

AGRO-FOOD EXPORTS FROM DEVELOPING COUNTRIES: THE CHALLENGES POSED BY STANDARDS

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Food safety and agricultural health standards can impede trade, especially for developing countries, through explicit bans on imports of particular products or through the high cost of compliance with stringent standards, which can diminish competitiveness. In certain circumstances, however, the new landscape of proliferating and increasingly stringent food safety and agricultural health standards can be a basis for the competitive repositioning and enhanced export performance of developing countries. Key to this is the ability of developing countries to upgrade capacity and make necessary adjustments in the structure and operation of their supply chains. In an attempt to rebalance much of the dialogue in this area, this chapter explores the nature of the new standards landscape and the related capacity requirements, before looking at the impacts on trade. In addition to the traditional approach using quantitative measures of changes in trade that are related to the evolution of standards, the chapter presents a number of illustrative case studies that relate losses or gains in trade to food safety and agricultural health requirements within the context of wider supply chain challenges.

Standards: Barrier or Catalyst?

The expansion of global trade in perishable agricultural products and high-value foods has highlighted the great divergence in national standards for food safety and animal and plant health and in the capacities of public authorities and commercial supply chains to manage the risks associated with trade in these products. For many higher-value foods, including fruits and vegetables, fish, beef, poultry, and herbs and spices, the challenges of international competitiveness have moved well beyond price and basic quality to food safety and agricultural health concerns.¹ There is increasing attention to the risks associated with microbial pathogens; residues from pesticides, veterinary medicines, and other agricultural inputs; and environmental or naturally occurring toxins. And there is greater scrutiny of the production and processing techniques employed along supply chains (Buzby 2003).

There are several reasons why food safety and agricultural health standards, referred to as sanitary and phytosanitary measures within the World Trade Organization (WTO), differ across countries

(Unnevehr 2003; Henson 2004). Differences in tastes, diets, income levels, and perceptions influence people's tolerance of these risks. Differences in climate and available technology (from refrigeration to irradiation) affect the incidence of food safety and agricultural health hazards. Standards reflect the feasibility of implementation, itself influenced by legal and industry structures as well as technical, scientific, administrative, and financial resources. Some food safety risks tend to be greater in developing countries because of weaknesses in physical infrastructure and the higher incidence of certain infectious diseases. Tropical and subtropical climates may be more conducive to the spread of certain pests and diseases that pose risks to health.

Thus the intrinsic risks associated with the production, transformation, and sale of high-value and perishable food products, combined with different standards and institutional capabilities, can pose major challenges for international trade. And food safety and agricultural health standards are changing rapidly, along with increased public awareness of food safety in high-income countries following a series of highly publicized food scares or scandals (bovine spongiform encephalopathy, or BSE, in beef in the United Kingdom, *E. coli* in hamburgers in the United States, dioxins in animal feed in Belgium). In response, there have been significant institutional changes in food safety oversight and reform of laws and regulations. For long-held concerns such as pesticide residues, there has been a tightening of standards in many countries. And new standards are being applied to address previously unknown or unregulated hazards, such as BSE, genetically modified organisms, and environmental contaminants.

As official standards and public oversight have changed, the private sector has moved rapidly to address food safety risks and the concerns and preferences of consumers, resulting in a proliferation of private codes of practice and other forms of supply chain governance. Private systems of food safety governance are also being applied more widely in middle-income and some low-income countries, in part through investments by multinational supermarket and restaurant chains and competitive responses by local firms (Reardon and Berdegue 2002). In addition, new food safety standards in industrial countries are shaping the expectations of

developing-country consumers, especially those with higher incomes and in urban areas.

The proliferation and enhanced stringency of food safety and agricultural health standards are a growing concern among many developing countries and those promoting their increased integration into the world trading system. Reflecting wider changes in the trade regime for various agricultural and food products, there is a presumption that food safety and agricultural health measures will be used as protectionist tools, providing "scientific" justification for prohibiting certain imports or applying higher standards to imports than to domestic supplies. Even if standards are not intentionally used to discriminate, their growing complexity and lack of harmonization could still impede the trading efforts of developing countries.

There is also a concern that many developing countries lack the administrative, technical, and scientific capacities to comply with emerging requirements. The investment and recurrent costs of compliance could undermine the competitive position of developing countries or otherwise compress the profitability of high-value food exports. The combined effects of institutional weaknesses and rising compliance costs could contribute to the further marginalization of weaker economic players, including poor countries, small businesses, and smallholder farmers.

A less pessimistic view emphasizes the opportunities provided by evolving standards, which some developing countries can use to their competitive advantage. Many of the emerging public and private standards can serve as a bridge between increasingly demanding consumers and distant suppliers. The standards can provide a common language within the supply chain and promote consumer confidence in food product safety.

From this standards-as-catalyst perspective, food safety and agricultural health standards may provide a powerful incentive for modernizing developing-country export supply chains and giving greater clarity to the management functions of government. Further, there may be spillovers into domestic food safety and agricultural health, to the benefit of the local population and domestic producers. Part of the costs of compliance could be considered necessary investments, while an array of foreseeable and unforeseeable benefits might arise from the adoption of different technologies and

management systems. Rather than degrading the comparative advantage of developing countries, enhancement of capacity to meet stricter standards could create new forms of competitive advantage, providing the basis for more sustainable and profitable trade over the long term.

This rather crude dichotomy between standards as barriers and standards as catalysts suggests a complex reality in which close attention is needed to the specifics of particular markets, products, and countries to understand how the changing food safety and agricultural health standards environment is providing challenges and opportunities for developing countries. This chapter draws on the literature and work in progress to examine the underlying evidence on the changing standards environment and its implications for developing-country exporters of high-value agricultural and food products. Drawing on both systematic and anecdotal evidence, the chapter presents a varied picture, partially supporting both perspectives.

The Sanitary and Phytosanitary Agreement: An End to Disguise and Discrimination?

During the Uruguay Round of multilateral trade negotiations, agricultural exporters voiced concerns that sanitary and phytosanitary measures were being used to restrict foreign competition and that such protectionist measures would likely increase as the use of more traditional trade barriers declined. The Agreement on the Application of Sanitary and Phytosanitary Measures provided a set of multilateral rules recognizing the need of countries to adopt such measures and creating a framework to reduce their trade distorting effects.

The agreement, built on the Standards Code of the 1947 General Agreement on Tariffs and Trade, permitted measures “necessary to protect human, animal, or plant life and health,” yet required that regulators base measures on a scientific risk assessment, recognize that different measures can achieve equivalent safety outcomes, and allow imports from particular regions in an exporting country when presented with evidence of the absence or low incidence of pests or diseases. The agreement encouraged the adoption of international standards, making explicit reference to those of the Codex Alimentarius Commission for food safety,

the International Office of Epizootics for animal health, and the International Plant Protection Convention for plant health. The agreement protects the rights of countries to choose their own “appropriate level of protection,” yet guides members to “take into account the objective of minimizing negative trade effects.”

Important underlying objectives are minimization of protectionist and unjustified discriminatory use of standards and promotion of greater transparency and harmonization. In both regards, experience has been mixed. The difficulties encountered are probably due less to specific shortcomings of the Sanitary and Phytosanitary Agreement itself than to the intrinsic complexities of managing food safety and agricultural health protection and the rapidly evolving markets for agricultural and food products. Further, it is evident that WTO members vary widely in their understanding of the agreement and their ability to take advantage of the rights and responsibilities it defines.

The agreement has not brought an end to the differential application of standards—nor should it. Differentiation is a necessary part of any risk-based food safety and agricultural health control system. The hazards to be monitored and the control measures to be implemented need to be prioritized at the country, industry, and enterprise levels. Political factors as well as scientific evidence influence priorities, focusing, for example, on issues of greatest concern to consumers and other interest groups (Henson 2001). As resources are limited and implementation may be costly, an effective risk management system will go beyond prioritizing potential hazards to differentiate explicitly among alternative sources of supply based on conditions of production, experience, and assessments of risk management capabilities in the supply chain.

Separating Legitimate and Illegitimate Standards Differentiation

When regulators and others have wide discretion and differentiation is required for cost-effective management of food safety and agricultural health, there remains ample scope for mischief. Yet separating legitimate differentiation from illegitimate discrimination is problematic. Even more difficult is clearly attributing standards to protectionist intentions, considering that in most circumstances at least

partially legitimate food safety or agricultural health issues are involved. For example, in two widely referenced cases of assumed protectionist motivation—restrictions on exports of Mexican avocados and Argentine citrus fruits to the United States—there was scientific justification for measures to prevent the spread of plant disease, though less-trade-restricting measures were available (Roberts and Orden 1997). In other cases, trade partners have different perspectives on the state of scientific knowledge and the need to make allowance for uncertainty. A prominent case is the dispute between the European Union (EU) and United States over the use of hormones in beef cattle (Pauwelyn 1999; Bureau, Marette, and Schiavina 1998).

Thus, questions remain about whether there is systematic discrimination against imports in the application of food safety and agricultural health controls. One question is whether foreign suppliers must comply with higher standards than domestic suppliers. No systematic research has been done on this subject, although a great deal of anecdotal evidence is presented by those who purport to have been adversely affected by such discrimination. And WTO members raised 241 complaints in the Sanitary and Phytosanitary Committee from 1995 to 2002 (Roberts 2004).

