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Regulation in the Process of Building Capabilities: Strengthening Competitiveness While Improving Food Safety and Environmental Sustainability in Nicaragua*

Paola Perez-Aleman
McGill University, West Montreal, QC, Canada

Abstract
To understand how regulation influences competitiveness and upgrading processes, this article focuses on the organizational changes involved in "rewarding regulation." Through a qualitative study of two clusters in the agrifood industry in Nicaragua, it analyzes two types of regulation and their interaction with small producers' production organizations: food safety and environmental sustainability. The analysis shows that regulation plays a crucial role in fostering changes in organizational practices and routines. This occurs when local organizations build new knowledge and skills to upgrade products and production processes, while developing new connections among producers and between them to other private and public actors that support economic development. "Rewarding regulation" is part of a process of learning and creating networks that help build local know-how and generate supportive collective resources.

Keywords
regulation, upgrading, organizational learning, clusters, development

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Corresponding Author:
Paola Perez-Aleman, Associate Professor of Strategy and Organization, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street, W., Montreal, QC H3A1G5, Canada.
Email: paola.perez-aleman@mcgill.ca

Introduction

The rise of transnational rules, standards, and norms to regulate cross-border trade, investment, and production in the global economy initiated new regulation of productive activities in developing countries. These regulations are generated and enforced by various combinations of public and private actors, within and beyond national states, including international and nongovernmental organizations, industry associations, and multinational firms.[1] In particular, a growing literature suggests that new regulations aimed at protecting consumers, workers, and the environment have fostered economic development and upgrading in diverse Latin American contexts.[2] This view contrasts with criticism that higher labor or environmental standards imposed on developing countries have a negative impact on indigenous firms and farmers, as they are barriers to market access, or they increase costs to achieve compliance levels. Instead, goals such as safer foods, more sustainable agriculture, and increased worker protection are enhancing the competitiveness of indigenous enterprises while supporting development. The idea that social and environmental protection goals contribute to upgrading and development underlies the notion of "rewarding regulation."[3] Key questions are explored here: How does regulation interact with and influence local efforts to enhance competitiveness and upgrading? What organizational processes are involved in rewarding regulation?

This discussion focuses on how "rewarding regulation" contributes to building the capabilities (upgrading) of local enterprises to improve their competitiveness by facilitating knowledge building and coordination among multiple actors. Regulation plays an influential, though not automatic, role. Existing research establishes the importance of enhancing human and organizational capabilities at all levels to facilitate development.[4] Previous studies demonstrate that development and catching-up dynamics require building the capabilities of domestic organizations, and improving their skills and know-how, which often involve adapting and modifying foreign practices.[5] Scholars identify the upgrading of local enterprises as crucial in the economic development process, that is, the ability to make better or new products, improve production methods and processes, increase commercialization channels, and move into more value-added or skilled activities.[6] Other researchers show that institutions governing local production systems influence the possibilities for upgrading the capabilities of indigenous enterprises.[7] In particular, empirical studies show the important role of standards at the local or industry level for improving the quality of products, working conditions, and environmental performance.[8]

The argument presented in this article is that "rewarding regulation" plays a crucial role in fostering learning that helps indigenous firms in developing countries upgrade and innovate. Learning refers here to improving existing organizational routines and organizations by building new knowledge and skills to upgrade—and innovate—products and production processes.[9] The influence of regulation in this dynamic process, particularly in facilitating learning, also depends on creating connections between private and public actors that support economic development. "Rewarding regulation" is part of a process of learning and creating networks that help build local know-how

and generate supportive collective resources. The analysis is based on two cases from the agrifood industry, dairy and coffee production, in Nicaragua: upgrading to produce safer food and upgrading to achieve more sustainable production, which illustrate how new standards disrupt existing practices and open spaces for generating improved organization and competitiveness.

Rise of Two Types of Regulation: Food Safety and Environmental Sustainability Standards

With globally integrated markets and production systems, enterprises in developing countries are experiencing institutional complexity from multiple regulations: national and international; industry and supply chain; government and nongovernment (NGO), public and private; and production-process oriented in addition to final-product characteristics. One type of regulation involves standards that address a variety of issues such as quality, environmental impact, consumer safety, and labor conditions. In general, standards are understood as constituting explicit conventions, rules, norms, shared expectations, agreements, and regulations that show certain regularity, eventually becoming institutions.[10] A standard can refer to product characteristics and production methods designed to meet certain expectations. It can refer to final product requirements (i.e., safe for human consumption) as well as to the process used for producing the product (i.e., elimination of toxic chemicals). These standards are part of the transformations that have been taking place in public and private regulation of firms, which have become pervasive in the European Union,[11] in North America,[12] and elsewhere in diverse sectors and activities.[13]

Food Safety

Food safety standards have been among the most globalized and regulated.[14] Food scares and scandals, consumer health concerns, and NGO consumer safety campaigns have pressured governments and firms worldwide to expand and enforce safety measures in the food supply chain. Governments in the United States and Europe have adopted food safety regulations to deal with carcinogenic chemicals and the use of hormones and antibiotics, all with considerable global impact.[15] While government regulation was predominant in the past, more recently private standards, with an international orientation and a focus on the production process, have grown dramatically.[16] In Europe companies have invested billions in adopting process control systems related to Hazard Analysis of Critical Control Points (HACCP) standards.[17] Private firms incorporate HACCP as a total quality management principle to guide their evaluation of potential hazards in the food production site, rather than wait for final testing at inspection centers.

The regulatory interactions between national and international organizations and global supply chains, with public and private standards, have contributed to the worldwide diffusion of HACCP systems for ensuring food safety. The characteristic feature of HACCP is its emphasis on a process-based approach where food producing firms

must analyze their entire production chain for hazards, identify points where contamination may arise, develop plans for controlling and reducing hazards, monitor plans, and develop actions to correct performance gaps.[18] The HACCP guidelines were adopted as international standards by the Codex Alimentarius Commission, which includes the UN Food and Agriculture (FAO) and the World Health Organizations (WHO). The World Trade Organization recognized the Codex standards as it elaborated the Sanitary and Phytosanitary (SPS) Agreement. Moreover, in the mid-1990s, governments in advanced countries also introduced HACCP-based systems for regulating food safety. These food safety regulations are in turn adopted and adapted by firms to their own procurement and production processes.[19] As many governments have adopted these standards to regulate both imported and locally produced food, and as multinationals (foodstuff manufacturers and retailers) have developed private standards to meet hazard and traceability requirements in their supply chains, the food producers and suppliers from developing countries are also interacting with these rules with their export and integrated domestic markets.

