/or uncertain land policies and tenure system, governance related uncertainty (e.g., corruption), weak institutional capacity to implement regulatory mandates</td>
</tr>
<tr>
<td><strong>Political Risks</strong></td>
<td>Security-related risks and uncertainty (e.g. threats to property and/or life) associated with politico-social instability within a country or in neighboring countries. Interruption of trade due to disputes with other countries. Nationalization/confiscation of assets, especially for foreign investors.</td>
</tr>
</tbody>
</table>
Weather Related Risks

Non-extreme weather events (e.g., too much or little rainfall, or too high or low temperatures) often affect agricultural supply chains for a single growing season and/or production cycle. However, such events can have systemic impacts on decision-making and productivity and market options. These weather-related risks are mostly associated with yield reductions, but also can affect the quality of products (especially hail and wind damage and high humidity/excess rain leading to pests/diseases), and disrupt the flow of goods and services. These non-extreme weather risks are usually associated with a very specific geographic location. That is, they might only directly impact individual supply chain participants, and differentially affect producers in a single community and/or producer group.

Localized impacts on producers’ yield quantity and quality can, in turn, impact their demand for inputs and other support services, ability to repay loans, and also impact buyers and processors upstream in the supply chain. In addition, these weather-related risks might impact logistics along the supply chain because of disruptions in transport, communications and energy services. Importantly, a localized drought can impact farmers in a given area, but upstream buyers, processors and traders might not be impacted because they might be able to transact with producers in non-drought affected areas and/or import commodities to complement or substitute for locally produced products (that have decreased supply). Thus, the overall supply chain might continue performing fairly well, whereas individual farmers (or groups of farmers) suffer from the risk.

Natural Disasters

Natural disasters can affect agricultural supply chains for multiple growing seasons and/or production cycles. These risks normally result in major yield reductions (and subsequent market price increases) and asset destruction that disrupts the flow of goods, services and information in the short-term, and, frequently, also productivity and market relations longer-term. Extreme weather related risks and natural disasters can extend over a wide geographic area. Thus, they can simultaneously directly impact multiple participants in a supply chain, along with service providers and the external environment, albeit with different intensity. These risks invariably impact logistics along the supply chain causing disruptions in transport, communications and energy services. Such risks can seriously impact downstream or upstream participants in the supply chain and/or support service providers and/or the external environment (national or international) and have a ripple effect through the supply chain.

Biological and Environmental Risks

Biological and environmental risks affecting agricultural supply chains are ubiquitous and varied. Some are mostly related to production and or/post harvest reductions in quantity, but many are also related to quality losses. Most biological risks directly affect the supply chain in a single growing season and/or production cycle. They can also have
systemic impacts on decision-making and productivity and market options. Biological risks are mostly associated with yield and quality reductions, but can also disrupt the flow of goods and services. These biological risks are usually associated with a very specific geographic location in the short-term, but can move through the supply chain.

Localized impacts on producers’ yield quantity and quality can, in turn, impact demand for inputs and other support services, ability to repay loans, and also impact buyers and processors upstream in the supply chain. In addition, these risks might impact timeliness of the movement of goods along the supply chain because of disruptions related to testing and certification. The presence of certain plant pests or livestock diseases may impinge upon international market access, not only for the farmers and firms immediately affected but perhaps for the entire country.

Environmental degradation (e.g. soil erosion; pesticide or factory effluent run-off into water supplies) could adversely affect (future) productivity, worker health, or downstream market access (where protocols for environmental management are in place). As more and more commodity supply chains now feature the tracking/recording of raw materials back to their original sources, downstream buyers can no longer claim that they don’t know how these raw materials are produced—i.e. their environmental footprint. The adverse environmental footprint of some production practices therefore constitutes a potential commercial and reputational risk for downstream processors and distributors.

**Market Related Risks**

Agricultural supply chains face important market related risks that can affect a single growing season and/or production cycle, and/or longer periods of time. Market related risks exist for inputs and outputs and for the critical services which support supply chains such as finance and logistics. Generally, market risks are related to issues which affect price, quality, availability, and access to necessary products and services. Of these, price risks are typically the most volatile, particularly in commodity markets where both local and global supply and demand conditions are constantly changing. Price uncertainty has a direct impact on decision-making related to the selection of crops/enterprises and investments which will be made in these activities in the hopes of maximizing profit.

Directly related to price risks are risks associated with quality. Quality is affected by availability of affordable inputs, delivered and applied in a timely fashion and decisions about production, post-harvest and processing practices. One of the characteristics of rural markets faced by many small-scale producers is that premia for higher quality are not passed on—unless sufficient volumes of supply are generated and aggregated to attract the quality-oriented buyer. This typically requires organized, collective action, although such measures are fraught with institutional risk. Producers cannot accept the financial risk of borrowing to upgrade unless the premium market is assured. Finance is required to invest in inputs and improve production practices but unfortunately it is not always accessible and affordable. There are risks associated with decisions to borrow, most serious of which is concern about the ability to repay loans. As a result, the
changing market for financial products also has a direct affect on other functions in the supply chain. Logistics related risks are similar.

Market-related risks vary constantly and are rarely associated with only one specific geographic location. Aspects of market risk may directly impact individual actors in a supply chain, and differentially affect producers in a single community and/or producer group. Managing such risks involves opportunistic attempts to maximize returns based on current conditions. At the same time it is important to realize that decisions made in a given season will impact the range of production, processing, and marketing opportunities available in the future.

**Logistical and Infrastructural Risks**

Agricultural supply chains increasingly face risks related to logistics and infrastructure that affect the availability and timing of goods and services, energy and information. In turn, failures in logistics are transmitted through the agricultural supply chain and can impact product quality and traceability too. Access to reliable and affordable transport, communications, energy and information technology are crucial for decision-making and productivity, the selection of different enterprises, and also for the selection of input and output markets. Thus, logistics related risks are closely related to price and market related risks, including the driving decisions on product lines and input use, which can affect future production, processing, marketing decisions. As mentioned, quality can be affected by lack in and/or poorly functioning infrastructure and services (e.g. power outages for processors). These risks are usually associated with very specific geographic locations. Logistical risks can differentially affect different participants in the supply chain. Conditions related to logistics can impact the demand for inputs and other support services, ability to repay loans, and also impact buyers and processors upstream in the supply chain.

For farmers and intermediary traders, the greatest sources of risk in this category are poor and perhaps seasonally impassable roads, together with intermittent trucking services and poor truck-loading practices (returning in damage/loss of product in transit). Also critical may be weak communications infrastructure and associated gaps in time-relevant market information—weakening commercial strategies and market bargaining power. The poor availability and access to well maintained market centers, collection stations, or other transaction points typically poses further logistical/infrastructural risks.

**Managerial and Operational Risks**

There are numerous managerial and operational risks facing individual chain participants and the chain itself. These risks are closely associated with human judgment and response—i.e. errors and action and inaction, commission and omission. These risks usually directly affect a single chain participant, but can then be transmitted through the

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8 Smallholder farmers typically face a systemic market risk in that their most accessible (localized) markets may be characterized by lack of access to information, poor transport and storage facilities, and low numbers of regularly active buyers.
supply chain. Managerial and operational risks are part and parcel of decision-making by farms and firms. These risks are mostly associated with productivity reductions, and low quality of products, and unreliable delivery (of inputs and outputs, and support services). They might only directly impact individual actors in a supply chain, and differentially affect producers in a single community and/or producer group. Yet, there may be operational failures by one entity which spillover to losses (or lost market access) to many others. For example, consider a farmer that uses a cheap yet presently banned agrochemical and residues for that pesticide are detected by regulatory authorities abroad. This single event could trigger harm to the reputation of the export industry and perhaps even its continued access to remunerative market segments.

Public Policy and Institutional Risks

Policy and institutional risks have major direct and indirect impacts on shaping incentives and decision-making in agricultural supply chains. These risks also have a major impact on the structure of the agri-supply chain and relationships among individual actors and the distribution of rewards and risks within the supply chain and with support service providers and government. Also, these risks are associated with public-private sector dynamics. There are anticipated “changes in the rules of-the-game”, uncertainty about changes in the rules themselves, and uncertainty whether or not the rules will be enforced in an efficient, equitable and transparent manner.

These risks have systemic impacts on decision-making and productivity, and market options. Because incentives can change (including the distribution of rewards and risks in the supply chain) these risks can result in changes in yield quantity and quality, and even lead to disruptions in the flow of goods, services, information and cash. These risks are sometimes articulated to benefit (or “tax”) a specific supply chain and/or geographic location. Thus, they might only directly impact certain participants in a supply chain and/or support service providers, and differentially affect producers in a single community and/or producer group. Impacts on individual chain participants can, in turn, have unexpected ripple effects through the supply chain.

Order of Risk Magnitudes

As noted above, the incidence and severity of different types of risks encountered in agricultural supply chains will vary considerably among different countries and among distinct locales within those countries—given underlying climatic conditions, geography/topography, demographics, and agrarian and industry structures. The relative importance of different types of risks will also vary among supply chains for different commodities, resulting from specific “technical” properties (i.e. their perishability/storability), prominent features of their markets, and trends in regulatory developments and consumer preferences (see Jaffee, 1995).

Table 2 below provides an ‘order of magnitude’ illustration of the relative importance of different types of risks potentially affecting an export-oriented supply chain from a
developing country—whose primary market orientation is higher income industrialized countries. The different types of risk are assigned a rating of either ‘high’, ‘medium’, or ‘low’. Some of these risk ratings would be substantially different for certain categories if the focal supply chain were exporting to neighboring or other developing countries. For example, concerns about sanitary/phytosanitary risks and about environmental/social dimensions of production could be decidedly lower.