General impressions suggest that many countries, both industrial and developing, have a lower tolerance for certain animal and plant health risks from imports than from domestic sources. There have been cases when countries have restricted imports from countries experiencing a plant pest or animal disease that is also prevalent domestically. Similar observations can be made for some food safety controls. For example, the United States has long argued that, like itself, a broad array of countries has a near-zero tolerance for salmonella in imported poultry products yet this pathogen is widely present in domestic supply chains. Countries can also apply discriminatory measures to different importing countries. For example, the Philippines complained that Australia prohibited imports of Philippine sauces containing benzoic acid while permitting imports from New Zealand of similar products containing that additive.

Private and Public Oversight and Monitoring

High-value food exporters in developing countries frequently claim that they face more rigorous

controls than do domestic suppliers in certain industrial countries. But this intensive oversight and monitoring often come from private entities, especially supermarkets and their buying agents, rather than from official systems. And the methods of control that exporters face are more visible in their effects, in that compliance for exporters is assessed at the border, with entry possibly denied on this basis, whereas domestic suppliers are regulated through inspection of processing facilities, with a focus on system-based controls and market surveillance.

Yet, there is anecdotal evidence that regulatory oversight is substantially more stringent on domestic supplies in certain products and markets. For example, there is no official requirement in the United States for border testing of cereals or nuts for the presence of aflatoxin. Private-sector testing for aflatoxin levels in cereals is commonplace in the domestic market, however, with frequent price discounts being applied by buyers. Over a typical three-year period the U.S. Food and Drug Administration's (FDA) Center for Food Safety and Applied Nutrition inspects all domestic firms that produce low-acid canned foods, yet only 3 percent of foreign facilities that export such products to the United States market undergo such inspection.² The FDA inspects only 1–2 percent of the more than 6 million consignments of food (and cosmetic products) imported each year. For relatively high-risk products (for example, fish and meat products), a higher proportion of domestic than imported supplies is inspected. In both the United States and the European Union compliance monitoring for pesticide residues pays considerably more attention (absolute and proportional) to domestic suppliers than to imports.³

There is also little research comparing the intensity with which private buyers and distributors enforce their own standards among domestic suppliers and foreign suppliers, especially in developing countries. With less opportunity to observe directly the food safety and agricultural health control systems employed by developing-country suppliers, private buyers would likely emphasize end-product testing or third-party certification of quality management systems. This is certainly a clear trend among buyers in the United Kingdom and the Netherlands, for example, yet it is doubtful that such requirements are being imposed on developing-country suppliers at the same rate as on their industrial-country competitors.⁴

Increased Complexity of the Standards Environment

The overall picture for food safety and agricultural health requirements in trade is becoming increasingly complex and fast moving as standards are promulgated in multiple spheres at both public and private and national and international levels. The complexity of this issue stems from the variability of the standards themselves and from differences in how and with what intensity standards are monitored and enforced, which is also changing over time.

The transparency of official regulatory measures in the application of food safety and agricultural health requirements has clearly improved since the Sanitary and Phytosanitary Agreement entered into force. Some 85 percent of WTO members have established an “enquiry point” for obtaining information on proposed food safety and agricultural health requirements. Between 1995 and 2002 WTO members submitted some 3,220 notifications indicating the nature and objectives of proposed measures, the products they applied to, whether they were based on an international standard, and when the measure was to come into force. These notifications provide advance warning of new or modified measures and an opportunity for trading partners to raise questions about the proposed measures, both bilaterally and through the Sanitary and Phytosanitary Committee. An increasing proportion of WTO members, including developing countries, has been taking advantage of this opportunity to raise concerns (Roberts 2004).

While the transparency of many food safety and agricultural health measures has increased, considerable variation remains in standards across countries. And there is widespread uncertainty about how certain countries are implementing their standards. Roberts, Josling, and Orden (1999) note the paucity of international standards for many agro-food products and indicate that the vast majority of food safety and agricultural health measures notified to the WTO during 1995–99 had no international standard.⁵ With specific reference to horticultural products, Roberts and Krissoff (2003) found that over the same period two-thirds of notifications involved measures for which there was no recognized international standard and that many involved maximum pesticide residue levels. Jaffee (2003) notes that despite EU efforts to harmonize maximum pesticide residue levels in

imported fresh fruit and vegetables, wide variations remain in operative standards due to countries’ different approaches to surveillance and enforcement.

Variations in standards are also common in other sectors. Henson and Mitullah (2004) note the varied standards that developing countries must meet to gain and maintain access to the U.S., EU, and Japanese markets for fish products. While some requirements overlap, differences remain in both regulatory and technical requirements. Likewise, Mathews, Bernstein, and Buzby (2003) highlight the range of product and process standards countries require to minimize the risk of salmonella contamination in poultry products. Dohman (2003) and Otsuki, Wilson, and Sewadeh (2001) discuss the significant differences in the maximum permitted level for aflatoxin in cereals and nuts and in the sampling methods used. This lack of harmonization of standards and conformity assessment procedures raises production and transaction costs for developing-country suppliers, necessitating duplicative testing and reducing their ability to achieve economies of scale in production and in food safety and agricultural health management functions.

Also contributing to the increased complexity of the standards environment is the expansion of risk-based process standards relating to production, postharvest, and other procedures, and the proliferation of private standards. Roberts (2004) notes that the major international standards organizations have devoted more of their attention and resources over the past decade to the development of common approaches to risk identification, assessment, and management than to international standards themselves. This reflects both the inefficiency and the inefficacy of end-product testing, particularly in view of the levels of risk deemed acceptable today and the emergence of new or newly prominent food-borne pathogens.

With respect to private standards, there have been attempts to harmonize standards formerly applied by individual private companies, yet a plethora of private standards are still simply communicated through individual supply chains and can vary widely in their specific requirements. Examples of private protocols that have been codified and are available to the public include food safety and food hygiene protocols, such as the British Retail Consortium Technical Food Standard and the EUREPGAP Fruit and Vegetable Standard,

which combines food safety, environmental, and social dimensions. Other standards focus on social or environmental issues, such as Social Accountability 8000, the Ethical Trading Initiative, and the Marine Stewardship Initiative.

Variations in food safety and agricultural health requirements together with the progressive shift toward process-based measures have enhanced the importance of “equivalence” of national standards and systems. Currently, there is no systematic recording of equivalence agreements. Most appear to be between industrial countries. Certain developing countries, including successful agricultural exporters, have highlighted the difficulties in gaining recognition for the equivalency of their food safety and other controls to those of their major trading partners (WTO 2001). A successful and wide-ranging example of equivalence, however, is the recognition by the European Union that many developing and industrial countries have established systems of hygienic control for fish and fishery products that offer a level of protection at least comparable to its own legislation (see discussion below).

A parallel trend, reflecting the proliferation of private standards, is the heightened importance of certification of compliance with defined standards, which is typically undertaken by a third-party agency that the buyer recognizes as “competent.” A crucial issue for developing countries is the establishment of certification capacity and parallel institutions for accrediting certification bodies. Exporters in countries that lack an accreditation certification system may be forced to use the services of an accredited body in another country, at considerable cost (El-Tawil 2002).

What Capacity Is Needed?

Countries frequently require guarantees that imports come from areas that are free of certain pests or diseases; that minimum standards of hygiene have been applied in manufacture, packaging, and distribution; and that products are free of excessive residues of pesticides, medicines, and other contaminants. The exporting country must have the capacity to comply with these requirements and to demonstrate compliance. Among the required capacities are:

- Detecting the presence or demonstrating the absence of biological, chemical, and physical

hazards and having an information system to inform decision-making processes.

- Employing emergency procedures in the event of emerging hazards or outbreaks.
- Certifying that traded products meet established food safety risks.
- Undertaking scientific analysis of hazards in agricultural inputs and food products.
- Establishing and maintaining the identity of agricultural products through the supply chain.
- Establishing and maintaining systems for hygienic practices in agro-food product handling and transformation.
- Registering the production, distribution, and use of agricultural inputs that may pose risks to human, animal, or plant health.

Administrative and technical capacities for food safety and agricultural health management are embodied in institutional structures and procedures, physical infrastructure, and human capital. It is frequently assumed that managing food safety and agricultural health is predominantly a public-sector responsibility. While some crucial regulatory, research, and management functions are normally carried out by governments, and importing countries may require that certain functions be performed by a designated public-sector “competent authority,” the private sector also has important roles:

- Because it is typically well informed about technical options and hazard management systems, it should contribute to standard setting.
- Compliance with food safety and agricultural health standards requires specific actions by individual producers and processors.
- Capacity building in the private sector can complement (or substitute for) public-sector capacity, as through investment in accredited laboratory testing facilities.

Development of food safety and agricultural health management systems is closely related to the availability of wider technical, administrative, and scientific capacities that reflect broader patterns of economic development as much as specific demands for food safety and agricultural health controls. Unnevehr and Hirschhorn (2001) highlight the capacity needs for food safety management at different stages of economic development.

Export-oriented agriculture gives rise to a new set of challenges because foreign food safety and agricultural health requirements may differ sharply from domestic requirements, especially in the case of low-income countries (Dong and Jensen 2004).

Some regulatory, technical, and administrative capacities represent a greater constraint on developing-country exports of agricultural and food products than do others.⁶ In general, weaknesses in the management of plant and animal health issues are more likely to be an absolute barrier to trade than is lack of food safety controls. For many food safety hazards there is an array of effective technologies or approaches, some of which do not require sophisticated equipment or expertise. Even where management of food safety hazards is well within the capacities of producers and processors, systems of conformity assessment require testing and certification of food safety management systems and end products. Many developing countries lack the capability to undertake the rigorous epidemiological surveillance and risk assessments demanded by trading partners. They lack the accredited laboratories and internationally recognized systems for certification (El-Tawil 2002). Thus, regardless of private-sector capacity to meet the food safety and quality requirements of foreign customers, the country as a whole will be unable to gain market access.