Although most initiatives to strengthen food safety come out of advanced economies in the EU and North America, safety concerns are a major problem for population health in developing countries. Malnutrition is not only related to reduced caloric access, but also to food quality and safety.[20] Food contaminants, such as microbial pathogens, parasites, and pesticide residues, can make people sick, limit nutritional intake, and increase the risk of chronic diseases from compromised immunity.[21] In the developing world, contaminated foods are a major cause of mortality and morbidity due to gastrointestinal diseases, especially among children under five.[22] Repeated episodes of food-borne diseases are one of the most important underlying factors for malnutrition in developing countries, with a serious impact on the growth and immunity of infants and children.[23] The practices underlying international food safety standards are primary methods to reduce the disease burden as well as improve food security in developing countries.

International food safety standards usually include dimensions such as hygienic practices; minimum temperature levels; maximum harmful bacterial limits; and the absence of residues from drugs, chemicals, and animal diseases. The technological requirements associated with new standards are significant and put pressure on producers to improve their knowledge and innovate locally to be competitive. For example, preservation, humidity control, cold chain maintenance, reducing pesticide use, and increasing nutritional content—which increasingly drive food production—all involve using new technological know-how.

Environmental Sustainability

Another area of active regulation is sustainable production to protect biodiversity, prevent climate change, stop deforestation, and eliminate hazardous chemicals, among others. Diverse value chains have experienced the rise of new private standards and certification systems that differ from traditional business regulation by focusing on social or environmental impact.[24] Since the early 1990s, social movements have

organized boycotts and campaigns targeting highly visible firms in North America and Europe, pressuring for more corporate social responsibility. These norms are defining expectations for more socially and environmentally sustainable production processes. Many of the new standards aim to influence business practices in the global supply chains, which grew in recent decades, linking multinational companies (MNCs) and developing country producers.[25]

A growing trend is to focus on the production conditions in industries such as food processing, fisheries, forest products, mining, coffee, cocoa, and electronics, among others. One example is the mobilization of the environmental NGO World Wildlife Fund (WWF) to address forest ecosystem health and biodiversity.[26] Similarly, environmental NGOs created the Forest Stewardship Council (FSC) to develop private standards for sustainable forestry and certify their compliance.[27] This certification provides traceability through each link in the supply chain from forest to final sale.[28] Another example is the coffee industry, where social movements advocating corporate social and environmental responsibility pressured multinationals such as Kraft, Sara Lee, Starbucks, and Nestlé to improve international working conditions and environmental practices.[29] This gave rise to new products certified as "fair trade," "organic," "bird-friendly," and "shade-grown," as well as other specialty coffee varieties.

A variety of public and private actors—including national governments and international organizations, NGOs, and multinational companies—are creating and enforcing environmental regulation.[30] In sustainable forestry, for example, branded manufacturers and government procurement agencies have required their suppliers to upgrade and achieve the FSC certification that was established through a transnational coalition led by environmental NGOs.[31] In the case of fisheries, the WWF, in partnership with the company Unilever, created the Marine Stewardship Council standards, which later evolved into an independent multi-stakeholder nonprofit organization that certifies and monitors maritime impacts.[32] In coffee, the significant growth of sustainable coffee products is driven by a variety of standards originating and enforced within supply chains by major companies such as Nestlé and Starbucks. Equally important, they are promoted and certified broadly at the product, sector, and industry level by environmental NGOs, joint public-private organizations, and trade associations.[33]

Like in food safety, the regulation of environmental risks through stringent and often precautionary standards to prevent or ameliorate them has been mainly driven by governments and environmental movements in Europe and North America.[34] But in developing countries, there is abundant evidence that growth and livelihoods, especially of poor people, depend on their natural resources.[35] Developing countries are the most vulnerable to serious environmental problems such as water and food supply crises, soil erosion, deforestation, water contamination, waste management problems, exposure to hazardous substances, and unsafe or unhealthy conditions for workers.[36] The goals of environmental protection also have relevance for reducing poverty and fostering development.

Despite the variety of organizations, many environmental standards have similar goals. For example, most sustainable coffee standards include protecting biodiversity,

improving environmental and social conditions in tropical agriculture, minimizing environmental impact, and improving basic labor and living conditions.[37] These goals generally translate into caring for the biodiversity of trees, birds, and other fauna; reducing agro-chemical use that harms the environment and workers; conserving soil and water; recycling; reforestation; and increasing access to schools and health services.

Impact of Standards on Firms in Developing Countries

Studies show that the cost burden of making changes to improve food safety tends to be pushed down from the standard adopters toward the suppliers, notably primary production producers in developing countries.[38] Current international food safety standards differ from present practice among low-income producers, where weak or nonexistent sanitation and food-safety government mandates are commonplace.[39] Firms in developing countries face significant challenges to adopting international standards that differ significantly from their traditional practices.[40] These firms operate in a low-income context lacking infrastructure, government assistance, and technical and financial services, and therefore face the challenge of making simultaneous and complementary changes involving multiple actors to improve their competitiveness. They typically start with disadvantages, such as being far away from the infrastructure that could support improvements in their productive activity.

Similarly, in the case of environmental standards, the issues of costs and lack of support are also important. For example, studies on the forestry sector indicate that while private certification achieved high coverage rates among industrial forest companies in advanced countries, their adoption remains weak in developing countries, especially in those with the diminishing tropical forests that originally sparked the campaigns for global regulation.[41] More than 25 percent of managed forest lands worldwide have been certified as sustainable, but the share of certified acreage in developing countries has been smaller due to the implementation costs, lack of external support, and lower or nonexistent domestic demand for certified forest products.[42] For some, as the social and environmental bars are raised, the new "ethical" standards are imposing new barriers and conditionality on market entry for developing countries.[43]

At the same time, existing research shows that indigenous firms and governments in developing countries engage in a search to achieve higher-quality products, increase value-added, raise productivity, and build skills to be competitive.[44] There are many examples of local enterprises shifting from lower- to higher-value economic activities, and making improvements in production processes, products, and functions.[45] These improvements have involved a learning process to build know-how and change existing practices and routines.[46] These changes that are central for upgrading and innovation frequently draw on foreign practices, not as simple copying, but as an intelligent adaptation and modification to local conditions.[47] A look at the process of how the upgrading and development occurs reveals that regulation, such as standards, becomes part of the mechanisms that support learning associated with economic development.[48]

This raises the question of how regulation that protects consumer safety and the environment enables improvements for local producers and fosters development in

developing countries. To explore this question, the article presents two examples of upgrading and increased competitiveness in two clusters in Nicaragua. Focusing on the process, the findings suggest that local actors use the new demands from higher food quality or environmental standards to uncover and address problems limiting their development, to experiment with alternatives, and to foster collective learning and network creation.