Table 2: Prominent Risks Affecting Developing Country Commodity Supply Chains Involved in Trade with Major International Markets

<table>
<thead>
<tr>
<th></th>
<th>Price Volatility of Commodity</th>
<th>Loss of Product (Quality) Due to Logistical Breakdown</th>
<th>Market Access Constrained by SPS Concerns</th>
<th>Adverse Weather Disrupting Production</th>
<th>Market Concern With Environmental or Social Dimensions of Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Cocoa</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Oil Palm</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Cotton</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Rice</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Tobacco</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Sugar</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>Maize</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>Spices</td>
<td>M</td>
<td>L-M</td>
<td>M</td>
<td>L-M</td>
<td>L</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Tea</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>Fruit</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>M-H</td>
<td>L</td>
</tr>
<tr>
<td>Vegetables</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>M-H</td>
<td>M</td>
</tr>
<tr>
<td>Cut Flowers</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>L-M</td>
<td>M</td>
</tr>
<tr>
<td>Beef</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Fish</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
</tr>
</tbody>
</table>
While there are limits to this type of categorization—and several individual ratings are clearly debatable—this formulation signals that agricultural supply chain risk assessments need not and should not devote equal attention to the broad range of potential risks. For most commodities, certain types of risk are expected to be more prominent and others less so. This should affect the relative emphasis given to different types of quantitative and qualitative analysis. For example, the volatility of international market prices (including periodic sharp downturns in those prices) is a prominent source of risk for producers and traders of most grain and oilseed commodities, and traditional beverage and industrial crops. For some industrial crops and for a range of perishable, higher value products, price risk, per se is a less important risk. For the latter, the higher order risks more commonly relate to logistics and to compliance with food safety and/or plant/animal health requirements.

2.3 Transmission of Risks

Attention is usually focused on individual participants in the supply chain. Yet, as the above discussion highlights, it is important to examine how risks and risk response are transmitted through the agrifood supply chain. Some adverse events are only experienced ‘locally’ by particular supply chain participants (i.e., “idiosyncratic supply chain risks”). Other participants may be unaffected, or they may be beneficiaries (due to lower prices for their own inputs or higher demand for their services). Other risks have snowball effects, impacting prevailing conditions of factor and product market demand and supply for other parties (e.g., “covariate supply chain risks”). The manner in which supply chain participants go about managing the risks that they face can help or hinder the risk management efforts of other participants. Thus risks and risk management in a given supply chain are linked and this requires a systems approach that considers the distribution and transmission of risk.

The supply chain risk assessment focuses on the distribution and transmission of different risks among individual participants and between participants. Table 3 below provides a simplistic rendering of how different risks, experienced by primary agricultural producers, can transmit themselves to the operations of input suppliers and entities involved in the collection, processing, trading and final distribution of food and agricultural commodities. One could also consider other patterns of risk transmission. For example:

- When a processor experiences a sustained power outage, this may transmit “backward” to reduced market opportunities for farmers and brokers and transmit “forward” to unfulfilled trade orders and, subsequently, half-empty retail shelves.
- Alternatively, the power outage could affect the stored raw materials or other (perishable) ingredients held by the processor, resulting in a contaminated food product that causes consumer illness and a product recall affecting traders and distributors.

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9 For example, the ratings pertaining to the risk of adverse weather incorporate assumptions about the ‘typical’ agricultural technologies used, especially irrigation. The lower ratings for sugar and cut flowers are thus because sugarcane is almost always grown with irrigation while cut flowers are prominently grown under controlled conditions (e.g. greenhouses).
• When an exporter encounters an interruption in or unexpected steep price increases for international logistics, this may transmit “backward” to reduced demand or lower prices for farmers, intermediaries and/or processors. This sharp price drop may discourage farmers from planting the crop the following season, resulting in multi-year reductions in exports, or exaggerated movements in supply cycle highs and lows.

• Consider when unseasonal rains and flash floods inundate a production area (say for groundnuts or maize). This event may have multiple repercussions. Intermediary traders may have difficulty accessing the production area, reducing the (timely) availability of the crop for processors/millers. The wet conditions may result in improper crop drying/storing, leading part of the crop to be non-compliant with buyer (moisture content) requirements and part of the crop developing fungal or bacterial contamination and being subsequently rejected by regulatory authorities abroad.

• Consider a scenario where an unusual plant pest outbreak occurs just prior to harvest time. In the main growing area farmers salvage the crop by extensive spraying of a pesticide that is banned in Europe. The biological risk is thus managed. Yet, high residues of this pesticide show up in the delivered crop. Traders are unable to sell the crop to Europe where the buyers and regulatory authorities are monitoring pesticide residues. The crop is then sold at a large discount domestically or in other less demanding export markets and/or large unsold stocks are built up.

These are just a few examples. Many other hypothetical and real examples of risk transmission could be identified. What these examples illustrate is the need to more fully understand the potential inter-linkages among risks that derive from the interdependency of supply chain participants and functions. Also, some examples above indicate, there could be circumstances in which the risk management measures taken by certain parties actually generate additional/different risks for other supply chain members. It is also important to recognize that risks can be transmitted between supply chains. Volatility in one supply chain may affect other supply chains for complementary or substitute products and lead to shifts in production, marketing and consumption patterns.

Volatility or disruptions in important agricultural supply chains may also pose risks to the achievement of governmental objectives. For example, weather-induced shortfalls in the production of a major staple food could trigger sharp increases in domestic food prices, raising overall inflation levels, threatening the food security of segments of the population, and causing social unrest in urban (and rural) areas.
<table>
<thead>
<tr>
<th>RISK</th>
<th>Input Suppliers</th>
<th>Farmers</th>
<th>Buyers</th>
<th>Processors</th>
<th>Traders</th>
<th>Distributors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weather Related Risks</strong></td>
<td>Demand for inputs Repayment for inputs on credit</td>
<td>Planting decisions</td>
<td>Availability, price, quality of products Logistic costs</td>
<td>Availability, price, quality of products Logistic costs</td>
<td>Availability, price, quality of products Logistic costs</td>
<td>Availability, price, quality of products Logistic costs</td>
</tr>
<tr>
<td><strong>Natural Disasters</strong></td>
<td>Demand for inputs in this and subsequent year Repayment for inputs on credit</td>
<td>Yield and quality</td>
<td>Availability, price, quality of products Logistic costs</td>
<td>Availability, price, quality of products Logistic costs</td>
<td>Availability, price, quality of products Logistic costs</td>
<td>Availability, price, quality of products Logistic costs Costs to develop new supply sources</td>
</tr>
<tr>
<td><strong>Biological and Environmental</strong></td>
<td>Demand for inputs Repayment for inputs on credit</td>
<td>Input use Yield and quality Production costs Income decline</td>
<td>Availability, price, quality and safety of products Next to screen/test supplies</td>
<td>Availability, price, quality of products; Brand reputation; Market access</td>
<td>Availability, price, quality of products; Brand reputation Market access</td>
<td>Availability, price, quality of products; Brand reputation; Product liability Need to procure from alternative sources</td>
</tr>
<tr>
<td><strong>Market Related Risks</strong></td>
<td>Demand for inputs Repayment for inputs on credit</td>
<td>Planting decisions</td>
<td>Availability, price, quality of products</td>
<td>Availability, price, quality of products</td>
<td>Availability, price, quality of products</td>
<td>Availability, price, quality of products</td>
</tr>
<tr>
<td><strong>Policy and Institutional Risks</strong></td>
<td>Demand for inputs Repayment for inputs on credit</td>
<td>Planting decisions</td>
<td>Availability, price, quality of products Operating costs Ability to Intermediate</td>
<td>Availability, price, quality of products Availability other products Need to procure from alternative sources Operating costs</td>
<td>Availability, price, quality of products Need to procure from alternative sources Operating costs</td>
<td>Availability, price, quality of products Need to procure from alternative sources Operating costs</td>
</tr>
<tr>
<td><strong>Logistics Related Risks</strong></td>
<td>Demand for inputs in current and subsequent year (or season)</td>
<td>Input access and use Yield and quality Post harvest losses Income decline</td>
<td>Availability, price, quality of products Availability of price of other products Operating costs</td>
<td>Availability, price, quality of products Availability other products Need to procure from alternative sources Operating costs</td>
<td>Availability, price, quality of products Availability of price of other products Operating costs</td>
<td>Availability, price, quality of products Availability of price of other products Operating costs</td>
</tr>
<tr>
<td><strong>Management and Operational Risks</strong></td>
<td>Demand for inputs in current and future years</td>
<td>Inappropriate decision and input use Reduced yield and quality</td>
<td>Availability, price, quality of products Operating costs</td>
<td>Availability, price, quality of products Operating costs Product liability Operating costs</td>
<td>Availability, price, quality of products Operating costs Product rejections and market access</td>
<td>Availability, price, quality of products Operating costs Loss of brand reputation; market or regulatory sanctions</td>
</tr>
</tbody>
</table>
2.4 Risk and Vulnerability

Risky events can be characterized by their magnitude, scope or spread, frequency and duration, and their history – all of which affect vulnerability. Risks can be classified as idiosyncratic risks that usually affect only individual farms or firms (e.g., plant and animal pests and diseases, illness of owner or laborers) and covariate risks that affect many farms and firms simultaneously (e.g., major droughts or floods, fluctuating market prices). The high propensity of covariate risks in rural areas is a major reason that informal risk management arrangements break down and that formal locally based financial institutions are hesitant to provide commercial loans for agriculture (Skees, Hazell, and Miranda, 1999; Skees and Barrett, 1999).