While many developing countries have widespread weaknesses in food safety and agricultural health management capacity, there is evidence that even low-income countries can establish the regulatory, technical, and administrative arrangements to meet demanding standards in high-income export markets. The European Commission has recognized a relatively large—and growing—number of low- and lower-middle-income countries as having standards of hygiene in the capture, processing, transportation, and storage of fish and fishery products that are at least equivalent to those of the European Union. Their shipments benefit from reduced physical inspection at the border.

How Significant Are Compliance Costs?

Developing countries can incur significant “costs of compliance” whenever changes are made in international standards or those of their trading

partners. These costs can come in various forms, including fixed investments in adjusting production and processing facilities and practices, recurrent personnel and management costs to implement food and other control systems and the public- and private-sector costs of conformity assessment.

Typically there are a variety of technological and administrative ways in which to achieve compliance with a certain standard. For this and other reasons the level and relative significance of compliance costs can vary enormously from industry to industry and between countries.⁷ Important variables include the structure and conditions of the supply chain, the extent of administrative and scientific capacities, the degree of cooperation within industries and between the public and private sectors, and the strength of technical service industries. Where the export industry is mature and reasonably well developed, changes in food safety and agricultural health standards may require only incremental adjustments by producers and exporters and modest changes in public-sector oversight arrangements. Where the supply chain is makeshift, however, or uses multipurpose facilities and when new requirements (or levels of enforcement) necessitate major upgrades, some firms may need to redirect their products to less-demanding markets, while others will need to undertake significant fixed investments.

Consider the differences in adjustment costs associated with investments in the upgrading of hygiene controls in the shrimp industries in Bangladesh and Nicaragua (table 6.1). In Bangladesh major investments had to be made in the mid-1990s to upgrade fish-processing facilities, product-testing laboratories, and other areas in response to repeated quality and safety detentions of products entering the United States and a ban in 1997 on shrimp imports into the European Union. These investments equaled 2.3 percent of the value of the country’s shrimp exports in 1996–98. Annual maintenance costs for hazard analysis and critical control point (HACCP) and regulatory systems equaled 1.1 percent of exports. The Nicaraguan shrimp industry needed to make adjustments during 1997–2002 to hygiene controls to ensure compliance with modified U.S. fish safety regulations, including requirements to implement a HACCP program. But many Nicaraguan factories were

TABLE 6.1 Costs of Compliance with Export Food Safety Requirements in the Shrimp Processing Industry in Bangladesh and Nicaragua
(millions of US\$)

Cost	Bangladesh 1996–98	Nicaragua 1997–2002
Industry facility upgrading	17.55	0.33
Government	0.38	0.14
Training programs	0.07	0.09
Total	18.01	0.56
Annual maintenance of HACCP program	2.43	0.29
Shrimp exports during focal periods	775.00	92.60
Average annual shrimp exports	225.00	23.20
Ratio of upgrade costs to focal year export (%)	2.3	0.61
Ratio of maintenance costs to annual exports (%)	1.1	1.26

Source: Based on Cato and Lima dos Santos 2000, and Cato, Otwell, and Coze 2003.

relatively new and modern, so only modest incremental investments were needed, equivalent to 0.6 percent of the value of exports.

Many technological and organizational changes involve shifts in levels and structures of operating costs. The costs associated with these changes are often controversial. The changes are sometimes perceived to be unjustified, because they lack scientific basis or replace simpler, less costly procedures that might provide similar outcomes. Another complaint is that suppliers obtain little or no benefit beyond continued market access, while the opportunity cost of the required investments can be considerable. This complaint is more difficult to sustain, often reflecting a lack of appreciation of the frequently intangible or indirect benefits that can result from enhancement of food safety controls, for example. Improved control systems can reduce waste, improve product-cost accounting, and enhance staff morale. Thus, changes in product and process technologies can generate substantial increases in efficiency, reducing production costs and promoting competitiveness.

The expenditures related to standards compliance can have other beneficial, multiplier effects. Some of the needed investments may require labor, especially skilled and supervisory workers, creating additional job opportunities. Other expenditures may go toward building materials, contractors, and technical services, much of which could be sourced locally. Only where upgrading relies primarily on imported equipment or expertise would there be few multiplier effects.

The enhancement of food safety capacity can also have more dynamic and wide-ranging impacts on private-sector suppliers. For example, implementing an HACCP system and gaining third-party certification can send positive signals to existing and potential customers, enabling firms to reposition themselves in the marketplace or access new markets. Indian fish-processing plants that have invested in sophisticated systems of hygiene control are seeking to access higher-value markets for processed and semi-processed products. Sometimes, when problems are experienced in complying with requirements in a particular market, producers and exporters will shift to markets with lower or different food safety requirements. Kenyan fish exporters, which have been highly dependent on European markets, have attempted to diversify their exports to Australia, Japan, and the United States.

But even where the administrative, technical, and financial burdens of compliance are manageable at the country or industry level, the burdens may be too great at the firm level. There is a general concern that the challenge of rising standards is marginalizing smaller players, especially producers, traders, and processors, as well as smaller industries as a whole. There is, however, little empirical evidence to support this argument. In part, this is because of the difficulties of disentangling the specific role of standards compliance in the consolidation processes of agro-food systems.

In many cases, compliance requirements exacerbate other factors that threaten the status quo in

established supply chains. For example, both the Indian and Kenyan fish-processing sectors were facing longer-term challenges when forced to comply with enhanced hygiene standards for exports. Indian exporters were facing intense price competition from other suppliers such as Thailand and Vietnam. The Kenyan fish-processing sector suffered from chronic excess capacity because of raw material shortages. In both cases the costs of compliance with stricter food hygiene standards have induced consolidation of the industry that likely would have occurred anyway, albeit over a longer period. In Nicaragua the decline in the production share of small-scale shrimp producers had more to do with Hurricane Mitch and its aftermath than with the tightening of standards (Cato, Otwell, and Coze 2003).

A particular concern is that smaller players can be disadvantaged where there are economies of scale or scope in the implementation of particular technologies or administrative systems. Studies of compliance with labor and environmental standards in the United States suggest that costs are proportionately higher for smaller firms (Crain and Johnson 2001). In some cases the necessary investments have elements of lumpiness, for example, in laboratory equipment and cold-storage facilities, which are economically viable only for large-scale operations or require collective action. Likewise, smaller firms may find it more difficult to hire certain types of skilled personnel. More generally, smaller firms can be overwhelmed by the sheer number of changes needed to comply with new food safety requirements, even when the cash investments required are not substantial.

Sometimes certifying that the standards have been met is more difficult for small producers than complying with food safety and agricultural health requirements. For example, Kenyan vegetable exporters face considerable oversight costs in demonstrating compliance to their major European buyers.⁸ In turn, this generates pressure for rationalizing supply chains. Changes in the product composition of trade may also affect structural patterns.⁹ Further, in a competitive environment, exporters find it difficult to control the volume and continuity of smallholder supplies due to side-selling by farmers. Where export supply commitments are firm and specific, exporters need more effective control, and this can induce backward integration into production.

A frequent presumption when discussing the marginalization of suppliers is that standards compliance is a do-or-die situation. In reality, however, there is rarely just a single market for a particular product. Suppliers need to seek out markets (and market segments) where they have advantages rather than disadvantages. For example, there may be opportunities in domestic or regional markets for the same or similar products, with lower prices offset by the absence of compliance challenges and costs. Directing attention to these markets may be one way to avoid marginalization. Thus, the development of high-value agricultural and food products sectors in the future is likely to be bimodal, with some firms upgrading and adapting and others targeting other markets and raising their capacity at a slower pace.

What Impact Are Standards Having on Exports of High-Value Agro-Food Products?

The application of food safety and agricultural health standards by governments and the private sector can significantly affect international trade. While most standards are designed in pursuit of the legitimate goals of maintaining human, plant, and animal health, they can also serve as technical barriers to trade. Roberts, Josling, and Orden (1999) classify technical trade barriers associated with agricultural and food products into three categories: full or partial import bans; technical specifications, including product and process standards; and information remedies, including packaging and labeling requirements and controls on voluntary (health and other) claims. Full or partial bans are the most trade restricting. Total bans are typically used when great risks are associated with certain plant and animal health problems and where cost-effective measures are not available. Partial bans may permit trade only in certain seasons or from certain countries or regions. Technical specifications and informational remedies will normally apply to both imports and domestic supplies. Their effects on trade will derive from the relative abilities of different suppliers to comply with these measures, the incidence of compliance costs, and how each affects the relative competitiveness of different suppliers.

While there is general agreement that food safety and agricultural health measures strongly

affect international agro-food trade, there is no consensus on the importance of individual measures, their impact compared with other trade-distorting measures, or their aggregate net effect. Testing the empirical impact of such standards on trade is enormously difficult. First, it requires assumptions about how the broad array of measures is actually enforced and how enforcement deters or encourages potential export suppliers, depending on whether suppliers need to make major or modest adjustments. This variable cannot be aggregated and differs across countries and industries. Second, food safety and agricultural health standards may have secondary effects, for example, leading to shifts in sourcing, the production of complementary and competitive goods, and the spread of regulations and restrictions to other countries. Third, a specific measure may not be a dominant or even important determinant of observed trade flows. There is a risk of ascribing agro-food standards to shifts in trade that are driven by other economic or technical factors. Fourth, there are problems in defining the counterfactual. Without the measure, would trade have been unimpeded, or would distributors and consumers have sought the product from other suppliers instead? In the absence of a (trade-restricting) measure, might overall demand have declined for a product for which certain problems were identified? Finally, many food safety and agricultural health measures will affect domestic suppliers as well, with varied outcomes in terms of shifts in the relative competitiveness and market share of the different players.