Case Selection

To explore these issues empirically, the analysis centers on two clusters in the agrifood industry, which is relevant for developing countries given that half of the population lives in rural areas and that activities based on the growth of plants and animals in farms are important. This industry has been transformed in the past three decades due to increased product differentiation and internationalization along with local production integration with global and regional consumption and distribution.[49] The industry has also seen considerable growth of transnational regulations, along with the rise of agrifood supply chains, focused on issues of food safety, health, and environmental impacts, in a context of increasing consumer concerns regarding health, nutrition, environmental impacts, and fairness in production and distribution.[50]

To exemplify the transnational standards aimed at regulating business activity across borders, I use cases from dairy and coffee production. Using two different examples brings in both the diversity found in the agrifood industry and the variety of transnational regulation (food safety and environmental) to analyze what processes the two types have in common that have most affected producers in the context of globalization. The dairy industry provides an excellent setting for observing food-safety standards where government and private policies have become deeply intertwined through interactions at the national and international levels as food-safety codes have been adopted in the context of increased market integration. The coffee case brings in an industry that has been a leader in market share and experience in new sustainability standards, seeing the fastest export market growth of sustainable products.[51] Moreover, the two types of regulation also have crucial overlaps in their goals to increase consumer and environmental protection. For example, the HACCP standard in the dairy case and the sustainable agriculture standard in the coffee case include norms to eliminate pesticides and chemical residues dangerous to human health, and prevent environmental contamination from waste disposal. Similarly, in both cases, private firms, NGOs, and governments have an important role in the regulating dynamics, a characteristic of transnational standards that regulate international business activities.[52]

Both cases are also typical of the agrifood industries where small producers have an important constituency. Small-scale family farms produce more than 70 percent of the world's coffee in eighty-five Latin American, Asian, and African countries.[53] An estimated 85 percent of Central America's coffee farmers are micro and small-scale producers (less than 3.5 to 14 hectares of land).[54] Likewise, dairy farming is a principal activity for small producers in Central America, with more than 400,000 small-scale livestock producers generating more than 75 percent of their income with milk sales.[55]

Recent estimates indicate there are 150,000 dairy producers in Nicaragua, the largest number in Central America.[56] National surveys indicate that Nicaragua's rural producers have an average of three head of cattle and one to two hectares of land for those in extreme poverty, and an average of fifteen head and six hectares for the less poor.[57]

The cluster level of analysis follows studies showing that processes of development and upgrading of local enterprises often occur in clusters, that is, geographically concentrated firms in the same or related activities.[58] This cluster-level approach focuses attention on the producers and the organizations interacting in the industry. The clusters selected for this study are located in Nicaragua, a representative low-income country that shares important similarities with other poor Latin American, African, and Asian countries. It has weak national institutional infrastructures and limited government capacity. In addition, it has undergone a political transition common to many developing countries, especially in Latin America, moving from dictatorship to democracy. Further, Nicaragua has experienced market liberalization since the 1990s, removing trade barriers and increasing cross-border integration through regional and bilateral trade agreements. These changes have created new international trade regulatory and market conditions, affecting the dimensions that are the focus of this study.

One is a dairy cluster located in the Nueva Guinea region, in southeastern Nicaragua, an area known as the agricultural frontier, about 270 kilometers east of Managua, the capital city. Nicaragua has been an important dairy producer in Central America, with some 100,000 livestock enterprises,[59] and the cattle industry—including beef, milk, and cheese—accounts for 7 percent of the GDP.[60] Historically, the country's dairy production concentrated in the agricultural frontier, which refers to marginal, degraded, or depleted soils in the Southern Central region, converted to pasture for cattle, as they were not useful for agriculture.[61] Seventy percent of the total raw milk volume produced in Nicaragua comes from producers located in the area of Nueva Guinea and two adjacent regions, Boaco and Chontales.[62] Small and medium-sized producers are responsible for the bulk of dairy production. Overall, small producers (one to twenty head of cattle) account for 80 percent of the raw milk produced in Nicaragua;[63] 73 percent of Nueva Guinea producers are small, with six to twelve head of cattle.[64] Production takes place in zones with difficult access, distant from market centers.

The other cluster in this study produces coffee and is located in the northern regions of Matagalpa, Jinotega, and Nueva Segovia. Coffee is one of the principal export crops and one of the most important rural activities in Nicaragua.[65] Of the 48,000 coffee farms in Nicaragua, 80 percent are micro-producers with less than 3.5 hectares of coffee and 90 percent are small holders with less than 10 hectares.[66] Most of these farms are located in areas with poor road access and insufficient electricity coverage; for example, only 36 percent of the population in the rural coffee-growing regions of the north has access to electricity, compared to 56 to 68 percent of the urban population.[67]

These clusters are in rural areas in the Central regions, where most poverty in Nicaragua is concentrated, in contrast to the richer Pacific zones.[68] Nationally, poverty levels are among the highest for smallholders in agriculture and livestock production.[69] As is common in Nicaragua, these small farmers have land, which most

obtained through agrarian reforms in the 1970s and 1980s, and in other cases from inheritance or purchasing. They face, however, more serious problems of access to credit, technical assistance, and crucial infrastructure.[70] Typically in Nicaragua, the smallholders have land and cattle holdings, but they live in isolated areas, with the lowest levels of access to electricity, roads, health and sanitation, and the greatest distance from schools.[71] In addition to lack of infrastructure, financing, and technical assistance, small producers commonly face low prices for their products, and distance from markets impedes commercializing their products.[72] The cases selected exemplify these common problems facing smallholders in Nicaragua and in other developing countries.