Risk is the possibility that an event will occur that will potentially have a negative impact on the achievement of a farm or firm’s performance objectives, and/or successful functioning of the overall supply chain. The exposure of farms and firms (hereafter ‘enterprises’) to risk depends on various factors, notably their assets and their allocation via livelihood and/or business strategies. An enterprise’s assets and their allocation, (crop and livestock mix, diversification of activities--farming, off-farm and non-farm) influences exposure to risk, and these allocation decisions are also influenced by risks. In addition, the allocation of assets and exposure to risk determine the severity of risk-related impacts. By combining the likelihood of risk, risk exposure and the severity of risky events, it is possible to estimate expected losses from a risky event for different participants in the supply chain as well as the cumulative losses throughout the chain. Indeed, researchers and practitioners examining exposure to risk have identified a set of key factors:

- **Inherent commodity characteristics**: product perishability complicates exposure to market and logistical risks. Commodity ‘quality’ may have both observable and non-observable characteristics, impacting on managerial and operational risks.
- **Inherent production characteristics**: technically sophisticated production processes and greater ‘specificity’ of production assets may exacerbate operational and market risks,
- **Geography and agro-ecology**: logistically remote and/or otherwise difficult terrain increases risk exposure, as due agro-climatic conditions conducive for pests and diseases,
- **Political boundaries**: border controls and crossing procedures add to risk exposure,
- **Transaction points**: the number of transport nodes and transaction points and the frequency of use influence risk exposure, as does the number of “compliance points”,
- **Infrastructure conditions**: the condition of transport, communications, energy water and sanitation infrastructure and their availability influences risk exposure.

**Expected losses** from a risky event include both tangible and intangible losses, and short- and longer-terms losses. It is critical to consider losses in terms of how they affect short-term outcomes (e.g., a decline in producer prices after harvest), versus livelihoods and outcomes in the longer term (e.g. a decline in the water table that impacts planting decisions and yields in the future). Thus, in addition to examining whether risks are idiosyncratic or covariate to the supply chain, it likewise is important to examine if they

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10 This relates to the aggregate (or whole enterprise) exposure to risk rather than within a single commodity chain.
impact performance flows (e.g., movement of goods and services, incomes) and/or also damage assets. For example, non-payment of a loan or failure to achieve quality standards or timely delivery can result in the termination of future supply contracts, compromise of business reputation and loss of access to credit and other supply services.

The expected losses are a function of probability of a risky event actually occurring and the exposure to that risky event, i.e. how performance outcomes might be influenced if the risk materializes. The expected losses are another way of considering the potential severity of negative impacts from a given risk, without any (ex ante or ex post) risk management. Some risky events will have low probability with low negative impacts and low expected losses; others will have high probability with high negative impacts and high expected losses. Still others could entail more intermediate expected losses (high probability and low expected loss or low probability and high expected loss) (Table 4).

Table 4: Expected Loss Scenarios (Probability x Severity)

<table>
<thead>
<tr>
<th>Probability of Occurrence of Event</th>
<th>Potential Severity of Negative Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td></td>
</tr>
<tr>
<td>Low Probability High Impact</td>
<td>High Probability Low Impact</td>
</tr>
<tr>
<td>Low Probability Low Impact</td>
<td>Low Probability High Impact</td>
</tr>
<tr>
<td>High Probability High Impact</td>
<td>High Probability High Impact</td>
</tr>
</tbody>
</table>

Based on Smith (2005)

Box 5: Risks and Potential Risk Impacts

In the recent literature on supply chain risk, a distinction has been made about the relationship between risks and potential risk impacts. Gaonkar and Viswanadham (2004) classify three major “scenarios” of expected losses emanating from risks faced by supply chains (and participants within supply chains) according to severity of their potential negative impacts on the supply chain. This includes (i) Deviations: Fluctuations in key parameters (such as costs, demand, logistics) that lead to performance that differs from the expected value, but without changes to the underlying supply chain structure (ii) Disruptions: Changes in the structure of the supply chain due to the non-availability of certain production, processing, marketing, distribution facilities--arising from risk events caused by natural or human factors. These events are unexpected, as is the risk management e.g. disruptions in supply due to a fire (external and/or internal to farm/firm); disruptions in supply due to a pest or disease outbreak/epidemic (internal and/or external to farm/firm); labor strikes at farm or firm, or at ports (internal and/or external to farm/firm) (iii) Temporary and/or permanent shut-down of parts or all of the supply chain (external and internal to farm/firm).

Table 5 provides an illustration of how different supply chain actors could be (differentially) impacted by a single risk event—in this case a shortfall of rain during a key part of the maize growing cycle.
The vulnerability of individual chain participants and the overall supply chain depends on the nature of the risks (correlation, frequency and timing, and severity) and the effectiveness of the risk management instruments in use. Risk, combined with the farms’ and firms’ modus operandi including their risk management responses, lead to performance outcomes. The magnitude, timing and history of risks and the timing and effectiveness of responses determine the outcome. For the farm or firm, and the supply chain as a whole, the outcome of the risk and response process, in terms of performance loss relative to a given benchmark, is an indicator of major interest. To make the concept of vulnerability useful, appropriate performance benchmarks need to be selected for each participant in the supply chain.

Table 5: Illustration: Differential Impact of ‘Insufficient Rainfall’ Affecting Maize

<table>
<thead>
<tr>
<th>Supply Chain Participant</th>
<th>What is exposed to risk?</th>
<th>Risky Event</th>
<th>Consequence</th>
<th>How Impact is Manifested</th>
<th>Expected Magnitude of Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Farmer</td>
<td>Rain-fed Maize Production</td>
<td>No Rains in Key Month</td>
<td>30% Decreased Yield, Lower Water Table</td>
<td>Lower Income, Limits Planting for Next Year</td>
<td>Medium Income Loss</td>
</tr>
<tr>
<td>Large Farmer</td>
<td>Irrigated Maize Production</td>
<td>No Rains in Key Month</td>
<td>Need to Increase Irrigation</td>
<td>Increased Irrigation Costs (electricity and labor)</td>
<td>Minimal Income Loss</td>
</tr>
<tr>
<td>Food Processor</td>
<td>Maize Purchases for Milling</td>
<td>No Rains in Key Month</td>
<td>10% Less Maize Available for Purchase</td>
<td>Higher Costs for Maize</td>
<td>Minimal Income if cost increases can be passed on</td>
</tr>
</tbody>
</table>

Adapted from Harland, Brenchley, Walker (2003)

However, risk-related performance losses for individual participants in the supply chain are neither necessary nor sufficient conditions for the existence of supply chain vulnerability. Such vulnerability is only associated with those losses that disrupt the flow of products in a manner which causes serious damage to the supply chain. To illustrate: yield declines, cost increases, and/or price declines resulting in income losses are not, in and of themselves, sufficient to determine farm or firm disruptions or closure and supply chain vulnerability. Only when the resultant income loss is so severe that it forces the farm or firm below some minimum performance standard, perhaps resulting in production and delivery losses that can’t be made up elsewhere in the chain, can an individual farm or firm substantially harm performance of the broader supply chain.

The farm or firm specific performance standards (benchmark indicators) should thus be based on objectives relevant for sustainable participation in the supply chain.\textsuperscript{11} Resilience

\textsuperscript{11} For example, if a farmer suffers a 20% yield shortfall, he/she might not be able to satisfy their supply contract and/or not be able to repay their loan. This could, in turn, mean that the farmer not only loses income in the current production cycle, but is excluded from future supply contracts and inputs on credit.
is the farm or firm’s ability to resist the potential negative impacts of risky events – especially when assets are degraded-- and the extent to which they can recover from negative impacts of risky events. An overall supply chain can also have greater or lesser capacities of resilience.\textsuperscript{12} Given the differing portfolios of assets among and between farms and firms, the same risky event can have different performance outcome effects. Similarly, farms and firms with similar assets but differing risk management responses might experience dissimilar outcomes.

Table 6 illustrates a continuum of vulnerability conditions. If capacity to manage risks is low, farms and firms facing high expected losses could, in fact, be vulnerable to profound disruptions that would curtail their ability to participate effectively in the supply chain. Yet, even when exposed to the same risky event, impacts will vary, depending on the farm or firm (or supply chain’s) capacity to manage risk.

Table 6: Vulnerability: Expected Losses and Capacity to Manage Risk

<table>
<thead>
<tr>
<th>Expected Loss</th>
<th>Capacity to Manage Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Low Vulnerability</td>
</tr>
<tr>
<td>Low</td>
<td>High Vulnerability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected Loss</th>
<th>Capacity to Manage Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Low Vulnerability</td>
</tr>
<tr>
<td>Low</td>
<td>Very Low Vulnerability</td>
</tr>
</tbody>
</table>

2.5 Risk Management Measures\textsuperscript{13}

2.5.1 Ex-ante vs. Ex-post Measures

Approaches to risk management can be articulated as \textit{ex ante} or \textit{ex post} strategies. \textit{Ex ante} actions are taken before a risky event occurs, and \textit{ex post} management takes place after its realization. \textit{Ex ante} risk management includes:

- **Risk Prevention or Reduction** – actions taken to eliminate or reduce risky events from occurring,
- **Reducing Exposure to Risk** – given the existence of risks, there are actions to reduce exposure to such risks, and
- **Risk Mitigation** – actions that will trigger compensation in the case of a risk-generated loss (e.g., social contracts, holding of savings, purchasing insurance).

\textit{Ex ante} actions can reduce risk (e.g., eradication of pests) or lower exposure to risks (e.g., pest resistant varieties, crop diversification). \textit{Ex ante} risk mitigation can also be realized through the purchase of insurance, and by other responses to expected losses such as self-insurance (e.g., precautionary savings) or reliance on social networks (for e.g. access to community savings). In most cases, mitigation will only partially compensate for actual

\textsuperscript{12} Resilience is a capacity to adjust on an inter-seasonal or inter-annual basis. One can also consider supply chain agility—i.e. the capacity to make immediate adjustments to cope with unfolding events. This might involve changes in the flow of products, use of substitute products and suppliers, etc.