These and other empirical problems have led researchers to devote more attention to specific cases and to attempt to highlight the role played by (changing) food safety and agricultural health requirements on bilateral or broader multicountry patterns of trade. Some of the cases are discussed below. Only one study, however, has attempted to provide an aggregate measure of the level of agricultural and food trade constrained or blocked by technical barriers. In 1996 the U.S. Department of Agriculture, drawing on the expert opinions of staff and other regulatory personnel, found that “questionable” technical barriers (measures judged to have no scientific basis) were inhibiting U.S. exports of agricultural and food products to some 62 countries. More than 300 market restrictions

were identified as constraining exports valued at \$5 billion, equal to around 7 percent of U.S. agricultural, food, and forestry trade in 1996. Two-thirds of the identified measures, including nearly all full or partial import bans, addressed risks for animal or plant health (Roberts, Josling, and Orden 1999).

This type of broad estimate of trade effects has not been made for any other country. Other approaches have provided insights into the subject, however. Most commonly, researchers have looked to the only two available multicountry sources of data on the subject, official listings of agricultural and food product detentions and rejections by industrial countries and the growing number of complaints recorded by the Sanitary and Phytosanitary Committee. Though incomplete, both are useful proxies for the trade-inhibiting effects of food safety and agricultural health standards.

Border Detentions and Rejections of Agricultural and Food Products

Information is available for a limited number of countries (through periodic reports and web-based databases) on the incidence of detention or rejection of imported agricultural and food products for reasons associated with quality, safety, labeling, or other technical issues. The most widely available and cited data are for the European Union and the United States.¹⁰ The data provide a reasonable picture of the incidence of product rejections over time by country of origin but do not specify the volume or value of rejected consignments.

Several patterns emerge from product rejection data for the European Union and United States:

- *Rising incidence.* In the European Union the number of notifications or alerts increased more than sixfold between 1998 (230 cases) and 2002 (1,520). This increased incidence of rejections reflects a combination of factors, including the tightening or harmonizing of standards, application of standards for formerly unregulated hazards, and substantially increased capacity for inspection and enforcement. In the United States there was a sixfold increase in the number of product inspections by the FDA, in part because of heightened concerns about bioterrorism.¹¹

- *Product concentration.* Most detentions and rejections occurred in a few product categories: fish and crustaceans (35 percent of rejections in 2002), meat products, and fruits and vegetables. For the European Union there was also a high incidence of rejections for nuts, while for the United States there were many rejections of low-acid canned foods. Comparatively few rejections were issued on quality or safety grounds for beverage crops, cereal products, feedstuffs, or spices.
- *Country of origin concentration.* A few countries accounted for the bulk of rejections. Among developing countries most of the rejections were from countries that have been dominant suppliers of “sensitive” products for many years (for example, Brazil, Mexico, Thailand, and Turkey) or newly emerging large exporters of such products (for example, China, India, and Vietnam). In 2002 five countries (Brazil, China, Thailand, Turkey, and Vietnam) accounted for nearly 60 percent of EU rejections of agricultural and food products from outside Europe. Some of these countries, however, are simultaneously increasing their EU market share for such products, suggesting that border rejections are more of an irritant than a major problem for larger exporters.
- *Minimal interception of products from low-income countries.* Exports from low-income countries account for a very small proportion of product rejections. For example, in 2002 the European Union rejected only 26 consignments from low-income Sub-Saharan African countries, with most countries experiencing only one or two rejections. Most of these countries are exporting less sensitive products in terms of food safety or agricultural health risks, or they have been recognized as being fully harmonized with EU requirements for more sensitive products such as fish and thus are subject to lower levels of border inspection.
- *Leading reasons for product rejections.* For the European Union the largest (and growing) proportion of rejections concerns chemical and other contaminants in food, especially veterinary drug residues, pesticide residues, and mycotoxins. Chemical contaminants accounted for nearly two-thirds of rejections in 2002, up from 55 percent in 2000. Microbial pathogens were implicated in 30 percent of rejections,

down from 41 percent. This pattern reflects the growing harmonization of EU standards for an array of chemical contaminants and the increased political and technical attention to these issues within the European Union. For the United States a large proportion of border rejections in the late 1990s was due to the presence of filth or foreign bodies (32 percent), microbial pathogens (17 percent), or problems associated with the packaging or labeling of canned food products for which botulism is a risk (13 percent). A smaller proportion of rejections was due to chemical contaminants (12 percent).

Neither the European Union nor the United States systematically reports on the volume or value of trade that is affected by border inspections and rejections. To obtain a rough notion of the value of trade interrupted by technical measures, data were collected (from official sources and consultations with private traders) on the proportion of trade in particular products that was likely to have been detained or rejected in 2000–01. These estimates were then applied to overall trade in these products to estimate the value of interrupted trade (table 6.2). For simplicity, the proportion of trade for particular products that is subject to rejections is assumed to be the same for products flowing between low-, middle-, and high-income countries. This is unlikely to be so in practice, but data are not available to provide more refined estimates.

The value of world agro-food trade affected by official product rejections at the import level is estimated at \$3.8 billion in 2000–01.¹² This is almost certainly an overestimate since similar levels of rejection are assumed for products entering developing countries as for those entering industrial countries, even though levels of standards and enforcement capacities are typically lower in developing countries. Reflecting the dominant share of high-income countries in certain product groups for which detention or rejection levels are high (for example, meat and dairy products, other processed foods, and processed fruit and vegetables), these countries are estimated to account for 53 percent of rejected exports, while they account for some 63 percent of world agricultural and food product exports. The estimated value of developing-country agro-food border rejections is \$1.8 billion, 74 percent of it accounted for by middle-income

TABLE 6.2 Estimated Value of World Agricultural and Food Trade Directly Affected by Import Border Rejections Based on Technical Standards, 2000–01
(millions of US\$)

Product Group	Estimated Proportion of Trade (%) ^a	High-Income Countries	Middle-Income Countries ^b	Low-Income Countries	China	Total Trade Affected
Meat and dairy products	1.25	811	142	8	21	982
Fish and fishery products	1.00–2.00	232	417	145	90	884
Fruit and vegetables	0.75–1.50	367	439	44	61	911
Grains	0.50	160	40	6	8	214
Animal feed	0.50	65	39	4	2	110
Tropical beverages	0.25	25	18	16	0	59
Nuts and spices	0.75–1.50	16	33	30	1	80
Other processed food	1.00–2.00	122	53	3	6	184
All other categories ^c	0.25	199	112	19	6	307
Total		1,997	1,332	275	195	3,799
Proportion of trade affected		0.70	1.10	0.93	1.25	0.84

a. Where there are two numbers the first relates to exports of high-income countries and the second to those of middle- and low-income countries.

b. Excluding China.

c. Includes oilseeds, textile fibers, drinks, tobacco/cigarettes, and sugar/confectionery.

Source: Authors' computation based on official data and consultations with private traders.

countries. For low-income countries the estimated \$275 million in agricultural and food product trade rejected at the importing-country border represents less than 1 percent of their agricultural and food exports. The product composition of the rejected exports is broadly consistent with the data presented earlier on EU and U.S. rejections. For middle-income countries, the dominant products are fruits and vegetables and fish, followed by livestock products. For low-income countries, fish is the dominant category, accounting for more than half the estimated rejections.

Until recently, border rejections for food safety or related technical reasons have had only a modest impact on overall trade in agricultural and food products, including that of developing countries. An estimated 1 percent of this trade was directly affected in 2000–01. Further, only a small proportion of rejected consignments is actually destroyed at the point of import. Some (perhaps significant) proportion of the product is reshipped, reconditioned, or otherwise managed for sale whether in the domestic market of the exporter or in some other international market. Indeed, for most food categories the proportion of agro-food trade that encounters official rejection is probably substan-

tially lower than the proportion of sales that are subjected to price discounts by private buyers because of quality defects, lack of timeliness, and poor presentation. The products with the highest estimated proportion of rejections are also those with the highest rates of growth in international agricultural trade.

Thus while undoubtedly an irritant to exporters, border rejections are not a major impediment to trade. Still, they are costly, both in the value of lost product and in adverse reputation effects on the supplier and the country of origin. Some importing countries will list for automatic detention particular suppliers or the entire country following repeated violations of food safety and other standards. Subsequent shipments are detained, inspected, and tested at the expense of the exporter or importer until a record of compliance has been (re)established. This can take a long time, and the costs can be considerable (Lamb, Velez, and Barclay 2004). Further, during this period exporters may lose customers who are unwilling to incur the costs and delays associated with enhanced border formalities.

In addition, there are some indications for certain high-income countries that increased attention

is being given to border inspections of products deemed “sensitive” in relation to new regulatory concerns about food safety and agricultural health risks. If the patterns described above are indicative, an increasing level of border interceptions of products would be expected in coming years. This will either increase the transaction costs for certain developing-country suppliers or induce them to make adjustments in production, postharvest, and product monitoring and testing arrangements.