While new commercial avenues expanded domestically and internationally for coffee and dairy production in general in the 1990s, small farmers faced serious problems in terms of the market conditions for their traditional products. In the 1990s, new commercial options developed with trade liberalization policies and the reestablishment of relations with countries that stopped trading with Nicaragua during the 1980s, opposing the Sandinista government.[73] In the case of the coffee cluster, however, producers faced a dramatic downturn in their socioeconomic situation in the mid- to late-1990s when international coffee prices plummeted.[74] Rural households engaged in coffee activities saw large socioeconomic declines, and small farm households were hit the most, even more than poor labor, which was also negatively affected.[75] In the case of dairy products, their perishable nature and the lack of crucial infrastructure throughout the dairy farming regions of Nicaragua meant that small producers were highly vulnerable to low prices received for their milk.[76] Producers in both clusters were dependent on private traders and processors that paid substantially below market prices for advance pre-harvest contracts, or for on-the-spot purchases that dominated these rural markets, in a context of limited financing and geographical isolation.[77]

Both the dairy and coffee cases represent attempts to trade away from commodities or undifferentiated products as part of local strategies to confront their existing vulnerable market conditions and uncertainties. Both clusters provide a vantage point to examine the interaction between regulation and competitiveness as local producers adopt standards for protecting consumers or the environment. This study investigates the process of upgrading the existing production system, as small producers engage in local efforts to make improvements in their products, production methods, and commercialization channels. How does regulation interact with the dynamics of building capabilities to upgrade and improve competitiveness of firms in these clusters? Focusing on process places the emphasis on the changes unfolding in interaction with the new standards, assuming this is ongoing and dynamic, rather than a finished outcome.

As is typical of research on "how" questions, this work is based on qualitative research that combines diverse data collection methods, including a mix of ethnographic observation, in-depth interviews, and archival data. The fieldwork in Nicaragua was conducted in various stages, in separate visits from 2002 to 2006 for the dairy cluster, and from 2011 to 2013 for the coffee cluster. The interviews included dairy and coffee producers; leaders and managers of cooperatives and associations in different

functions (processing, quality control, technical assistance, testing centers, labs); government officials at the national and municipal levels; and development practitioners (project managers). The interviews were not recorded and typically lasted an hour. In addition, the data from field observations was collected during visits to farms, procurement centers, processing plants, and labs. Successive field visits allowed data collection on evolution over time and interactions between standards, producers, and production organizations.

Rewarding Regulation in Nicaragua

Food Safety and the Dairy Cluster

The cooperative COOPROLECHE in Nueva Guinea, Nicaragua, began first as a fluid milk producer and later became a successful cheese manufacturer selling in the domestic market as well as exporting to Central American countries. Its evolution shows how food-safety regulation interacts with a local process of uncovering problems and major gaps in the current products and production system, and secondly, with local efforts that leverage new gained knowledge to build their organizations and capabilities that, in turn, transform the cluster of dairy producers. In the dairy sector, food-safety standards emphasize hygienic conditions and elimination of hazardous substances at every stage of the process: raw milk production, handling, processing, and finally distribution of milk products. More recently, a key component of international practice is the evaluation of on-farm practices and raw milk handling prior to pasteurization as part of the HACCP certification process. Critical dimensions for all international standards for safe dairy production include minimum temperature levels, maximum bacterial limits, and absence of residues from drugs, chemicals or animal diseases.

A decade ago, the COOPROLECHE cooperative did not exist as an organization, and fifteen years ago the local producers in Nueva Guinea did not have experience with the routines used to produce safe milk products.[78] As is typical in low-income contexts, North American and European food-safety standards represented a major challenge for these small rural producers located in zones lacking electricity, potable water, access to roads, or sanitation facilities. Moreover, milking took place on dirt floors in muddy open corrals. There was also weak government capacity to reach rural areas with animal health programs and therefore there was an absence of cattle disease testing or control services. It was commonplace to use chemical preservatives, such as formalin (formaldehyde), a human carcinogen,[79] to slow down bacterial growth to prevent spoiling, as small producers usually had no access to refrigeration centers to cool milk. This reality is common to rural areas of developing countries, and underlies the concerns about the negative impact of food-safety standards on indigenous producers unable to meet them. This characterized the situation in Nueva Guinea until the late 1990s.

Given the distance from their local reality and the practices necessary to produce safe food, there is evidence in Latin America showing that rural smallholders are disadvantaged and easily excluded from markets regulated by global food-safety standards.[80] Similarly, in Nicaragua, dairy producers of Nueva Guinea lost their foreign

market option in 1998, when neighboring countries adopted government regulation in compliance with HACCP standards, and they could not meet them. For example, in 1998, El Salvador passed a new consumer protection law, which established that all imported dairy products must be pasteurized. This neighboring country had become the biggest market for Nicaraguan cheese exports, accounting for 75 percent of Nicaragua's dairy exports in 1995 through 2001.[81] At the time, Nueva Guinea producers did not follow hygienic milk collection procedures, nor did they pasteurize their raw material, so they were prohibited from selling to El Salvador. This was the first time these producers had encountered regulatory pressures related to milk hygiene, as there was no regulation of milk-safety quality in Nicaragua. They experienced a local crisis as they lost their foreign market, and milk prices collapsed.

The appearance of food-safety issues, however, was not the first crisis for the Nueva Guinea producers. It emerged under existing market and socioeconomic vulnerabilities, with highly unstable prices, dependence on private traders that paid low prices for milk, and their isolated conditions. Most of Nicaragua's milk products, estimates state 75 percent, were sold in the domestic market.[82] Locally, small producers were already struggling with drastic seasonal price fluctuations and unreliable payments from intermediaries or middlemen. Small dairy producers had constant income insecurity, resulting from particularly abundant production in the rainy season, lack of refrigeration tanks to store milk, product perishability, and isolated location; all of these factors combined to create high price volatility, drastic variation in producers' cash flow, and low-quality dairy products. The crisis surrounding the closure of one of the producers' market options, however, motivated alternative search strategies for reducing or even eliminating some of the vulnerable and unequal aspects of their old dairy production system. Facing these desperate conditions, upgrading milk quality was driven by local producers organizing to improve commercialization through different channels, and then ultimately to enhance production practices to compete in different local and export markets.

Food-safety standards played a role in guiding the emergence of new methods, new infrastructure, and new products that required incremental knowledge building.[83] Developing local products that accounted for consumer safety was not a mechanistic, externally driven process. On the contrary, it depended on building local know-how to improve milk on-farm collection, local procurement, processing, and commercialization in the Nueva Guinea context. This is important, as the ability to locally adopt and adapt a regulation like HACCP is not detached from practice.[84] Those enacting the production practices build their knowledge while integrating and implementing the standard into the local system. This was visible in the following changes introduced to the old production routines: on-farm hygienic milking conditions; delivery to joint collection points; testing for chemicals and bacterial contamination; on-farm control of cattle diseases; collective milk storage; and joint processing of new milk and cheese products. These changes were essential to building the competitiveness of these dairy producers, and adopting them entailed a learning process to allow different routines to become the new production practice.