\textsuperscript{13} This section draws on concepts presented in Heitzmann, Canagarajah, and Siegel (2001); and Siegel (2005).
losses. In addition, ex-ante risk management actions have real and or opportunity costs associated with them. This is a major constraint, especially for asset and income constrained farms and firms.

Ex post activities cope with realized losses by e.g. selling assets, seeking temporary employment, and migration. Additionally, governments sometime forgive debts and provide other types of bailouts, or provide formal safety nets, such as subsidies, rural works programs and food aid to help farms and firms (and their laborers) cope with negative impacts associated with risky events. Some short-term risk coping strategies often have longer-term negative impacts on assets, livelihood/enterprise strategies and achieving performance objectives. Thus, some coping activities result in selling or degradation of assets and/or increased debt, which, in turn, results in a negative dynamic (that can even lead to an inability to participate in the supply chain).

Thus, ex ante measures allow farms and firms to eliminate or reduce risks, lower risk exposure, and/or mitigate against the losses associated with risky events. But, they have a real and/or opportunity costs BEFORE a risky event actually occurs. In contrast, ex post risk management actions and instruments only respond to realized risk-related losses, but can have very high real and opportunity costs after a risky event occurs. Whatever strategies are taken to respond to anticipated risky events, a variety of different instruments is available within each strategy, and all have different private and public costs and benefits, which might either increase or decrease vulnerability of individual participants and the supply chain. When selecting a mix of risk responses it is essential to take account of the many inter-linkages between different types of risk management strategies and instruments.

2.5.2 Location and Formality of Risk Management

The risks affecting agricultural supply chains can, potentially, be managed at different points and by different players. For example, risks may be managed:

- By individual farms and firms, through enterprise strategies, various management practices, etc.;
- In their interface with other supply chain participants, via transactions, contractual arrangements, information flows, etc., with some distribution or sharing of risk with those players;
- At a meso level, e.g. through joint action with other farmers and firms (i.e. through community networks, farmer groups or cooperatives; industry associations, etc.); and/or
- At a macro or external level where players ‘outside’ of the specific supply chain—including banks, insurance companies, government agencies, donor agencies—share or absorb part or major elements of the risk through various financial instruments, physical stock-holding, and other means.

It is also useful to consider the formality of the risk management arrangements. There are private informal arrangements that reflect self-insurance by farms and firms through personal arrangements or management measures. Many types of informal risk-sharing
measures are also adopted at the community level in developing countries. Table 7 provides a few examples of informal risk management measures at farm and community levels.

**Table 7: Informal Risk Management Strategies**

<table>
<thead>
<tr>
<th></th>
<th>Farm Household-level (mitigating risk)</th>
<th>Community-level (sharing risk)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex-ante</strong></td>
<td>Savings</td>
<td>Food crop sharing</td>
</tr>
<tr>
<td></td>
<td>Buffer Stocks</td>
<td>Common property resource management</td>
</tr>
<tr>
<td></td>
<td>Enterprise diversification</td>
<td>Social reciprocity</td>
</tr>
<tr>
<td></td>
<td>Low risk, low return cropping patterns</td>
<td>Rotating savings/credit</td>
</tr>
<tr>
<td></td>
<td>Production techniques</td>
<td></td>
</tr>
<tr>
<td><strong>Ex-post</strong></td>
<td>Sale of assets</td>
<td>Sale of assets</td>
</tr>
<tr>
<td></td>
<td>Reallocation of labor</td>
<td>Transfers from mutual support networks</td>
</tr>
<tr>
<td></td>
<td>Reduced consumption</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Borrowing from relatives</td>
<td></td>
</tr>
</tbody>
</table>

Private formal arrangements involve various types of contracting and/or use of financial instruments. Some formal risk management measures are publicly mandated or implemented, including mandated (and sometimes subsidized) insurance, credit guarantees, transfers or public works, etc. These are provided when private informal or formal arrangements have broken down, are dysfunctional, are considered to be inappropriate, simply do not exist, or are not sufficient to meet policy specific objectives. Table 8 indicates a range of formal risk management measures.

**Table 8: Formal Risk Management Measures**

<table>
<thead>
<tr>
<th></th>
<th>Market-based (share/transfer risk)</th>
<th>Publicly-provided (transfer/absorb risk)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex-ante</strong></td>
<td>Contract marketing</td>
<td>Pest/disease management</td>
</tr>
<tr>
<td></td>
<td>Financial hedging tools (options)</td>
<td>Physical crop/food stocks</td>
</tr>
<tr>
<td></td>
<td>Traditional insurance</td>
<td>Price guarantees or stabilization funds</td>
</tr>
<tr>
<td></td>
<td>Weather-index insurance</td>
<td>Input subsidies</td>
</tr>
<tr>
<td></td>
<td>Contingent funds for disaster relief</td>
<td>Public insurance</td>
</tr>
<tr>
<td><strong>Ex-post</strong></td>
<td>Savings</td>
<td>Disaster assistance</td>
</tr>
<tr>
<td></td>
<td>Credit</td>
<td>Social funds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cash transfers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waiver (cancellation) of crop loans</td>
</tr>
</tbody>
</table>
2.5.3 Alternative Instruments for Managing Agricultural Supply Chain Risk

An array of approaches and instruments that are available to help manage risks in an agricultural supply chain. These can be grouped into several broad categories, namely:

- **Technology development and adoption**: Agricultural research and development of improved varieties and breeds, post harvest technology, software development, information and knowledge technology, basic and advanced applied education programs.

- **Enterprise management practices**: Farm and firm diversification practices, farming systems approaches, just-in-time management, inventory control, improved forecasting capacity, food safety practices, certification of “best practices”, logistics planning, early warning systems, etc.

- **Financial instruments**: Credit and savings (formal and informal), insurance (formal and informal), warehouse financing, price hedging instruments, etc.

- **Investments in infrastructure**: Investments in transport and communication infrastructure (including air and sea ports), energy infrastructure, informatics and knowledge transfer infrastructure, storage and handling facilities, marketplaces, processing facilities, weather stations, etc.

- **Policy and Public Programs**: Institutional arrangements: and regulatory measures, government policies, property and human rights, labor laws, disaster management units, safety nets, etc.

- **Private Collective Action**: Commercial and non-commercial actions taken by farmer groups, cooperatives, industry associations, etc. plus various types of commercial contractual arrangements and partnerships.

Multiple strategies are typically combined as no single approach or instrument can effectively reduce, mitigate, or transfer the broad range of risks encountered. As noted above, these strategies may need to be supplemented by ex-post coping following adverse events, perhaps through the sale of assets, down-scaling of farm/firm operations, temporary migration, or other means. Table 9 provides a detailed listing of these alternative instruments, sub-divided between their broad objective and the locus within (or outside) the supply chain where the measures can be applied. Apart from categorizing the different kinds of instruments, the levels and providers, it is important when conducting a RapAgRisk assessment to fully understand, and if possible, to scale or quantify the effectiveness of these instruments in relation to the underlying risks, risk exposure, and expected losses.\(^\text{14}\)

---

\(^{14}\) As outlined above, this would enable analysts and stakeholders to distinguish between circumstances where (i) there is high risk exposure yet adequate mechanisms in place (e.g., low vulnerability), (ii) there is high risk exposure yet weak/highly unsatisfactory risk management (e.g. high vulnerability), and (iii) there is lower risk exposure/severity and adequate risk management measures (e.g. low vulnerability). Those circumstances determined to involve “high vulnerability” would then be focal points for in-depth examination and subsequent remedial action(s).
Table 9: Possible Instruments for Risk Management for Agricultural Supply Chains