Border rejections attributable to food safety concerns represent only a small part of the constraint on international trade in agricultural and food products associated with food safety and agricultural health measures. For example, although meat and dairy products may be subject to the highest level of rejections in global trade, these are not significant for low-income countries and are probably of secondary importance for most middle-income countries. In terms of the impact on aggregate trade, far more inhibiting are the broad array of measures related to animal and plant health that render large numbers of countries ineligible to supply many livestock products and food crops to other countries (Sumner 2003).

While this pattern undoubtedly reflects traditional trade protections and subsidies in industrial countries that distort world trade, animal disease controls exclude many developing countries from world markets for these products altogether.¹³ In part this reflects the prevalence of endemic infectious diseases of animals in many low- and middle-income countries. Indeed, the high costs of establishing and maintaining disease-free areas can be beyond the means of many of the poorest countries. Many developing countries lack the surveillance and risk assessment capacity to demonstrate that they have areas that are disease-free and to get these areas recognized as such by the International Office of Epizootics.¹⁴ And even where developing countries have established disease-free areas, they face the risk that trade will be disrupted should outbreaks of disease occur. A recent example is the restrictions applied to exports of poultry from Thailand and Vietnam because of an outbreak of avian flu. The overall impact of animal disease issues, therefore, is to enhance the risks associated with trade in livestock products and put a great onus on public authorities to invest in disease controls and to ensure their continued efficacy.

Because of an inability to meet a broad array of food safety and agricultural health requirements pertaining to livestock disease and hygiene controls, most low-income countries are restricted to trade in live animals rather than livestock products. This avoids the need for attention to hygienic slaughter in an abattoir, meat inspection, and refrigerated transport.¹⁵ Even if animal disease and hygiene capacity could be enhanced, however, low-income countries would need to compete with well-established livestock product exporters such as Argentina and Australia, which are more reliable producers with fewer animal health problems and more standardized production. However, the benefits from access to high-value markets could be considerable for developing countries that invest in animal disease controls, as a case study of foot and mouth disease controls in Zimbabwe shows (Perry and others 2003).

Disputes and Complaints through the WTO

Complaints and counter-notifications made through the Sanitary and Phytosanitary Committee within the WTO also provide an indication of the nature and breadth of the standards challenge for developing countries (table 6.3). While the counter-notification database and the information provided in most counter-notifications do not permit quantifying the levels of developing-country trade that has or might be affected by the contested measures, it does provide some insights. A summary of complaints by regulatory goal and country group suggests that (at least some) developing countries have actively used this formal review and complaint process to register their concerns about a significant number of notified measures by both industrial and developing countries. A more detailed look at the individual complaints, indicates that:

- Complaints by developing countries are dominated by a handful of countries—Argentina, Brazil, Chile, and Thailand. Each of these countries has issued or supported more than a dozen complaints, with Argentina being involved in more than a quarter of all developing-country complaints. Only a handful of other countries, including Ecuador, India, the Philippines, South Africa, and Uruguay, have been involved in

TABLE 6.3 Number of Counter-Notifications to the Sanitary and Phytosanitary Committee Relating to Reported Measures, 1995–2002

Complaints	Regulatory Goal of Contested Measure				Total
	Plant Health	Animal Health	Human Health	Other ^a	
<i>By industrial countries against:</i>					
Industrial countries	16	7	44	3	70
Developing countries	17	11	41	4	73
Multiple countries	—	2	—	—	2
Subtotal	33	20	85	7	145
<i>By developing countries against:</i>					
Industrial countries	12	12	34	2	60
Developing countries	8	17	7	2	34
Multiple countries	—	2	—	—	2
Subtotal	20	31	41	4	96
Total	53	51	126	11	241

— Not available

a. Includes complaints about horizontal regulations (such as those regulating products of modern biotechnology) that reference human, animal, and plant health as objectives.

Source: Roberts 2004.

multiple cases. This pattern of participation reflects the prominence of certain countries in trade in a few product categories, especially beef and horticultural products, rather than the overall structure of developing country agricultural and food trade.

- These data alone provide little information about the extent to which food safety and agricultural health measures are inhibiting exports of low-income countries. Low-income countries are weakly represented in counter-notifications, issuing or supporting complaints in only five cases. This could reflect the structure of their exports (concentrated in commodities for which food safety and agricultural health measures are of lesser importance) or their limited capacity to participate in the formal review process. This lack of formal complaints does not mean that they have been able to resolve their concerns bilaterally.
- Among the seemingly large number of developing-country complaints are a limited number of repeated concerns, with slight variations. Most complaints about animal health issues relate to what are claimed to be overly restrictive (and nonscientifically based) measures dealing with foot and mouth disease and beef products or bovine spongiform encephalopathy and animal by-products for pet food, animal feed, and cosmetics. Similarly, most complaints about plant health issues relate to claims of overly restrictive measures for plant diseases or pests or for horticultural products. Complaints related to food safety are a mixture of specific concerns, with no large clustering around particular themes. Surprisingly, given the huge importance for developing-country trade, there are few complaints about measures governing fish products.
- The reasons for developing-country complaints are varied, yet most involve concerns about the lack of scientific evidence in relation to food safety, the absence of risk assessments in relation to plant health, and inconsistencies between country and international standards in animal health.
- Among industrial countries, the European Union has been the subject of the largest number of complaints by developing countries. There were more than three times as many complaints against the European Union as against the United States. Several factors might account

for this. Harmonization of food safety and agricultural health measures within the European Union has often resulted in the adoption of the most stringent standards previously applied by individual member states. The European Union has more frequently and most visibly embraced the precautionary principle when adopting certain standards, sometimes giving rise to controversies over the scientific basis for the measures. And because of the complex administrative structure of the European Union, some countries find it difficult to resolve concerns through bilateral discussions and therefore more readily turn to the Sanitary and Phytosanitary Committee for concerns related to the European Union than for other countries.

Thus, the growing number of recorded complaints or counter-notifications by developing countries provides only a crude indicator of the extent to which food safety and agricultural health measures impede their trade in high-value agricultural and food products. These complaints probably represent only the tip of the iceberg as most concerns and disputes are raised bilaterally, and the majority of negotiations are handled by technical organizations rather than country trade representatives. Some of the complaints have occurred in the context of expanding trade ties, which can increase the seriousness of previously minor effects.

There is little basis for associating the growing number of complaints with deliberate protectionism. Many of the concerns seem to be related more to inadequate (scientific) information rather than to discrimination. Further, the apparatus of formal complaints relates only to mandatory standards set by public agencies. A growing array of standards are being set privately, either through consensus within particular industries or by the gatekeepers of the dominant supply chains. While many such standards are ostensibly voluntary, they are becoming the de facto standards to gain or maintain access to particular buyers or market segments.

Some Illustrative Case Studies

Because the data on agricultural and food product rejections and disputes related to food safety and agricultural health measures provide an incomplete picture of the effects on developing countries,

analysts are using case studies to examine the effects of specific standards on the trade of particular countries and products. Earlier work emphasized the potential disruptive impact of food safety and agricultural health measures on exports from developing countries (Otsuki, Wilson, and Sewadeh 2001; Wilson and Otsuki 2003). More recent work by the U.S. Department of Agriculture (Buzby 2003) and the International Food Policy Research Institute (Unnevehr 2003) point to more varied experiences. Other case study analyses have been undertaken by the United Nations Conference on Trade and Development (UNCTAD), the United Nations Environment Programme (UNEP), and the World Bank.¹⁶

This section draws on selected examples to illustrate the complex ways in which sanitary and phytosanitary measures can affect developing-country exports. Three of the most prominent concerns raised in the literature are emphasized in the selection of case studies: fish trade bans and their wider supply chain effects, limits on mycotoxins as trade barriers, and the strengthening of horticultural product and process standards.

Fish Bans and Their Wide Supply-Chain Effects

Since 1990 developing-country exports of fish and fishery products have increased at an average annual rate of 6 percent (Delgado and others 2003). A major challenge faced by developing countries in seeking to maintain and expand their share of global markets is the progressively stricter food safety requirements, particularly in major industrial countries. Previous studies suggested that some exporters experienced considerable problems in complying with these requirements.

The European Union lays down harmonized requirements governing hygiene throughout the supply chain for fish and fishery products. Processing plants are inspected and approved individually by a specified "competent authority" in the country of origin, whether an EU member state or a third country, to ensure compliance. Imports from third countries are required to have controls that are at least equivalent to those of the European Union.¹⁷ Exports from countries for which local requirements have been recognized as equivalent are subject to reduced physical inspection at the border. Countries that have not yet met these

requirements but that have provided assurances that their controls are at least equivalent to those of the European Union are permitted to export but are subject to higher rates of border inspection. The current deadline for all countries to be fully harmonized with the EU's hygiene standards is December 31, 2005.

Kenya is an example of longer-term efforts to comply with the European Union's food safety requirements, overlaid with the need to overcome restrictions on trade relating to immediate food safety concerns. Kenya's major fish export is Nile perch from Lake Victoria. Until the mid-1980s this was a relatively minor species in the Lake Victoria fishery, but with a shift in focus from local to export markets, Nile perch came to account for more than 90 percent of Kenya's exports of fish and fishery products by the mid-1990s, with a value of around \$44 million in 1996. Most exports were destined for the European Union. Through the 1980s there was significant investment in industrialized fish-processing facilities, and 15 facilities were in operation by the mid-1990s. At the landing beaches, however, there was little or no change in fishing methods or marketing facilities.