For example, the elimination of contaminants such as formalin or harmful bacteria and achieving low somatic cell counts (SCC), a key measure of milk quality indicating animal health, challenged existing ways of "doing dairy," and the change involved interactions that simultaneously required and developed new information, know-how, tools, and collaborative organization. To produce milk that was free of adulteration and chemicals meant that new activities were necessary. For example, the introduction of milk testing to monitor its condition at the reception points where producers bought their milk was a new activity. Another involved changing the timing of delivery (typically on horseback) to early morning, to avoid high midday temperatures that accelerated decomposition. Yet another required speedy transfer from farm to a refrigerated collection point to avoid the spoiling conditions created by long hours where the milk sat at the farm unrefrigerated under the hot sun. Similarly, a new activity was educating farmers about the harmful effects of formalin and that new milk delivery routines were a better way of doing business. Still another was helping producers learn to recognize cattle diseases and to avoid using the milk that was contaminated with bacteria causing mastitis, brucellosis, or tuberculosis. Additionally, the adoption of simple hygienic pre-milking routines such as washed hands and containers, clean udders, and surface areas contributed dramatically to reduced somatic cell counts. Finally, the introduction of collective refrigerated centers close to farms, as farmers were too poor to own an individual cooling tank, also created new interdependence in the dairy activities that involved new coordination and communication to accomplish the changes.

Changing the old dairy routines to improve milk quality involved learning, and the producers' learning occurred through the experiences of adjusting their dairy production activities. This was a difficult process, going beyond knowing the standard (written or unwritten) to actually accomplishing its performance.[85] A dairy producer stated: "A common feeling was that changing our production process seemed too complicated and very difficult."[86] For example, Nueva Guinea producers did not believe that their milk had a "problem." The notion that their milk was "dirty" and contaminated with bacteria was a foreign concept. They took for granted that the milk could stand under the sun for hours waiting to be picked up at the farm, or transported during the hottest period of the day. They did not initially understand why their farm-level practices were causing problems. Through interactions with the new standards and other dairy producers, and in performing the new activities to improve milk quality, they developed a new understanding that supported implementing the change in dairy practices.

For instance, the new tests supported local understanding on how to avoid farm-level contamination. The new milk testing system involved an initial Ph level test, a check for milk adulteration, and a temperature test to determine its adequacy for later pasteurization. Milk that did not meet acceptable levels for these three attributes was rejected at the local collection center, where a board of dairy producers managed the operation. The producer was immediately notified, a local board member made a farm visit to explain the problem, and their milk was not accepted again until it met the goal. In addition, the tests served to make explicit why a specific milking or delivery practice was important. Through these discussions and problem-solving activities, the Nueva Guinea producers were actively contextualizing the technical knowledge embedded in the standard.

Importantly, achieving upgrading of hundreds of producers required coordinating and interacting so that others could change and create new routines as well.

At the same time, as dairy producers grappled with how to eliminate harmful bacterial and chemical contamination, new microbiological tests on the milk samples from each producer nurtured a higher level of understanding and knowledge flow among producers. An international development project funded the installation of a modern milk-quality test laboratory in the central processing plant located in Nueva Guinea. Having a lab to test for milk quality helped to increase local understanding of harmful bacterial content as a dimension of quality, and the links between producers' actions and the resulting milk quality. This, in turn, allowed for the definition of clearer guidelines and the ability to get immediate feedback on how their farm and milk-handling procedures were affecting milk quality. The lab provided a written report of the bacterial content for each sample taken from individual producers (i.e., quantity of bacteria per milliliter). The microbiological tests were a major revelation that challenged the producers' prior assumptions. With the new routine, lab test reports could immediately reveal problems, identify the source, and then make it easier to locate and clear bottlenecks. Producers who did not deliver quality milk received notice that they needed to improve, and a local board member visited to check everything on site (milking procedure, hygiene, animal health).

Another important step was the establishment of training programs to identify and control for common cattle diseases. Producers stated that before they would guess blindly what the disease was and what to do about the problem. With training, they learned how to identify and control the diseases. This was a crucial aspect that the local producers had not addressed before, as animal health programs had not reached the region, yet eliminating and controlling for diseases such as mastitis and brucellosis was an important aspect of food-safety standards. This newly gained expertise supported the implementation of the safer food standard and how to apply it in the local context. Here too, the HACCP standard influenced changes in a production system that was distributed among hundreds of small producers.

Accompanying the process of achieving safer milk was the increasing interdependence that developed among producers in the Nueva Guinea case. In contrast to the old production system, they began to procure their milk collectively through jointly owned refrigerated tanks, decentralized through their region, located close to farms. This aspect was essential to accessing previously unavailable refrigeration infrastructure, to achieve volumes attractive for new commercialization options, and to increase spaces for interactions that supported the building and circulation of new know-how. But the installation of the refrigerated tanks alone was insufficient to achieve improvements in milk quality. The changes at the level of the farm, and along the production chain, which involved joint activities and feedback, were essential to eliminate harmful elements from the milk. In this sense, the increasing connections among producers contributed to develop new understanding about how to produce milk, and enabled the circulation of new knowledge. The more the producers interacted, the more they could achieve the new performance, that is, the collective capacity to produce the highest quality milk possible: unadulterated and with the lowest bacteria and SCC count.

The new activities helped to build stronger connections and Nueva Guinea producers felt they developed a sense they could work together and create a joint organization. In the mid- to late-1990s, these producers had rejected the idea of creating a cooperative amidst distrust of that organizational form, and because of politically opposite camps among them. But by 2000, Nueva Guinea producers created a cooperative enterprise for the procurement and processing of their milk product. By 2003, the cooperative COOPROLECHE had grown to 250 producers.[87] By 2004, they collectively achieved maximum total daily volumes of 20,000 liters.[88] As a group they also developed agreements about desired performances that led to new health and safety norms, including a commitment to maintaining a healthy herd by controlling for diseases (absence of brucellosis, mastitis, and TB); while insuring hygienic milking and handling of milk from farm to delivery at the peripheral center. The producers in the cooperative also developed a differentiated pricing arrangement based on product quality.[89] By 2004, 96 percent of Nueva Guinea producers' daily milk production achieved "A-level" milk quality, the highest rank.[90] These connections among producers in different zones of Nueva Guinea supported the learning of new or adjusted dairying routines. Their connections with other organizations also enabled the shift to upgrade their production system.