<table>
<thead>
<tr>
<th>Risk Reduction or Mitigation</th>
<th>Supply Chain Specific Production, Marketing, Processing</th>
<th>Support Service Providers</th>
<th>External to Supply Chain:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investments in Infrastructure</td>
<td>Farm machinery and equipment</td>
<td>Machinery + equipment</td>
<td>Weather stations</td>
</tr>
<tr>
<td></td>
<td>Irrigation + drainage systems</td>
<td>Water + sanitation</td>
<td>Early warning systems</td>
</tr>
<tr>
<td></td>
<td>Water + sanitation</td>
<td>Storage + handling facilities</td>
<td>Large-scale transport, communication, energy infrastructure</td>
</tr>
<tr>
<td></td>
<td>Storage + handling facilities</td>
<td>Maintenance of physical assets</td>
<td>Back-up systems for critical infrastructure</td>
</tr>
<tr>
<td></td>
<td>Maintenance of physical assets</td>
<td>Enterprise-évè transport, communication, + energy infrastructure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small transport, communication + energy infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>Adopt new technology (improved varieties and breeds)</td>
<td>Adopt new logistics or processing technology</td>
<td>Investments in research and development (e.g., CGIAR)</td>
</tr>
<tr>
<td></td>
<td>Adopt other improved inputs</td>
<td>Information services to producers</td>
<td>Global centers of excellence for research and education</td>
</tr>
<tr>
<td>Management Practices</td>
<td>Food/livestock stocks</td>
<td>Food/raw material inventories</td>
<td>Macroeconomic management</td>
</tr>
<tr>
<td></td>
<td>Crop + livestock diversification</td>
<td>Enterprise + market diversification</td>
<td>Trade and market policies</td>
</tr>
<tr>
<td></td>
<td>Farming systems approach</td>
<td>Seek alternative buyers and suppliers</td>
<td>Inspection/testing services for food safety</td>
</tr>
<tr>
<td></td>
<td>Disease and pest management practices</td>
<td>Adopt and promote best practices for food and occupational safety</td>
<td>Regulate best practices for human health and safety on farm</td>
</tr>
<tr>
<td></td>
<td>Improve farm hygiene</td>
<td></td>
<td>Education + information for risk management</td>
</tr>
<tr>
<td>Financial Instruments</td>
<td>Precautionary savings</td>
<td>Insurance Price hedging Warehouse receipts</td>
<td>Regulatory and legal rules for financial system (credit, savings, insurance)</td>
</tr>
<tr>
<td></td>
<td>Crop/livestock insurance</td>
<td>Access and provide credit for risk-reducing inputs and investments</td>
<td>Subsidize select financial instruments for risk management</td>
</tr>
<tr>
<td></td>
<td>Access informal and formal credit for risk-reducing inputs and investments</td>
<td>Provide flexible financial services</td>
<td>Global financial markets</td>
</tr>
<tr>
<td>Policy and Public Programs</td>
<td>Community projects and public insurance</td>
<td>Extension services</td>
<td>Global insurance and reinsurance markets</td>
</tr>
<tr>
<td></td>
<td>Extension services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Collective Action</td>
<td>Contract farming mutual insurance</td>
<td>Contracting Cooperative Organizations</td>
<td>International commodity agreements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>International development agencies</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Coping</td>
<td>Supply Chain Specific Production, Marketing, Processing</td>
<td>Support Service Providers</td>
<td>External to Supply Chain:</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>---------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td><strong>Investments in Infrastructure</strong></td>
<td>Repair and/or replace infrastructure</td>
<td>Repair and replace services</td>
<td>Fund repair and replacement of infrastructure</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Repair and/or replace infrastructure</td>
<td>Repair and replace services</td>
<td>Investments in new transport + communication infrastructure</td>
</tr>
<tr>
<td><strong>Management Practices</strong></td>
<td>Alter technology for future application</td>
<td>Adopt and promote new technology for future</td>
<td>Develop and promote and adopt new technology for future</td>
</tr>
<tr>
<td><strong>Financial Instruments</strong></td>
<td>Consume/don’t sell products</td>
<td>Seek alternative suppliers and buyers</td>
<td>Provide information on alternative suppliers and buyers</td>
</tr>
<tr>
<td><strong>Policy and Public Programs</strong></td>
<td>Sell off financial assets and stocks</td>
<td>Sell off other productive assets</td>
<td>Provide information on alternative suppliers and buyers</td>
</tr>
<tr>
<td><strong>Private Institutional and Organizational</strong></td>
<td>Sell off other productive assets</td>
<td>Provide emergency financing</td>
<td>Provide advice on new products and markets</td>
</tr>
<tr>
<td><strong>Safety net and credit mechanisms</strong></td>
<td>Non-repayment of loans</td>
<td>Purchase financial assets and stocks from supply chain actors</td>
<td>Provide loan repayment plans</td>
</tr>
<tr>
<td><strong>Safety net and credit mechanisms</strong></td>
<td>Non-repayment of loans</td>
<td>Develop and promote and adopt new technology for future</td>
<td>Loan Forgiveness Financial bailouts Emergency disaster funds</td>
</tr>
<tr>
<td><strong>Safety net and credit mechanisms</strong></td>
<td>Non-repayment of loans</td>
<td>Charity or aid from national organizations and institutions</td>
<td>Charity or aid from international organizations and institutions</td>
</tr>
<tr>
<td><strong>Safety net and credit mechanisms</strong></td>
<td>Non-repayment of loans</td>
<td>Assistance from national organizations</td>
<td>Assistance from international private entities.</td>
</tr>
</tbody>
</table>
2.5.4 Case Study: Support Service Providers: An Illustration of Agricultural Supply Chain Finance

Table 10 indicates that various types of service providers may play an important role in enabling producers and marketing entities to better manage risks either through investments, adopting better management practices, or by transferring certain risks to others. Financial institutions may play especially important roles provided that they well understand the prevailing risks faced by prospective clients and tailor their credit, insurance or other products accordingly.

There are a number of unique characteristics to rural and agricultural markets that constrain both the supply and demand for market-based finance. These challenges include high transactions costs for both borrowers and lenders, high risks faced by potential borrowers and depositors due to the variability of incomes, exogenous economic shocks, limited tools to manage risk, lack of reliable information about borrowers, lack of adequate collateral, and inhospitable policy, legal and regulatory frameworks (USAID, 2005a).

In all cases, lending for agriculture can expose (formal and informal) lenders to high levels of liquidity risk and covariant risk. Liquidity risk is greater because of the seasonality of crop production and the likelihood that all farmers in the region will seek a loan or access to their savings at the same time (in the event of expected or actual risk-related losses). Lenders also have high exposure to covariant risks such as climatic risk and market (e.g., price) risks that are endemic to agriculture and that effect all farms and firms in a given region who borrow for similar purposes (USAID, 2005b). Financial institutions such as commercial banks, credit unions and MFIs are direct providers of financial services, and tend to focus attention on the series of transactions to bring a product from inputs to the final market, rather than a given stage in the chain. A supply chain approach to the provision of financial services focuses attention on the kinds of financial flows and the opportunities and risks associated with the provision of formal and informal financial services, whether direct or indirect

Supply chain finance operates with the same logic as other financial transactions. Lenders face the risk that borrowers will not pay back. Successful financial relationships must include some form of client screening, client monitoring, and contract enforcement. Appropriate incentives must be in place to ensure that the costs to borrowers who default are higher than the cost of repayment. In some cases, supply chain participants working in cooperation for production, processing and marketing are better situated to enter, screen, monitor and enforce contracts than are the more formal providers of financial services (Meyers and Johnston, 2006).

Table 10 below provides an illustration of how financial institutions can consider various types of agricultural risk in the design of their lending products and policies. This case relates to the cotton supply chain in Uganda. There are thus opportunities for Ugandan banks to make sound lending decisions (managing their portfolio risks) and to tailor or
customize their products while still assisting chain participants with finance for production and trading activities.

Table 10: An Illustration of Supply Chain Finance: Uganda Cotton Transaction Points, Risk, and Opportunities

<table>
<thead>
<tr>
<th>Transaction Point: Input Supply</th>
<th>Risks</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Retail price falls due to competition because margins are thin</td>
<td>Short-term lending product of only one to two months to limit the exposure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of the lender</td>
</tr>
<tr>
<td>Transaction Point: Production</td>
<td>Risks</td>
<td>Opportunities</td>
</tr>
<tr>
<td></td>
<td>Inputs for production are late or incomplete</td>
<td>Monthly phased disbursement lending product to limit the exposure of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lender</td>
</tr>
<tr>
<td></td>
<td>Farm gate price is below cost of production</td>
<td>Monitor minimum prices announced by CDO. Donor financed credit guarantee</td>
</tr>
<tr>
<td></td>
<td></td>
<td>facilities.</td>
</tr>
<tr>
<td></td>
<td>Loan term is longer than production and marketing cycle</td>
<td>Adjust the term of the loan product to match the seasonal production and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>marketing cycle</td>
</tr>
<tr>
<td></td>
<td>Yield is lower than expected</td>
<td>Design the loan product to pre-finance only a portion of the total cost of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>production</td>
</tr>
<tr>
<td></td>
<td>Operational acreage borrowed for is not realized</td>
<td>Opt for loans based on ginnery receipts so as to lend only post harvest</td>
</tr>
<tr>
<td>Transaction Point: Buying Agents/Traders</td>
<td>Risks</td>
<td>Opportunities</td>
</tr>
<tr>
<td></td>
<td>Transport is inadequate</td>
<td>Offer finance and/or operating leases for trucks</td>
</tr>
<tr>
<td></td>
<td>Price is below cost of procurement</td>
<td>Finance only against forward contracts provided in advance of borrowing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>from regional traders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Price insurance products (not yet developed) compensating for low price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>years from earnings of high price years through a commercial insurer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Opt for loans based on warehouse receipts so as to lend only post delivery</td>
</tr>
<tr>
<td>Transaction Point: Ginneries</td>
<td>Risks</td>
<td>Opportunities</td>
</tr>
<tr>
<td></td>
<td>Ginneries secure financing at low rates against international dollar</td>
<td>Few if any, financing opportunities exist</td>
</tr>
<tr>
<td></td>
<td>denominated, forward contracts</td>
<td></td>
</tr>
</tbody>
</table>

Source: USAID (2005c)
3. Guidelines for Application of RapAgRisk Assessment

The objective of Section 3 is to outline the steps and sequences required in planning and undertaking the RapAgRisk. The section is complemented by a “methodological annex”, which presents supporting assessment materials and approaches in more detail.

3.1 Assessment Principles

To start, it is useful to present some basic principles underpinning the RapAgRisk assessment. The assessment is devised as a time-bound process to provide a ‘first approximation’ of major risks, vulnerabilities and areas requiring priority attention for investment and capacity building. The guidelines assume a ‘rapid’ assessment process, involving a small study team and spanning a period of approximately three months.

The assessment combines analyses of secondary data with consultative processes based on interviews and field exercises involving a range of supply chain participants and service providers (from the private and public sectors), as well as policymakers. While not all stakeholders will share similar perspectives (nor is it expected that they should), the assessment should contribute to common understandings and agreed commitments to work towards mutually beneficial risk management outcomes. To ensure appropriate stakeholder participation for the assessment, the study team should include national experts, where possible.

The RapAgRisk assessment facilitates supply chain sector and spatial mapping, risk and vulnerability analysis and recommendations for improved risk management options. The assessment builds upon existing methodologies to carry out supply chain analyses, but expands beyond traditional applications. Given the multidimensional nature of the RapAgRisk, the essence of this approach is to bring together a range of partial, complimentary approaches to finally arrive at a representative ‘bigger picture’.