Initially, Nile perch exports were extremely profitable. Processing capacity soon exceeded the supply of fish, however, a situation that sets the competitive environment in which all levels of the chain operate. Although food safety requirements in their major export markets were evolving, most processors made little attempt to upgrade their facilities and systems of procurement, processing, and marketing. Likewise, the legislative framework of food safety controls remained largely unchanged, despite the fact that the structure and focus of the supply chain had shifted to exports. The picture was of a supply chain that had not been upgraded in line with the growth in exports and was unable to implement effective controls within the context of rapidly evolving standards overseas. Thus, both the public authorities and exporters were in the position of continuous problem solving.

In recent years exporters of Nile perch have faced a catalogue of restrictions on trade with the European Union. In 1996 salmonella was detected in a number of consignments of Nile perch from Kenya (and Tanzania and Uganda) at the Spanish border, and Spain immediately prohibited imports. In April 1997 the European Commission introduced a requirement for salmonella testing of all

consignments of Nile perch from the region. Following an outbreak of cholera across East Africa, testing was extended to all fish and to cover *Vibrio cholerae* and *Vibrio parahaemolyticus*. These requirements were lifted in June 1998. In March 1999 a suspected case of fish poisoning with pesticide was identified in Uganda. The European Union subsequently imposed a ban on exports of Nile perch in April 1999 that was not lifted for Kenya until December 2000. In each case, the impact was immediate. Exports declined, although over time declines were partially offset by increased sales to other markets. Fish-processing plants, most already operating at less than 50 percent capacity, reduced their production, and some closed. In turn, the landed price of Nile perch fell.

Both the Kenyan government and the private sector tried to upgrade food safety controls. Responsibility for regulatory controls was split between the Ministry of Health and the Fisheries Department of the Ministry of Agriculture and Rural Development, creating significant coordination problems. To improve compliance, the Fisheries Department was made the sole "competent authority," and legislation was quickly revised in line with the European Union's requirements.

Fish-processing plants upgraded their facilities and implemented an HACCP system, at an estimated average cost per plant of about \$40,000 and a total cost of \$557,000. These costs were prohibitive for several processing facilities, which closed, helping to reduce excess capacity. Simultaneously, fish-processing companies began to cooperate to present a united voice to the government and European Commission. The Kenya Fish Processors and Exporters Association (AFIPEK), formed in 2000, has developed a code of good manufacturing practice for the sector.

A remaining weakness in the Nile perch supply chain is standards of hygiene at landing beaches. Most attempts by the government to implement effective management of the fishery resource and marketing arrangements have failed. Only recently have efforts been made to provide toilets, paved and fenced landing areas, potable water, and covered markets. This is the biggest compliance issue facing the sector in the short to medium term for access to EU markets.

The efforts of the Kenyan government and private sector eventually paid off, and in December 2003 the European Commission recognized the

controls in place as equivalent to those in the European Union. The European Union's hygiene requirements for fish and fishery products have had profound effects on the Nile perch sector in Kenya. Whereas the export supply chain had developed with a sole focus on EU markets, today most exporters have diversified their export base and have major markets in Australia, Japan, and the United States. Compliance with EU requirements helped Kenyan exporters to access and maintain these markets.

This case illustrates the significant impact that stricter food safety requirements can have on a supply chain that is almost entirely export oriented and dependent on a single market. It also demonstrates how such requirements can exacerbate pressures for restructuring and reform, while prevailing supply and capacity issues constrain how various levels of the chain are able to respond. The case also illustrates the interdependencies between levels of the supply chain and between the public and private sectors in meeting food safety requirements in export markets. And it demonstrates the importance of responding quickly to emerging food safety and agricultural health standards. The periods of restrictions faced by Kenyan exporters of Nile perch very much reflect the fact that little had been done in response to the implementation of stricter food safety requirements in the country's most important export market. Rather, most of the concerted effort to comply with these requirements was stimulated by the sudden loss of market access, in very much a crisis management mode of operation.

Limits on Mycotoxins as Trade Barriers

Mycotoxins are toxic by-products of mold infestations, affecting as much as a quarter of global food and feed crop output (Dohlman 2003; Reddy and others 2002). They commonly occur in the production of corn, wheat, and peanuts, causing considerable crop losses (Bhat and Vasanthi 1999). Their incidence is affected by weather and insect infestation, although proper production and postharvest (especially storage) practices can strongly mitigate occurrence.¹⁸ Consuming foods with very high levels of mycotoxins can be fatal, and long-term consumption of foods with lower levels has been linked to liver cancer. Since the discovery of mycotoxins in the 1960s, regulatory limits have been established

in 77 countries to protect consumers (Egmond 1999). There are wide differences in national standards, however, linked to different susceptibilities and different perceptions of acceptable health risks. For example, acceptable tolerances for aflatoxin in food range from zero to 50 parts per billion.

There are indications that mycotoxin problems have disrupted developing-country trade. Thailand was once a leading world exporter of corn. Because of persistent aflatoxin problems, however, Thai corn regularly sold at a discount, costing the country an estimated \$50 million a year in reduced export revenue.¹⁹ Similarly, India was historically a significant supplier of peanut meal to the European Union, but this trade declined sharply in the early 1980s because of problems meeting stricter standards for aflatoxin. Otsuki, Wilson, and Sewadeh (2001), in a widely cited study, examine the process of harmonization of the European Union's standards for aflatoxin and the potential impact on exports of selected products, including cereals and dried fruit and nuts, from African countries.²⁰ In 1997 the European Union proposed a set of harmonized standards for aflatoxin for member states, which had developed their own standards, and a uniform sampling procedure for testing. In response to the European Union's notification to the WTO, developing countries raised a series of objections to the proposed standards and sampling methods. The proposed standards were to be far more stringent than the proposed Codex standard, without proper scientific justification.²¹

Otsuki, Wilson, and Sewadeh (2001) argue that these standards are unnecessarily stringent given the estimated risk reduction that would be achieved. Their work is widely cited for its econometric estimation of the potential loss of African trade that could be attributed to the change in the European Union's standard. Using a gravity model, which incorporates a number of variables assumed to affect bilateral trade flows, they compare existing levels of African exports to the European Union with likely levels following implementation of the new standards and likely levels had the European Union adopted the Codex standard (15 parts per billion) across all product categories. They estimate that annual African exports to the European Union of cereals and nuts and dried fruit would decline from \$770 million to \$372 million following adoption of the EU standard but would rise to slightly more than \$1 billion under the Codex standard.

Hence, the decision by the European Union to adopt the more stringent standards was estimated to have cost Africa some \$667 million.

The conclusions of this work were headline grabbing but widely misinterpreted. Many subsequent commentators have mistakenly referred to the estimates as if they were actual losses rather than the results of an econometric simulation. Several shortcomings of this method need to be taken into account when interpreting the results.²² The major focus here relates to the value of exports before and after the adoption of the standard and the lessons that stakeholders take from the example.

The trade data used to establish the baseline put African exports to the European Union (in 1998) at \$472 million for dried fruit and nuts and \$298 million for cereals, with the bulk of this trade occurring with France. These figures seem implausible, especially for cereals, given Africa's lack of competitiveness in this sector relative to Europe. Statistics from the United Nations COMTRADE database show much lower European imports from Africa in 1998 of \$104 million for dried fruit, \$45 million for groundnuts, \$27 million for other edible nuts, and less than \$14 million for cereals and cereal products.²³ This suggests that the baseline against which the impact of the standards should have been assessed was \$190 million (c.i.f.—cost, insurance, and freight—value) rather than \$770 million.

What about the evidence on impact? Most of the region's dried fruit trade is accounted for by two North African countries—Tunisia and Algeria—whose exceptionally dry climate contributes to a very low incidence of aflatoxin. The only other African country with any history and recent strength in exports of dried fruit is South Africa. The new EU standards came into full force in April 2002. Both in the year proceeding and the year following that date there were no cases of dried fruit consignments from Africa being detained on entry to the European Union. In fact, while total EU imports of dried fruit declined somewhat in 2002, imports from Africa increased, boosting Africa's share from 9.8 percent in 2001 to 10.3 percent in 2002. Competing countries with more humid conditions (especially Turkey) incurred higher levels of product rejections during 2003. For dried fruit, the more stringent EU standards and enforcement at the border worked to the competitive advantage of Africa's leading suppliers.

What about groundnuts? Africa's groundnut exports are dominated by South Africa, although Egypt, The Gambia, Sudan, and Senegal have maintained small exports of confectionery nuts. Various supply-side constraints have inhibited the competitiveness of many African countries in the international market for groundnuts (see chapter 12).²⁴ In 2002 South Africa had 12 consignments of groundnuts rejected by EU member states because of aflatoxin. Only 3 of the 12 would have met the less stringent Codex standard or the standards applied previously by the individual member states. The rejected consignments were returned to South Africa, presumably for sale elsewhere, rather than destroyed. Probably a few hundred thousand dollars of business was affected, although the probable sale of these nuts in other markets would have substantially mitigated these losses. No evidence was found that Africa's limited exports to the European Union of either cereals or tree nuts have been adversely affected since the adoption of the new standards. Thus the near-term loss of African trade because of the more stringent EU standards has likely been in the hundreds of thousands of dollars rather than in the hundreds of millions.

While the case for significant African trade losses is weak, compliance with the EU aflatoxin standards remains a challenge for some developing countries. Between 2000 and 2002 the number of border rejections of nuts, nut products, and other snacks increased threefold (from 92 to 251). In 2002 some 235 consignments of nuts and dried fruit were rejected on grounds of excessive levels of aflatoxin. Most of the rejected shipments were from Turkey (77 cases involving hazelnuts and dried fruit), Brazil (51 cases, mainly Brazil nuts), and Iran (50 cases, mainly pistachios). Other countries with more than a few rejections were China (18), South Africa (12), the United States (7), and Argentina (5).