Underlying these changes were the creation of resources to make the investments in new infrastructure to support the process of shifting to a new production system, notably peripheral refrigeration tanks, a microbiology lab, a central refrigeration tank at the procurement plant, and new on farm-tools (i.e., stainless-steel containers), among others. Here too, the connections Nueva Guinea producers developed with government and nongovernment organizations helped to generate and direct resources to their region. In the same period, while local producers searched for alternatives, the Nicaraguan government and foreign aid partners were focusing on rural development programs, in a post-1980s war context and with the goal of improving food security.[91] One of the rural programs promoted by the Nicaraguan Institute of Rural Development, financed with aid from European countries, focused on credit subsidies and investments in physical infrastructure for the cattle industry, including support for the Nueva Guinea region. As local dairy producers grappled with constant fluctuations in milk prices and the increasing adoption of HACCP-based food-safety standards by current and potential markets, domestically and internationally, the goal of producing safe milk became integrated into the efforts to foster economic development in the region. Given the importance of the dairy sector for rural smallholders, new government programs in the 1990s, financed by international aid organizations through bilateral programs, targeted the Nicaraguan dairy regions with investments in roads, electrification, milk collection, and industrial processing infrastructure.[92] Notable government programs included the Project for Dairy Development (PROLECHE) in Nueva Guinea and the Project for Cattle Development (PRODEGA) in the adjacent region of Boaco. In all of these, the goal of improving milk and cheese quality produced by smallholders was central to regional development efforts.[93]

In this sense, improving food safety played an important role in facilitating the coordination of efforts by Nueva Guinea producers, as well as guiding the direction

and actions of the investments for rural development programs led by the government and international aid organizations in the dairy producing region. In addition to infrastructure investments, other government agencies, such as the Nicaraguan Ministry of Health and the Ministry of Agriculture, began to develop programs to assist with the HACCP certification process, particularly for those engaged in cheese processing.[94] The potential local and foreign markets that required improving milk quality along the HACCP standard provided a common goal and reference point about what they needed to change, ways to change it, and desired outcomes. Assembling the needed resources involved multiple sources, local and foreign, government and nongovernment. The new activities aimed at improving milk quality created different kinds of networks: among producers from the various zones of Nueva Guinea, between them and a variety of government agencies, as well as with foreign technical assistance managers. These new relationships affected both their capacity to build new local knowledge and the generation of resources (financial and technical) for changing dairying practices.

The active creation of new networks and associations occurring among Nueva Guinea producers, however, also went beyond to regional and nationwide connections to improve conditions for rural dairy producers in Nicaragua. They created working committees with government agencies, such as the Technical Assistance Institute, the Ministry of Agriculture, and the Ministry of Public Works, to work with policy makers to define strategies for overcoming obstacles to further growth. A new university campus was established in Nueva Guinea to expand opportunities for local youth to train in technical fields related to dairy production (veterinary science, animal nutrition, lab technicians). By 2004, 70 percent of the students completed work practice in local farms.[95] They also participated actively in the creation of the dairy sector national organization, the Nicaraguan Chamber of Dairy Products, which mobilized in the late 1990s and early 2000s to bring government attention and resources to address the new challenges created by increasing international market integration.[96] These new local and national networks played a role in activating, creating, and directing technical and financial resources to support the producers' upgrading struggles.

While food safety regulation influenced the strategies for upgrading existing dairy products and methods, local producers also began to develop new commercialization channels and new products. In 2004, the Nueva Guinea producers began efforts to create infrastructure in their central plant to process their own milk and produce specialty cheese. With credit financing from the government and the European Union, as well as the resources pooled by the cooperative members, they built an industrial cheese plant in 2005.[97] Producers participated in new training programs on how to process their milk to produce cheese. This entailed acquiring new knowledge about the industrial phases of the dairy chain to manage and operate the collectively owned processing plant. At the beginning of 2006, the new cheese plant began to process 10,000 liters milk daily to produce a variety of soft and hard cheeses. They sold the remaining milk (10,000 liters per day) to a multinational operating in Nicaragua. Their goal was to export to the United States and other Central American countries. By 2007, this cooperative was exporting 100,000 kilos of cheese monthly to El Salvador.[98] Now, the cooperative converts 60 percent of its fluid milk into cheese and sells the rest to local

dairy companies. As exports of dairy products from Nicaragua to the United States doubled from 2006 to 2009, COOPROLECHE, along with other Nicaraguan dairy cooperatives, have been able to tap into this market as they achieved United States Food and Drug Administration (USFDA) approval.[99]

The transition from old to new dairy practices did not happen all at once, and changes are ongoing as COOPROLECHE continues to diversify and innovate with new products and markets. In addition to processing cheese, they are experimenting with whey-based drinks with national fruit flavors. As important, they have received funding from the Nicaraguan government and European aid sources to improve their environmental performance, particularly for the handling of wastewater from their industrial plant. This environmental challenge facing cheese processors represents a new area for upgrading.

Studies indicate that small producers in other dairy regions such as Boaco and Chontales, adjacent to Nueva Guinea, have also joined to address the challenges of marketing their milk, even in the context of growing national and international market demand prevalent in the 1990s. They have set up their own processing facilities and services to farmers supplying milk, including sanitary and health services for cattle, through local organizing and government support.[100] Like COOPROLECHE, another cooperative, Camoapan, successfully improved its milk quality, so that currently only 12 percent of milk collected is of inferior quality (Grade C), whereas four years ago, 50 percent of all the cooperative's milk was rated Grade C.[101] Also, like COOPROLECHE, this cooperative has diversified its commercialization channels, reducing dependence from large companies by increasing value added and selling directly through local and export channels.

Environmental Sustainability and the Coffee Cluster

In the mid to late 1990s, small coffee producers in Nicaragua were searching for alternative solutions to the coffee crisis, when commodity prices collapsed worldwide, and they faced dramatic drops in their incomes as farm-gate prices dropped to thirty-year lows.[102] The Nicaraguan government, for its part, had been reducing financing and services to the agricultural sector in the 1990s, as part of its austerity program. There was a weakening of the extension services in the national agricultural system as the government "downsized" and employed few extensionists at the local level.[103] Many small coffee producers were members of co-ops created in the 1980s, when they were promoted by the Sandinista government as part of the land reform of large coffee estates.[104] By the 1990s, many cooperatives had collapsed, while others searched for new organizational strategies in a context of liberalized trade. Still, estimates indicate that by 2001 about 50 percent of small coffee producers were organized into cooperatives.[105]

Paradoxically, the decline in coffee prices coincided with the rise in niche specialty coffee markets, including fair trade, gourmet, green, organic, bird-friendly, and sustainable. Most of these were promoted by international NGOs. Environmental movements discovered coffee farms as havens for biodiversity, and began to promote sustainable coffee production through standards like those of the Rainforest Alliance.[106]

While these standards focused on improving the production process, the fair trade movement targeted international trade relations, seeking ways to increase equity for producers in developing countries, stipulating a minimum floor price.[107] In the Nicaraguan context, fair trade and organic coffee often became closely related.[108] In addition, many coffee processing multinational companies also began to pay higher price premiums, offering an incentive to shift away from conventional to sustainable coffee production.