The assessment assumes a certain level of baseline information will be available for the selected agricultural commodity supply chain. This will enable quantitative analyses to complement more qualitative analyses based on stakeholder opinions. The assessment tool is designed to deal with crop-based (rather than animal product) supply chains (but can also be adjusted to deal with any agricultural supply chain).

Finally, the supporting annex materials are designed to facilitate transparent and objective analysis. This is important to map and compare risks across the supply chain. However, it is also important that propriety supply chain information is respected e.g. contract relationships, certain financial information, environmental audit results etc. It should be noted, that some stakeholders might be weary about providing information about their risks exposure, risk management practices and vulnerabilities. Thus, considerable tact must be used to elicit information, which includes a coherent explanation of the exercise to stakeholders.
3.2 Assessment Process

The basic sequence for a RapAgRisk is outlined in Figure 2, with detailed steps set out in the assessment planning matrix in Annex 8.

These steps can be sub-divided into four major components:
- Component 1: Supply Chain Situation Analysis
- Component 2: Risk Analysis
- Component 3: Risk Management and Vulnerability Assessment
- Component 4: Recommendations and Suggested Follow-up Actions

Figure 2: Overall Sequence of Analysis and Consultative Steps

Component 1 involves the gathering of secondary data and analysis related to the supply chain structure, conduct, and performance. During this ‘situation analysis’ the assessment team will gather baseline and contextual information, map the supply chain according to its sectoral and spatial dimensions, and where possible gather cost structure information. In the early stages of analysis a number of priority (tentative) risks may emerge from the analysis for further investigation.
**Component 2** involves the identification, characterization and, where possible, quantification of various risk events related to weather, price, food safety, policy, labor, environmental, logistical and other factors. In this stage of the analysis the assessment team will assess 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 the supply chain’s performance as a whole.

**Component 3** involves the assessment of risk management capacities i.e. consideration of existing risk management instruments and their evident effectiveness and sustainability. Combined with information on expected loss the assessment team will then be able to identify areas of residual (high and low) vulnerability.

**Component 4** identifies recommendations and suggested actions for follow up based on the conclusions of the RapAgRisk. This will include suggestions on areas where additional information and analyses are needed and/or recommendations regarding priority areas for investment and capacity building.

### 3.3 Stakeholders

Guidelines for pursuing the above noted steps are outlined in sections 3.5 through 3.9. Before getting into those details, it is important to draw more explicit attention to the political economy dimensions of the RapAgRisk. The RapAgRisk assessments of specific supply chains will need to combine ‘objective’ analysis of available and gathered data with the perceptions of multiple stakeholders. The underlying objectives pursued by these actors and their specific motivations for participating in the focal dialogue could vary, cutting across commercial, personal, political, economic development, and even humanitarian concerns and considerations. Some set of goals, perspectives, and expectations may be shared; others may not. Therefore, a commonality of goals cannot be an assumption at the start of the assessment process, yet one of the objectives of the process is build a greater degree of common understanding as well as commitments toward some common goals.

In managing the dialogue and other components of the risk assessment process, one needs to take account of the divergent goals and motivations of different stakeholders, address (mis-)perceptions that could be disruptive to the effectiveness of the process, and, in so doing, advance the acceptance of the analysis, recommendations, and other outcomes irrespective of the motivations of individual stakeholders. In some circumstances, stakeholders might compete with one another to take ownership over the assessment process and the recommended agenda for action. Table 11 provides an illustration of the potentially varied perspectives of different stakeholders.
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Motivations</th>
<th>Perceived Positive Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Cabinet and Security-related Ministries   | • political & social stability  
• security/law & order forces loyalty | • lower Party and personal “political risk”  
• lower internal security costs  
• assured food supplies for army and police |
| Ministry of Finance                       | • economic stability & growth  
• improved macro-level “food security” | • increased ‘risk amelioration’ budget expenses  
• lower emergency budget funding requirements  
• improved sustainability for rural sector  
• lower urban “cost of living”  
• improved & stabilized household incomes  
• less risk exposure to financial/banking system |
| Ministry of Agriculture/Ministry of Food Supply | • improved macro-level “food security”  
• stable & market-responsive food production and delivery | • larger budgets & staff  
• increased rural activities  
• modernization of agriculture  
• increased integration of the rural economy into the market/urban economy  
• improved household incomes |
| Regional, District and Urban Administrations | • improved food-market & related operations  
• improved local infrastructure | • increased political stature  
• increased administration budgets/staff  
• improved household “food security”  
• improved sustainability of local enterprises  
• less disruption in local services |
| **Food-Related and Other Enterprises**    |                                                                             |                                                                             |
| Farmers/growers (non-contract suppliers)  | • increased certainty for production & yield  
• improved certainly of input supplies, services and prices  
• improved certainty of market access and prices | • [lower risk premium/discount in all pricing (inputs, outputs and services)]  
• increased production margins  
• [improved household sustainability]  
• increased household “food security”  
• [increased ability/willingness to enter into grower/supplier contracts] |
| Rural & urban food traders                | • increased certainty/stability of supplies  
• improved ability to forecast supplies | • improved predictability of supplies & prices  
• lower contract-default risk  
• [increased ability/willingness to enter into supply & delivery contracts]  
• [lower risk premium/discount in all pricing (supplies and services)] |
| Urban food stores and supermarket chains  | • increased certainty/stability of supplies  
• improved ability to forecast supplies/prices | • lower cost of doing business  
• lower supplier contract-default risk  
• less need to have in place contingency alternative supply plans = reduced cost of business  
• lower business premises security costs (food riots first target is breaking the food stores/warehouses to steal supplies) |
| Urban agro-industries/processors         | • increased certainty/stability of supplies  
• improved ability to forecast supplies  
• lower risk in execution of business expansion strategies | • improved processing margins  
• lower supplier contract-default  
• lower risk of their delivery contract default  
• lower supply management efforts (coping mechanisms)  
• improved enterprise sustainability |
| Financial: Banks and Insurance            | • lower financial risks  
• lower property damage loss claims | • improved margins  
• less risk management requirements  
• increased deal flexibility  
• wider client base |
3.4 Data and Information

Multiple sources of data and information are required to undertake an agricultural supply chain risk assessment. Given the cross cutting nature of the Rap Ag Risk, a diverse set of literature should be reviewed in preparing for an assessment. Annex 1.1 outlines a key set of themes and lines of inquiry to be considered when first reviewing the background literature. This involves an in-depth analysis of the supply chain covering performance trends and variability in recent years; the supply chain’s structure, dynamics and level of integration and the position of the focal commodity sector in the overall economy. The initial literature review will also elicit the key drivers of change in the supply chain and broader agri-food system in recent years. At this stage the literature should also be reviewed to pull out information on risk management and vulnerabilities, as well as particular poverty dimensions that may be relevant to the analysis.

Baseline data should also be collected at this point, covering commodity market characteristics, macroeconomic conditions, supply chain structure and selected enabling environment and risk factors (See Annex 1.2). Sources of information/data for the agricultural supply chain risk and vulnerability assessment could include (i) existing household surveys, subsector studies; firm-level surveys; policy analyses; (ii) meteorological department data or studies on weather-related risks, (iii) data on production, costs, profitability, and quality parameters; (iv) project background documents examining structure/performance of input/output markets or financial system status; and (v) interviews with banks/MFIs, input suppliers, exporters, processors, representatives of farm and industry organizations, research/extension personnel; local/regional government officials.

In reviewing the literature and available information sources, a number of specific challenges should be anticipated. First, information and data may be context specific, and so a mix of information is often required to balance different aspects e.g. spatial or seasonal dimensions. Second, in some instances certain strands of information may be of a propriety nature to supply chain participants.

3.5 Supply Chain Situation Analysis

The purpose of the situation analysis is to identify major participants in the supply chain and to fully decompose the system and its current status (sub-systems, cost structures, spatial, seasonal dimensions) in order to better identify events that can lead to major losses and/or breakdowns in the chain. This step is a crucial building block for the remainder of the exercise. It is important to understand the broader, more general context in which the supply chain is operating so to better appreciate the causes of and potential solutions for risk and uncertainty. In most instances, already a substantial amount of pertinent information will have been collected and analyzed for other purposes and so the supply chain situation analysis should draw upon this analysis
The situation analysis involves (i) a contextual overview of the supply chain (Annex 2.1), a mapping of the supply chain to reflect different spatial and sectoral dimensions (Annex 2.2.) and (iii) an analysis of the supply chain cost structure (Annex 2.3).

The supply chain contextual analysis (Annex 2.2.) covers a number of key elements including:
- Role and Significance of Focal Commodity in Economy and Rural Sector
- Demand & Market Context
- Structural Patterns, Relationships and Spatial Distributions
- Government / Policies / Institutions
- Recent Performance and Costs Structures

The analysis takes into account factors related to the broad enabling environment, including:
- The importance of this supply chain in the national economy, regional and local economies, agri-food sector, farms and firms, and rural-urban households.
- The salient policy, regulatory and institutional, and political economy issues regarding agriculture generally and the focal supply chain.
- The overall reliability/dependability of transport, communication and utility (e.g., energy, water & sanitation) infrastructure and services.
- Salient features of the prevailing arrangements for finance and insurance in agriculture generally and in the focal commodity subsector.
- Salient features of public and private sector service providers of technical assistance, capacity building, and general education services.
- Broad patterns in the geography of agricultural production and supply chain organization
- The country’s prominent agro-ecological zones and weather patterns and what are the pertinent conditions in relation to the focal commodity subsector.