Although the data are incomplete, the EU notifications and alerts database reports the actual test results for levels of aflatoxin for many months. In most cases of rejection, the measured levels of aflatoxin are substantially higher (sometimes many times higher) than the Codex standard and also significantly above the domestic standards of the exporting countries. For example, of the 15 nut and dried fruit consignments rejected in January 2002, only 3 were above the EU standard but below the Codex standard. In October 2002, one country source of nuts had 38 individual consignments

rejected, 15 involving aflatoxin levels of 100 parts per billion or more.²⁵ This suggests that suppliers, especially those producing in humid conditions, are having considerable difficulty controlling aflatoxin contamination.

It is still unclear, however, how much EU standards on aflatoxin have affected developing-country trade. For example, Iran has been experiencing problems with aflatoxin for several years. Its exports of edible nuts declined from \$452 million in 1996 to less than \$210 million in 2002. Further analysis is needed to determine how much of this decline can be attributed to problems with aflatoxin contamination and of that, how much to regulatory measures rather than to a more general loss of buyer confidence. Exports from Turkey, however, seem to have been little affected by the increased stringency of EU standards and enforcement. In 2002 the volume of products rejected by the European Union constituted less than 1 percent of Turkish exports of nuts and dried fruit to that market. Any rejected product is reexported to countries with less strict standards (or enforcement) or sold domestically, reducing losses.

Proliferation of Horticultural Product Standards

The regulatory and private governance systems for international fresh produce markets are becoming increasingly complex. This changing regulatory environment appears to be raising the bar for new entrants and throwing new challenges in the path of existing developing-country suppliers. Concern is mounting about the ability of small and low-income countries to meet rising public and private standards and thus their ability to remain competitive in international fresh produce markets (Dolan and Humphrey 2000; Chan and King 2000; Buurma and others 2001). High-profile food scares and highly publicized instances of pesticide residue violations have created an impression of extreme vulnerability of developing-country suppliers. Yet experiences are mixed, and most countries and industries that have run into standards-related barriers have also been struggling with other supply-chain problems that have inhibited their profitability and competitiveness. Consider the contrasting experiences of two low-income countries, Guatemala and Kenya.

Guatemalan raspberries: a cautionary tale? In the late 1980s several firms began exporting

raspberries from Guatemala to the United States during months when U.S. domestic supplies were limited (Calvin 2003; Calvin, Flores, and Foster 2003). By 1996 these exports had reached \$3 million, with some 85 growers participating. In that year, however, the U.S. Centers for Disease Control and Prevention and Health Canada received reports of some 1,465 cases of food-borne illness associated with the parasite *Cyclospora*. Raspberries from Guatemala were identified as the most likely source of the contamination.

The FDA sent a team to Guatemala to investigate, amid considerable scientific uncertainty and great difficulty identifying the likely source of the contamination. The association of Guatemalan growers (GBC) remained unconvinced that its raspberries were the source of the problem. It attempted to put in place a limited program to screen out potentially high-risk farms, but the program had no effective enforcement mechanism. After another large outbreak of *Cyclospora*-related illnesses in the spring of 1997, the GBC voluntarily agreed to stop exports of raspberries to the United States. Despite the fact that the Guatemalan government created a food safety commission with enforcement powers in late 1997, the FDA was unconvinced and essentially imposed an import ban on Guatemalan raspberries.

During the next two years many organizations in the United States and Canada worked with the Guatemalans to solve the problem. A Model Plan of Excellence was put in place in 1999, involving the application of food safety practices by growers, mandatory inspection by government, and a system of product traceability back to individual growers. The United States lifted the ban on imports of Guatemalan raspberries. In 2000, however, there were two further *Cyclospora* outbreaks, which were traced back to a single Guatemalan farm. The grower was removed from the program, and there have been no further outbreaks.

While the Model Plan of Excellence was technically successful, it came too late to save the industry. Facing consumer concerns, several supermarkets in the United States sought alternative sources of raspberries. Recognizing the enormous challenge of rehabilitating the reputation of Guatemalan raspberries in the eyes of both consumers and distributors, several leading firms (both Guatemalan and international firms) shifted their operations to Mexico. By 2001 only four growers of raspberries

for export remained in Guatemala, with exports of less than \$200,000. Meanwhile, Mexico's exports of raspberries grew from \$2.9 million in 1998 to \$8.9 million in 2002 and now account for the largest share of an expanding U.S. import market.

Although the Guatemalan raspberry industry never recovered, other parts of the fresh produce industry built on the institutional capacity building that had taken place. For example, the inspection agency, the Integrated Program for Agricultural and Environmental Protection (PIPAA), has been working closely with local blackberry growers, a leading local supermarket chain, and others to enhance food safety management systems. PIPAA is also collaborating with the Animal and Plant Health Inspection Service and the FDA in the United States on a program for Guatemalan exports of mangoes and papayas.

Calvin, Flores, and Foster (2003) draw several lessons from Guatemala's experience. Delays in addressing food safety and agricultural health problems may hurt an industry's exports and reputation. An effective traceability system allows focusing on particular growers or exporters rather than needing to enhance standards in an entire industry. Finally, strong grower organizations can improve an industry's ability to respond to food safety challenges. There is also a wider lesson from Guatemala's experience. Small countries and niche products are probably far more vulnerable to loss of markets and collapse of reputation in the face of food safety problems than are larger countries and more mainstream or generic products. Both international buyers and consumers would likely be more tolerant and patient with core, long-standing suppliers that have established a "brand" in which they have confidence.

Kenyan fresh produce exports: some success.

Kenya's fresh produce trade dates to the mid-1950s, when small quantities of temperate-climate vegetables and tropical fruits were supplied in the European winter off-season to up-market stores in London.²⁶ This off-season trade was later joined by year-round supplies of high-quality green beans and a broad array of vegetables that are part of the traditional diets of UK immigrant populations from South Asia. Most of the products were air-freighted in two-kilogram boxes for sale through wholesale markets or to distributors and caterers.

For years the industry functioned with simple supply chains, involving little investment in infrastructure, product development, or management systems. Around a dozen medium-size firms plus large numbers of small, part-time operators handled the exports, frequently trading with relatives or similar small-scale companies in Europe. Fresh produce was purchased from large numbers of growers. Produce was generally collected in cardboard boxes from farms or along roadsides and brought to a central warehouse, sifted through and regraded if necessary, cooled a little, and trucked to the airport for evening shipment. Ministry of Agriculture officials at the airport conducted limited inspections. This was the model from the 1960s to the mid-1980s. The industry remained competitive in some markets and for some products, but not for others. The Kenyan fresh produce export trade grew slightly in the 1970s but stagnated in the 1980s.

Since the early 1990s the industry has been reshaped and transformed in response to—and in anticipation of—commercial, regulatory, and private governance changes within its core external markets. Commercial pressures came from saturated markets for certain products and increased competition from suppliers that had improved their supply capabilities and had less expensive sea or air-freight costs than did Kenya. Commercial changes within Europe also required a shift in the Kenyan approach. In many countries large supermarket chains were in ascendancy while wholesale markets were declining. Consolidation was also occurring among importers, packers, and distributors. The growing segments of the fresh produce market were being managed by fewer players. On the regulatory front a steady wave of activity was geared toward strengthening and harmonizing EU and member state regulations and monitoring systems for food safety, quality conformity, and plant health. Also emerging were progressively refined private-sector standards or codes of practice governing food safety, plant health, and other issues.

Several leading Kenyan exporters caught an early glimpse of this new fresh produce environment and began to reorient their operations. With the encouragement of several UK supermarkets, they began to experiment with new crops, new consumer packaging, and new combinations of vegetables. An increasing proportion of products was

directed to selected supermarket chains, which began to send “audit” teams to Kenya to check hygiene and other conditions on farms and pack-houses. Improvements and investments were recommended and in some cases required. With renewed confidence in the future of the industry, several exporters invested heavily in new or upgraded pack-houses and related food safety management systems for packing ready-to-eat and semi-prepared products. Mixed salads, stir-fry mixes, vegetable kebabs, and other value-added products now account for more than 40 percent of what has been a burgeoning trade over the past decade. Between 1991 and 2003 Kenya’s fresh vegetable exports increased from \$23 million to \$140 million.²⁷

Rising public- and private-sector standards have posed challenges to the Kenyan fresh produce industry, yet they have also thrown a lifeline to the industry. Because of Kenya’s location and relatively high air-freight costs, its fresh produce sector cannot compete with many other players on a unit-cost basis. Margins have been squeezed in the market for mainstream, commodity-type vegetables. With rising labor costs in Europe, however, the Kenyan industry has positioned itself as a slicer, dicer, and salad-maker, all labor-intensive functions. Thus far, this market segment has grown fastest in the United Kingdom, although there is increased buyer interest and consumer demand on the European continent as well. This suggests that well-organized industries in low-income countries can use stricter standards as a catalyst for change—and profit in the process.

Conclusions

There are now a number of documented cases in which developing countries have faced restrictions because of their inability to meet food safety or agricultural health requirements. In some of these, well-established export-dependent sectors have been compromised by the implementation of new, stricter standards, with negative repercussions for the livelihoods of those involved. At the same time, other countries have managed to gain access to high-value markets in industrial countries despite the exacting standards. Clearly, the situation is not as black and white as some commentators suggest. What cannot be disputed, however, is that stan-

dards have become an increasingly important influence on the international competitiveness of developing countries, especially for high-value agricultural and food products.