In the midst of the 1990s crisis, the rise of sustainable coffee consumption became an alternative market for insuring the survival and competitiveness of Nicaraguan small coffee producers, as they generated revenues more than double the conventional market price.[109] Moreover, the idea of using ecologically sound production methods to reach the emerging specialty market generated enthusiasm as coffee smallholders saw this alternative as a way out of their crisis, and thus began to look for ways to enter the sustainable coffee markets. Local organizing efforts in Nicaragua became linked to the shift to sustainable production.

The experiences of cooperatives like PRODECOOP and CECOCAFEN, which did not exist as organizations in the 1980s, and were created in the 1990s, illustrate how sustainability standards interact with a local upgrading process. CECOCAFEN and PRODECOOP are the two largest certified coffee cooperatives in Nicaragua in fair trade, organic, and sustainable production. They had to build capabilities to become direct exporters and to produce coffee using practices that reduce environmental contamination; both aspects challenged existing ways of "doing coffee."

In the 1980s and early 1990s, small coffee producers did not engage in the processing and exporting functions. When coffee-producing cooperatives first formed in the 1980s, their focus was only to produce coffee, which was then sold to the state. Under the Sandinista government, foreign trade in agro-export commodities was a state monopoly, and export products were sold to government trading boards at fixed prices.[110] The state controlled coffee trade through a state-owned company that commercialized all of Nicaragua's coffee.[111] The government also imposed a difference between internally paid coffee prices and the external price paid in foreign markets.[112] Cooperatives did not develop skills in managing and handling exports, as they did not commercialize their crops. Moreover, the Sandinista government programs focused more on expanding land area cultivated with coffee for the conventional commodity market, and less on quality.[113]

In the late 1990s and early 2000s, small coffee producers began to break away from their dependence on large private exporters (foreign and local). After the dismantling of the coffee state board in 1990, large private firms and multinationals began to dominate nearly all exports, with cooperatives accounting for a mere 1 percent of coffee export volume in the early 1990s.[114] This changed, however, as cooperative organizations began to learn and develop new processing and exporting functions and became an alternative commercialization channel for small coffee producers. By 2006, coffee cooperatives accounted for 10 percent of Nicaragua's export volume, and then 19 percent in 2008.[115] Importantly, the producers are exporting directly, competing with established private corporate exporters.

This functional upgrading to become competitive exporters required building new capabilities, which involved learning new routines: organizing procurement logistics from small farms; doing dry milling for processing coffee; building technical assistance services; developing brands; understanding quality dimensions and creating skills to own cupping labs; establishing direct links with foreign buyers. In some cases, this transformation meant changing old routines, like dry milling and classification. In other cases, it has involved the introduction of new routines, such as financing, accounting, inventory, quality cupping, roasting, and packaging. These ongoing changes in the activities of small coffee producers have occurred in interaction with the specialty, sustainable, organic, and fair trade market standards.[116] A producer in a cooperative union stated: "It was hard to do our own inventory and controls because of my academic level. I could barely read and write. I went to adult education programs to finish elementary and secondary levels so I could manage inventories and control sheets."[117] Comparative studies indicate that building new organizational-managerial skills has been among the most important impacts of standards such as fair trade and Rainforest Alliance, comparing small producers that have such certification to independent ones that do not have it.[118]

At the same time, going beyond market access and commercialization channels, environmental standards have been influencing the upgrading of small coffee producers, particularly their on-farm activities. Two areas that sustainable standards target are water contamination and waste management, which illustrate other learning processes for producers. The traditional way of making the fruit ready for consumption involves massive amounts of water, along with large production of solid and liquid waste. In Nicaragua, where the Arabica variety is predominant, washed postharvest processing is commonly used. The beans are collected in fermentation tanks, which are then washed to remove residues and mucilage. This wet mill process is very water intensive, and typically, this water is not recycled. Even worse, the water used in processing coffee is full of organic pollutants and fermented sugars, which are usually not removed. The typical practice has been to "dump" the "slush" in local rivers and water sources. The high acidity of the slush is detrimental to aquatic flora and fauna, reducing biodiversity. Moreover, many farms are often in the same vicinity, creating further stress on the environment. A secondary negative byproduct is the bad odor this waste produces in rivers and waterways.

As important, the families living in the coffee-producing regions often rely on noncentralized, nonmunicipal water sources (i.e., wells, springs) that can be contaminated by coffee waste products. The sweet wastewater containing high levels of organic matter pollutes surrounding water bodies and can leach into the shallow groundwater sources, polluting the drinking water sources for surrounding communities.[119] Studies indicate that around coffee processing plants the downstream concentrations of BOD, phosphate, nitrate, and suspended solids from point-source discharge are much higher than permissible limits set by the World Health Organization.[120]

CECOCAFEN, CAFENICA, and PRODECOOP have been promoting reusing the water in addition to the installation of filtering and water-treatment systems to reduce waste contamination during the postharvesting processing of the coffee

cherries. The idea is to redirect all wastewater through filter treatment systems. In 2001, the cooperatives began to document the problems with the wet mills in all the member farms.[121] They then created manuals that described three models for building new wet mills of different sizes, and they began to hold training sessions to demonstrate how to make wastewater filter systems. Their goal was to have 100 percent of the cooperative members using new ecological wet mills, still an ongoing process.[122] In addition, the move to eliminate solid waste pollution has also entailed learning new routines for collecting and processing pulp waste during the harvest season. Moreover, the collected pulp is then composted, which in turn has created a new routine: producing organic fertilizer used to restore soil productivity. This environmental dimension is a crucial step for improving the competitiveness of smallholders as the current dynamics of the differentiated global coffee markets value quality upgrading. A producer who had changed his waste management routine stated, "With the new pulp collection system and my new soil management system I have elevated the quality grade of my coffee from 70 to 86 percent, and the higher the quality, the higher the price I receive."[123] Going beyond price floors, to improve yields, quality, and profitability makes a difference in further upgrading, and these depend on innovations in the production system.[124]