The analysis also zeroes in on issues directly relevant to the specific agricultural supply chain. Conventional concepts and analytical tools would be used to describe the structure and performance of the focal supply chain, and to determine:
- Salient techno-economic characteristics of production and marketing for the supply chain.
- Final markets for the primary and secondary products.
- Key participants in the supply chain, and where are they located. (direct and dedicated participants, versus indirect and partial participants, private and public sector).
- Key product, finance, information flows, when/where they take place, and by whom.
- Key transaction points in terms of flows and potential bottlenecks.
- Supply chain performance, also relative to the national economy and the agri-food sector.
- Underlying structure of costs, prices, and margins through the supply chain in a representative ‘normal’ year.
- Performance effectiveness in a representative ‘normal’ year.
• Levels of (farm, processor, other player) productivity in a representative ‘normal’ year.
• Entry/exit conditions in the agri-food supply chain. Competitiveness and maturity of the supply chain in the country and individual participants.
• the “poverty dimension” of the supply chain story (e.g. small farmers, SMEs, hired farm labor, non-farm rural labor, urban labor, producers, consumers).

In order to facilitate the subsequent risk analysis, a series of mapping exercises are required to depict different activities, actors, and relationships among segments of the chain, and the interactions between producers and intermediaries. Information gathered here provides an understanding of the sourcing, production, and delivery segments within the commodity sector, as well as the different dimensions through which a supply chain can be viewed. Annex 2.2 outlines a number of graphical examples which depict the supply chain according to its structural and spatial dimensions.

Supply chain cost structures can be determined and later used to simulate the effects of various types of risk (See Annex 2.3). Where relatively good cost, financial, and productivity data are available, simulations can be done assessing differential impacts of adverse (price, weather, other) events and critical points where stakeholders incur financial losses or more severe disruptions to their operations. A representative supply chain cost structure can help to capture the difference between some ‘normal’ situations and some diversions form the norm, as well as identifying the magnitude of changes in certain variables that would put supply chain participants (most notably farmers in this instance) at a financial loss.

Sources of information for the supply chain situation analysis can include existing supply chain or industry analyses, broader country agricultural development or trade studies, investment climate studies, agricultural strategy documents, national and international databases, national poverty assessments, and general country economic development studies.
3.6 Risk Analysis

Once the supply chain situation analysis is completed, it is possible to focus attention on the risks and uncertainties that affect the focal agri-food supply chain. While numerous reports may identify selected risks, there is a need for a more systematic assessment highlighting patterns of risk exposure and the associated expected losses from various risky events for different supply chain participants. In addition, it is important to map out different patterns of risk transmission through the supply chain.

With particular regard to the risk analysis and risk management dimensions, the sequence of analytical and consultative steps involves:

- Characterizing and charting key players in the supply chain and identifying critical flows/transactions of product, information, finance, and logistics,
- Identifying and characterizing the range of risks faced by players along supply chain, with a focus on critical flows/transactions,
- Ranking risks in terms of probability and potential severity—identifying the “key risks”, and their “expected losses”.
- Identifying the existing ex-ante and ex-post risk management strategies taken by players in supply chain (and/or external parties),
- Assessing the apparent effectiveness, costs and benefits of the risk management strategies taken by players, and options to improve risk management effectiveness.

This stage of the assessment results in a number of key outputs e.g. a presentation of the risk profile of individual supply chain entities and the supply chain as a whole, as well as the documentation and summary of key informant interviews (Annexes 3 and 4). This will involve interviews with representative entities throughout the supply chain (i.e. farmers, input suppliers, market intermediaries, transporters, processors, etc.) as well as additional service providers (i.e. farm extension advisors, financial institution representatives). For supply chain participants, perceptions about the risks they face should be sought in relation to their:

- Sourcing of inputs (goods, services, raw materials),
- Own production/processing of goods/services
- Marketing of the ‘product’ (whether this be a finished or intermediary good/service)

Each chain participant should provide perspectives on their own exposure to different risks, the exposure to risk of their suppliers and buyers, and that of the broader supply chain. Survey instruments and/or stakeholder meeting dialogues should be structured in order to obtain both perceptions and data so that the probability and severity of different risks can be quantified/ranked, with some degree of confidence. Additional information will be obtained from published price and weather data. Service providers (i.e. financial institutions, freight and transport operators, technical advisors, etc.) will also be interviewed to assess the risks that they face in their business relations with the supply
chain and also to gauge their perceptions about the risks borne by those chain participants. Once a preliminary mapping and rating of different risks has been constructed this should be reviewed through a meeting with multiple stakeholders.

Annexes 3 and 4 set out supporting materials to categorize different risk impacts and to guide stakeholder interviews. For a given commodity context, the assessment team may wish to prioritize a number of risks that have emerged from the initial situation analysis. Annex 3 sets out guidelines for the analysis of key risk categories including (i) the definition and scope of different risks (ii) an illustration of direct risk impacts according to supply chain entities, and wider spillover impacts (iv) defining indicators to measure the risk (iv) analytical steps to determine expected losses and (v) dimensions to consider in the assessment of risk management capacity.

Annex 4 sets out semi structured interview guidelines to assess the risk perceptions of supply chain entities and to examine how these risks and possible negative impacts could be managed more effectively. For supply chain entities the interviews are structured to determine respective roles in the supply chain (and the relative importance of the candidate commodity to business enterprises), to prioritize risks and estimate expected losses, to overview supply chain linkages and to elicit risk management options and capacities. Interview guidelines for supply chain service providers assess supply chain risk perceptions, and spillover risk effects that face those service providers in both the public and private sector realms.

The risk analysis should address a number of issues including:

- The risk and uncertainty factors that can disrupt the supply chain (differentiating between risk-related deviations, disruptions, disasters).
- The extent to which risks/uncertainties are idiosyncratic (affecting individual chain participants) or covariate within the chain (affecting multiple chain participants) and/or covariate outside the chain (impacts chain participants and the broader economy).
- Changes in costs, prices, and productivity levels that result in financial loss for the supply chain participants.
- The transmission of risks through the supply chain. Where and when does risk and uncertainty unfold and how does it spread through the chain (via individual participants and between chain participants).
- Whether there are perceptions of equitably or inequitably shared risks within the chain.
- Which supply chain participants are most exposed to risk and uncertainty.
- What is exposed in terms of assets and/or livelihoods and enterprise strategies (e.g., reduction of income/consumption and/or destruction of assets).
- How risks are manifested, how risks impact farms and firms (e.g., destruction of assets and/or lowering of income/consumption).
- The key transaction points and types of transactions that are associated with risk and uncertainty.
- What, who, how, where, and when are the greatest expected losses.
- What tend to be shorter term vs. longer term losses or impacts.
• How important are the expected losses internally for different participants in the chain, relative to their assets, livelihood/enterprise strategies, and performance outcomes.

Even where only qualitative information or perceptions can be obtained, efforts can be made to organize such feedback in a systematic way, enabling comparisons and rankings, and a prioritization according to expected losses. For example, Table 12 sets out a matrix to organize information on risks, risk exposure and expected losses. Here the potential severity of risks are mapped against the probability of the event occurring. Depending on the point of intersection a prioritization on expected losses (low, medium, high) can be determined, as outlined in Table 13.

Table 12: Expected Loss Ranking Matrix (Probability x Severity)

<table>
<thead>
<tr>
<th>Probability of Event</th>
<th>Potential Severity of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negligible</td>
</tr>
<tr>
<td>Highly Probable</td>
<td></td>
</tr>
<tr>
<td>Probable</td>
<td></td>
</tr>
<tr>
<td>Occasional</td>
<td></td>
</tr>
<tr>
<td>Remote</td>
<td></td>
</tr>
<tr>
<td>Improbable</td>
<td></td>
</tr>
</tbody>
</table>

Table 13: Ranking of Expected Loss: “Separating the High from the Low”

Priority 1 = High Expected Loss
Priority 2 = Medium Expected Loss
Priority 3 = Low Expected Loss
3.7 Risk Management and Vulnerability Assessment

Based on the information gathered it is important to identify and characterize existing risk management strategies and measures undertaken by supply chain participants and third parties, such as insurance companies, the government, donor agencies, etc. The reasons why certain risk management measures have been adopted would also be probed. Risk management strategies/approaches would be characterized in relation to their locus, their timing (e.g. ex ante, ex post), whether they are formal or informal, their type (i.e. technology, infrastructure, financial, management practice, organizational/institutional arrangement), and their breadth of application.

In examining current practices for risk management and their evident efficacy, the following themes can be pursued:

• who are the formal and informal and public and private sector providers of risk management services?
• what is the accessibility/availability/affordability of risk management instruments to different participants in the chain?
• for each chain participant, what are the present ex-ante risk reduction/prevention practices? What real/opportunity costs are associated with these? Is this strategy perceived to be effective? What constrains its effectiveness? What might be a more preferred strategy?
• for each chain participant, what ex-ante risk mitigation is practiced? For each chain participant, what ex-post (coping) is practiced? What real/opportunity costs are associated with these? Is this strategy perceived to be effective? What constrains its effectiveness? What might be a more preferred strategy?
• what are examples where risks are transferred to third parties or shared among supply chain participants? What is the perceived effectiveness of these measures? What constrains their further use? Is the risk sharing equitable?
• what is the evidence regarding the resiliency of the supply chain and of individual participants? That is, what transpired during the last significant ‘shock’. What adjustments were made? How quick was the recovery? Were the players able to cope/respond on their own or did they require external support (i.e. from government)?
• what are the actual and potential synergies for risk management between participants in the chain, with support service providers, others not directly in supply chain
• how do chain participants view their capacity for risk management?
• are there major differences in capacity to manage ex-ante risk deduction and risk mitigation and/or ex-post risk coping,
• what are the perceived constraints to improved supply chain risk management? Are these perceptions consistent with the ‘real’ constraints? If not, why not?

The effectiveness and current capacity for managing pertinent risks should be reviewed and ‘rated’ utilizing the 1-5 scale outlined in Table 14. In determining the most appropriate ranking of capacity to manage, a range of factors should be considered
including access, affordability, effectiveness and sustainability of different risk management measures. Figure 3 elaborates on these key parameters.