The evidence presented in this chapter, while admittedly incomplete, suggests that the picture for developing countries as a whole is much less pessimistic than that widely presented by the standards-as-barriers perspective. Indeed, rising standards accentuate underlying supply-chain strengths and weaknesses and thus affect the competitive positions of countries and distinct market participants, making it important to view the effects of food safety and agricultural health measures in the context of wider capacity constraints. The key question for developing countries is how to exploit their strengths and overcome their weaknesses to emerge as gainers rather than losers.

Still, by raising the bar for new entrants and placing a premium on effective safety management and logistical coordination, higher official and private standards can weaken the competitive position of small and poorer countries and the ability of small enterprises and farmers to remain active and profitable in export supply chains. But food safety and agricultural health standards are here to stay, and there is no slowing down their rate of change or applying for special and differential treatment. Much of the impetus for standards comes from consumer and commercial interests, magnified by advances in technology and added security concerns.

The answer for developing countries is to develop and improve food safety and agricultural health management systems. This requires simultaneous attention to legal systems, human capital, and physical infrastructure, among other things. Management capacity is required not only to comply with different requirements in different markets, but also to demonstrate compliance with standards. Although many countries have struggled to meet ever stricter standards, even some very poor countries have managed to implement the necessary capacity. This has most commonly occurred where the private sector is well organized and the public sector is well focused and supports the efforts of exporters. To meet the challenges posed by standards in international markets for high-value agricultural and food products, developing countries need institutional frameworks to help them

overcome the problems associated with being poor or small. These can include outgrower programs for smallholder farmers, systems of training and oversight for smaller enterprises organized through associations and other groups, and twinning and regional networking for small countries.

An overarching message is the need for developing countries (and their exporters) to be proactive on food safety and agricultural health issues. It is important not to be pushed into action by a major crisis. By thinking strategically, countries, producers, and exporters can program capacity enhancement into wider and longer term efforts to enhance domestic food safety and agricultural health management systems and export competitiveness. The alternative is that large investments will be required over a long period just to “put out fires.” In all of this, there is a need for the public and private sectors to work together to identify the most efficient and effective ways to develop capacity, viewing food safety and agricultural health controls as a collaborative effort.

Notes

1. For the more traditional food exports of developing countries, such as beverage crops, fiber crops, tobacco, and sugar, international trade is still largely governed by price and quality and by traditional forms of trade protection and preferences (see chapters 3 and 4).

2. According to a source at the Food and Drug Administration, while 99 percent of domestic facilities are found to be in compliance, some 30 percent of inspected foreign facilities have significant system defects.

3. See www.cfsan.fda.gov and europa.eu.int/comm/food/fs/inspections/fnaoi/reports/annual_eu/index_en.html.

4. For example, as of August 2003, two countries—the Netherlands and the United Kingdom—accounted for more than two-thirds of the area certified as being EUREPGAP-compliant. EUREPGAP is a set of good agricultural practices (GAP) based on accepted standards and promoted by the European retailer produce group (EUREP). Only a small proportion of the area in developing countries on which fresh produce is grown for the European market was so certified, the bulk of it in South Africa. Recognizing these constraints, extended deadlines have been given to many developing-country exporters and producers to adopt and gain certification against the EUREPGAP protocol.

5. Only 20 percent of the notifications by low-income countries and 22 percent of those of high-income countries involved applications of international standards.

6. An array of capacity assessment instruments are used to gauge strengths and weaknesses of food safety and agricultural health management capacity. Some instruments focus on specific dimensions of capacity, while others provide a broader overview.

7. In practice, it is rather difficult to measure “costs of compliance.” Food safety is very often achieved in combination with

other business functions and is thus a joint product with those functions. Thus, there are questions over what investments and which management systems are put in place strictly to ensure compliance with particular standards and which service a multiplicity of functions. In practice, it is often difficult to make this separation. For example, cold-store facilities may be needed to prevent the multiplication of bacteria in fresh produce, yet such facilities are also critical for achieving a quality characteristic or extended shelf-life.

8. One leading Kenyan firm estimated that the costs of its small farmer oversight arrangements represented about 12 percent of its costs of raw materials. These transaction costs represent 6 percent of the f.o.b. (free on board) value of French beans, which is equivalent to the exporter’s profit on the product and about 60 percent of the grower’s profit.

9. Some new products may not require as much farm labor as previously traded products or may require more capital investment. In either scenario the comparative advantage of smallholders may be reduced.

10. Data for the United States can be found at www.fda.gov/ora/oasis/ora_oasis_ref.html, and for the European Union at www.europa.eu.int/comm/food/fs/sfp/ras_index_en.html. The data exclude certain agricultural and food products for which the FDA has no jurisdiction, most notably meat and poultry. Until 2002 these data referred to border detentions regardless of whether the product was eventually permitted to enter. Since then they have recorded border rejections. The European Union has made disaggregated data on import alerts available only since 2002, although annual reports with broad summary statistics were published previously.

11. Between 2002 and 2003 the number of ports at which the FDA has assigned inspection staff increased from 40 to 90. During this period, a \$96 million increase in the FDA’s budget for food security work enabled it to hire 655 new field personnel. In the Bush administration’s proposed 2005 budget, the FDA would receive a 9 percent increase in funding to expand its “food defense” program. The fiscal 2005 budget calls for 97,000 import inspections, seven times the number undertaken in 2001. Similarly large increases were proposed for the Department of Agriculture’s work on food safety.

12. To put this number into perspective, the estimated total costs to the United Kingdom alone from BSE-related market losses and for the various cull and disposal schemes was more than \$5 billion (Mathews, Bernstein, and Buzby 2003). This does not take any account of the adverse impact on the country’s tourism industry.

13. For example, the United States currently permits imports of beef from only 33 countries and imports of chicken from only 4 countries.

14. Currently, the International Office of Epizootics recognizes only 57 countries as being totally free of foot and mouth disease without vaccination, of which 26 are developing countries—only 3 of them low-income countries. For further information, see www.oie.int.

15. Indeed, more widespread cases of both new and well-established animal diseases have led to heightened concerns about the role of international trade in the spread of such diseases. In the case of BSE, widespread restrictions have been applied to trade in live animals, meat, animal feed, and an array of by-products used in the cosmetics, pharmaceutical, and other industries.

16. For the case studies produced by UNCTAD, see r0.unctad.org/trade_env/test1/openF1.htm. For the case studies produced by UNEP, see www.unep.ch/etu/publications/Ctry_studies.htm.

17. The European Commission has presented its controls on hygiene for imports of fish and fishery products as a practical example of the application of equivalence (WTO 2001). Thus, rather than laying down specific requirements, the European Commission focuses on the conditions under which products will be equivalent to those produced in the European Union.

18. Although the growth of mycotoxin-producing molds is an endemic problem in humid areas, management of this problem need not involve very sophisticated or costly measures. See Boutrif (1997), Park, Njapau, and Boutrif (1999), and Dimanche and Kane (2002) for examples of practical and low-cost measures.

19. There, most of the problem occurred during postharvest as the harvested maize was typically stored in moist if not wet conditions for one to two months before sale and processing (Tangthirasunan, T. n.d.).

20. This is probably the most widely cited study on the potential or actual impact of rising food safety standards on exports of agricultural and food products from developing countries.

21. In response to objections, the European Union revised some of its proposed measures. In its 1998 Directive, it established a limit for total aflatoxin in groundnuts subject to further processing at 15 parts per billion, and a limit for aflatoxin B1 at 8 parts per billion, which was consistent with the proposed Codex standard. For other nuts and dried fruit subject to further processing, more stringent limits were set at 10 parts per billion for total aflatoxin and 5 parts per billion for aflatoxin B1. There was no equivalent Codex standard. The strictest standard was set for cereals, dried fruits and nuts intended directly for human consumption with maximum levels of 4 parts per billion for total aflatoxin and 2 parts per billion for aflatoxin B1. Again, there was no equivalent Codex standard.

22. See, for example the discussions about gravity models and other approaches to estimating the trade impacts of standards in Beghin and Bureau (2001), OECD (2003), and Wilson (2003).

23. In that year, African exports of cereals totaled \$105 million, with Egypt accounting for \$70 million. The vast majority of this trade was conducted with countries of the Near East and Middle East.

24. In the 1960s and 1970s Africa was a major world supplier of groundnuts, with large exporters in Malawi, Nigeria, Senegal, and other countries. For reasons unrelated to aflatoxin, these exports lost their international competitiveness, and most production went to serve domestic markets or for use in oil crushing. Over the years, research activity and the commercial trade in Africa moved away from confectionery-type varieties preferred in world markets, and recent attempts to revive confectionery nut exports have encountered major problems attributable to inadequate seed, basic quality control and price incentives for farmers.

25. Moonen (2004) reports on testing results from the Dutch import control authority. It is common that groundnut shipments from developing countries have levels of aflatoxin contamination of between 50 and 800 parts per billion. Also cited by Moonen are toxicological surveys in Senegal for groundnuts sold in the domestic market. Some 90 percent of sampled groundnuts were contaminated with aflatoxin with the average level being 230 parts per billion.

26. The discussion in this section draws on Jaffee (2003).

27. Systems for crop procurement have also been transformed, with many leading companies investing in their own farms or inducing changes in the practices of outgrowers. There has been an array of joint public-private initiatives to train growers in all aspects of good agricultural practice. But not all of

the industry has transformed itself. Some 25 smaller exporters lack the financial resources to invest in modern pack-houses and continue to supply loose produce to commission agents and others in European wholesale markets and the Middle East.

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