### Table 14: Capacity to Manage Risk Scale

<table>
<thead>
<tr>
<th>Rank</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Partially effective yet approaches are likely to be costly, unsustainable.</td>
</tr>
<tr>
<td>2</td>
<td>Between 1-3</td>
</tr>
<tr>
<td>3</td>
<td>Effective yet mixed pattern of affordability/sustainability.</td>
</tr>
<tr>
<td>4</td>
<td>Between 3-5</td>
</tr>
<tr>
<td>5</td>
<td>Very effective and high likelihood of sustainability.</td>
</tr>
</tbody>
</table>

### Figure 3: Assessing Capacity to Manage Risk

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Key Dimensions of Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Risk management instruments are available e.g. functioning insurance, financial markets</td>
</tr>
<tr>
<td></td>
<td>Risk management instruments can be accessed by key players at risk</td>
</tr>
<tr>
<td></td>
<td>Ex ante risk management instruments are in place (for prevention, mitigation, preparedness), ex post instruments can be quickly deployed (transfers, assistance)</td>
</tr>
<tr>
<td></td>
<td>Risk management instruments do not impose unreasonable cost constraints is e.g. interest rates insurance premiums</td>
</tr>
<tr>
<td></td>
<td>Responsibility for risk management arrangements lie within private (formal and informal) and public sector.</td>
</tr>
<tr>
<td></td>
<td>Adequate knowledge and information dissemination about the value of a specific risk management instruments</td>
</tr>
<tr>
<td></td>
<td>Demonstrated positive impact of risk management instruments</td>
</tr>
<tr>
<td>High</td>
<td>Risk management instruments meet present needs, as well as those in the indefinite future</td>
</tr>
</tbody>
</table>

The previous steps focus attention on the risks, the expected losses, and risk management practices and capacity. In essence these steps examine to what extent there is a problem that can be defined as “vulnerability” to fall below some performance benchmark as a result of the occurrence of some risky event (e.g., the lack of risk management capacity to compensate for the expected losses). Clearly, the identification of appropriate performance indicators, to set a benchmark for vulnerability, is critical, and can vary by farm and firm. While past experience sheds considerable insight on the topic, vulnerability is actually a forward-looking concept. One is seeking to understand the sequence of risk => risk exposure => expected losses => risk management capacity => “outcome” before a risky event takes place. This could facilitate the adoption of a risk management strategy that can negate vulnerability to a given risky and/or uncertain situation. At this stage, the analysis seeks to pinpoint clear gaps in the prevailing approach(es) to risk management and/or circumstances where prevailing practices are unlikely to be sufficient given the potential severity of loss.
In examining vulnerability some key considerations include:

- Are underlying (weather, market, other) conditions in the (near) future expected to be better, worse, or the same?
- How have recent changes/events enhanced or degraded the capacity of supply chain participants (and/or third parties) to manage risks? (i.e. have contingency funds been used up? Have assets been enhanced or degraded?)
- Have perceived vulnerabilities been reduced because risk management capacity has been enhanced or because the likelihood/extent of expected losses has been appropriately or inappropriately downgraded?
- What has recent experience illustrated about the resilience of individual supply chain participants in the face of major shocks? Minor disruptions?
- To what extent have changes in production practices and institutional arrangements for marketing render participants more or less vulnerable to shocks?
- What currently perceived vulnerabilities might be readily addressed? Which would require very substantial resources, capacity building measures, etc.?
- To what extent is it possible to quantify the vulnerabilities of the supply chain and/or of particular types of participants therein?

Even where the analysis is more qualitative than quantitative, an attempt should be made to cluster or rank order different types of vulnerabilities. Table 15 and Figure 4 provide a suggested method for doing so.

**Table 15: Vulnerability to Risky Event Based on Expected Loss + Capacity to Manage Risk**

<table>
<thead>
<tr>
<th>Expected Losses</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Figure 4: Vulnerability Scale

<table>
<thead>
<tr>
<th>Vulnerability Scale</th>
<th>Code</th>
<th>Key Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Vulnerable</td>
<td>Red</td>
<td>High expected loss, low capacity</td>
</tr>
<tr>
<td>Highly Vulnerable</td>
<td>Pink</td>
<td>Medium-High expected loss, low-medium capacity</td>
</tr>
<tr>
<td>Moderate Vulnerability</td>
<td>Yellow</td>
<td>Medium expected loss, low-medium capacity</td>
</tr>
<tr>
<td>Low Vulnerability</td>
<td>Green</td>
<td>Low –medium expected loss, medium-high capacity</td>
</tr>
<tr>
<td>Limited Vulnerability</td>
<td></td>
<td>Low expected loss, high capacity</td>
</tr>
</tbody>
</table>

3.8 Recommendations and Suggested Follow Ups

Based on the above analysis the assessment should conclude with a set of considerations to improve existing risk management measures and to facilitate the adoption of additional measures—either by individual supply chain participants, sets of participants in collaboration, or third parties. In final conclusions the assessment team should consider:

- Primary attention should be given to possible ex-ante measures to reduce, mitigate or share risks, although in some circumstances assessments will be conducted during/after adverse ‘shocks’ and attention will certainly be needed on workable coping strategies.

- Attention should be given to both formal and informal risk management options available to the different parties, although in practice, most analytical attention will likely focus on the scope for improving or supplementing formal mechanisms, including institutional and financial arrangements, technological changes, adoption of improved management practices, and/or investments in infrastructure. To the extent that the overall assessment is focused on the position and welfare of poorer farmers, then greater attention would need to be given to alternative informal mechanisms and improving their efficacy.

- Primary attention should ordinarily be devoted to addressing areas categorized as ‘high vulnerability’, either for individual chain participants or the chain as a whole. This high vulnerability may already be evident from recent/past experience or be expected due to unfolding changes in market conditions, regulations, or other circumstances. Depending upon the purposes for which the assessment is done, primary attention might be given to addressing areas of high vulnerability for specific entities (i.e. smallholder farmers; ginners; the government treasury).

- The relative attention between improving upon existing approaches/instruments and laying the basis for the introduction of new approaches/instruments would vary by the prevailing circumstances. There could well be circumstances where the range of existing arrangements would seem to be adequate, yet their effectiveness is below expectations due to data or capacity shortcomings and/or...
the adverse effects of government policies/regulations. Providing options and recommendations for strengthening existing arrangements would be essential.

- Considerations of alternative (and especially new) approaches/instruments should include at least preliminary coverage of expected costs and benefits, potential technical or regulatory constraints, possible distributional consequences, and realistic scenarios for adoption and impact on underlying vulnerabilities.
- Specific analysis should be undertaken on the needs/options for policy and regulatory reforms that affect farmer/agro-enterprise risk management as well as the possible revision/reform of governmental risk management instruments.

This step will likely involve an iterative process of consultations with supply chain participants, providers of risk management services, and pertinent government entities. Ideally, the output would involve some type of ‘Action Plan’, highlighting areas for near-term investment, capacity-building and facilitation, and also indicating other areas where more in-depth (and likely quantitative feasibility) assessment would be needed. The TORs for such follow-up assessments should be prepared.

3.9 Feedback, Monitoring, and Evaluation

This step would not be part of the immediate supply chain risk and risk management assessment. However, it is noted here because risk management is a longer term challenge. Strategies need to be refined over time in light of experience and unfolding market, climatic, regulatory and other circumstances. Therefore, it is essential to include provisions for short-term feedback and longer-term monitoring and evaluation of adopted supply chain risk management strategies.

This need not be a complicated nor costly exercise. But, there is a need to establish a suitable baseline—covering prevailing risks, risk management efforts, and outcomes—and monitor changes in these over time. Where interventions are being designed to strengthen existing risk management measures or to introduce new instruments, efforts are needed to monitor and evaluate implementation experience and to draw lessons for broader discussion and dissemination.

These M&E efforts should consider the interface between risk management and broader (changing) patterns of competitiveness, participation, and the distribution of rewards and risks within the supply chain. That it, while it is of interest to understand the pattern by which this or that institutional or financial arrangement has been taken up—or, how effectively a government program has been better targeted or implemented—that experience should be related also to the broader performance of the supply chain.
Conclusions

The purpose of the paper has been to present the conceptual basis and methodological approach underpinning a Rapid Agricultural Supply Chain Risk Assessment. The paper focused on the application of this assessment for crop based supply chains in developing countries. In the introduction the paper detailed the motivating context for this type of assessment, taking into account the changing risk landscape, current structural changes in major food systems and the reorganization of risk management approaches amongst public and private entities.

The paper has been framed around a conceptual framework highlighting the roles of and linkages between direct supply chain participants, service providers (e.g. financial intermediaries, transporters) and third party stakeholders e.g. government. A typology of risk categories was detailed, which illustrated the main areas of focus for the assessment i.e. weather, price, food safety, logistics, environment, labor and policy aspects. Based on this typology, the paper examined risk transmission mechanisms across the supply chain and within particular sub-systems. The conceptual framework also dealt with the analysis of risk management practices and vulnerability. The final section of the paper set out the steps and sequences required to undertake the RapAgRisk. The section also reflected on some basic assessment principles to guide future work highlighting the time bound, consultative and evidenced based nature of analysis.

The assessment should result in an identification of priority areas for investment and/or capacity building interventions. The target audience for final assessment products includes World Bank staff, country level stakeholders, policy makers and other practitioners. Bearing this in mind, final assessment materials will need to include a range of messages tailored for (i) policy makers (ii) supply chain participants and (iii) donors/technical agencies/NGO’s. A detailed set of methodological guidelines have been developed to carry out such assessments and can be found at [INSERT NEW CRMG EXTERNAL WEB URL]
References


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