In another program, PRODECOOP has fostered alternative pest-management training programs for its members. Use of pesticides and herbicides had become common practice. With the help of the Central American Institute for Tropical Agriculture (CATIE), a training program began establishing experiments in the plots of producers, who then shared their own experiences with other producers in their community. The idea was to multiply the knowledge gained. The training programs included producers, agricultural extensionists, and specialists. After initial training sessions with thirty producers in one community, the cooperative organized meetings and training sessions at what would become demonstration plots to discuss seed selection, disease incidence, plant nutrition, and how to develop seedlings without using chemicals.[125] These producers, in turn, would train an equal number of producers, to spread new approaches at the local level to new groups of farmers through farmer-to-farmer channels. They emphasized building the capacity to manage the local variability created by diverse soils, weather, topography, distance-to-market, and infrastructure.[126] Studies indicate that families receiving training in integrated pest management options were significantly more secure, with a 61 percent lower probability of suffering total crop loss than those who did not participate in the training programs.[127] The percentage of coffee farmers using synthetic pesticides has dropped significantly from 90 percent to 10 to 20 percent.[128] The vast majority (96 percent) of farmers have seen crop quality improvements, which are reflected in increased prices.[129]

The Nicaraguan coffee producers have been adopting and adapting environmental standards driven by regulations generated and enforced by private and public actors, cooperative associations, and multinationals. As they develop experience in the new production methods, they draw on the support from their organizations and other local producers to build the expertise that they lacked before. Through their interactions

with local and foreign actors, they adopt new environmental practices that upgrade their products and improve their competitiveness and the health of their families.

A crucial aspect accompanying the changes in the production, processing, and commercialization routines of small coffee producers was the organization and reorganization of their cooperatives. New connections were created between small cooperatives as they sought ways to create marketing channels, financing resources, and technical services. The new networks developed in the late 1990s and 2000s as small producers faced the adjustments and promoted changes in their on-farm and processing practices. Hundreds of first-tier cooperatives created second tier cooperatives. Small producers in cooperative-organized associations like PRODECOOP and CECOCAFEN developed new connections among themselves and with other local and international organizations.

The evolution of CECOCAFEN, created in 1997, with 2,600 members illustrates how smallholders in a co-op become affiliated with a larger association of cooperatives (union of co-ops) to provide members newly created technical and financial services as well as processing and commercialization support. Another example is CAFENICA, an association of coffee cooperatives that represents more than 7,000 smallholders also mobilized to create similar capabilities.[130] The cooperative association PRODECOOP, born in 1996, brought together sixty-nine co-ops and 3,000 small coffee producers.[131] The producers organized in PRODECOOP began to develop programs to upgrade their practices and become competitive in the specialty market. Cooperatives evolved organizationally and in terms of investments. By 2011, the small coffee producers had created two federations, fifteen unions bringing together more than 100 grassroots cooperatives, fourteen multiple service cooperatives, and two associations, all of them processing (dry mills) and exporting enterprises, with cupping laboratories, fertilizer production in some cases, and credit and technical assistance teams.[132] Through these increased interactions, coffee producers developed new understanding and know-how about how to assume new functions in the coffee chain, how to improve the quality of their production process, and how to create new products.

The emergence and development of new relationships also went beyond the cluster, as local and foreign organizations contributed to generate financial, technical, and commercial resources. European and US foreign aid organizations (both governmental and nongovernmental, such as the EU cooperation programs, Fair Trade Foundation, Rainforest Alliance, Danish Cooperation, USAID, and many more) provided funds that helped finance investments in dry mills, labs, and pest management. The ecological wet mills efforts received financial support from the Swedish Cooperative Center and the Spanish government.[133] In the 2000s, the national government also began to make investments in the clusters to improve roads and electrification; and municipal governments in Matagalpa, Jinotega, and Esteli created environmental plans that fostered the protection of their water sources from solid waste contamination from on-farm coffee activities. In all of these, the goal to improve environmental performance and social equity, related to sustainability standards, guided the investments and efforts of these organizations.

Raising Standards from the Bottom Up

In this ongoing and dynamic process, where many more Nicaraguan coffee and dairy producers have yet to upgrade, the cases discussed provide a window from which to understand the organizational change process involved in building competitiveness with rewarding regulation. These examples illustrate the ways in which regulation (standards) influences and facilitates the upgrading of products, methods, and markets among these poorer rural enterprises. It is not the standard by itself that determines the local improvement process. The upgrading depends on what local actors do with that standard and how they use it to foster learning processes that improve their competitiveness. The examples suggest that rewarding regulation involves a local organizational process in which local knowledge is built through interactions with new standards; and new networks with local and international actors develop to provide supportive resources (financial, technical, commercial) to build new competences guided by the standards.

Local Learning: New Knowledge and Changing Routines

In interaction with food-safety and environmental standards, the introduction of labs, production tests, technical services, ecological waste and pest control, and quality control during processing supported the upgrading of products and production, linking producers' local knowledge with knowledge from others to build new capabilities. Capabilities are based on routines, and they are related to the skills and know-how.[134] Learning occurs when there are changes in routines.[135] Standards can influence routines by creating new goals, expectations, and ideas about how to accomplish production and processing activities. There is a process of building a common understanding and know-how through conversations and interactions among people.[136] Extensive shared activities lead to shared know-how, which in turn, facilitates knowledge building. Standards should not be seen as mere formal certification, but rather as facilitating knowledge circulation when producers attempt to put them into practice as they engage in new activities to produce safer food or to reduce environmental impact.

The standard becomes one of the ways local producers gain access to and create new knowledge. It reveals gaps and problems with existing performances and conditions. It indicates a different way of accomplishing production. It guides local strategies for making improvements. Standards arise from specific practices and embed tacit knowledge.[137] As Nicaraguan producers interact with the new standard, it becomes important input that provides orientation to their activities. It guides the local collective process of sharing new practical experiences to build know-how. It helps local actors to set a collective direction for new skill acquisition, training, infrastructure investments, and production that supports their discovery of new ways of producing. For example, monitoring through microbiological lab tests fosters sharing of know-how as it becomes an occasion to face problems revealed by new testing procedures, get feedback, and to learn from other producers' experiences—enhancing producers' understanding of causal links between their actions and the quality of their products.

Local-level interactions help to foster understanding, interpretation, and implementation of the changes, which facilitates the shift to practices that protect consumers and the environment. The knowledge is built through concrete experiences and grounded in the specific conditions of the producers' context. For example, members and committee representatives engage in visits and discussion to identify problems. Suggestions on how to take corrective actions are developed together. Prevention training and problem-solving occurs in groups. Appropriate designs for ecological wet mills are developed on the farm using group services with technical assistants who bring experience from other farms. By performing activities tied to the new norms—such as reading lab tests results, identifying animal diseases, controlling for temperature, cupping labs, collecting waste, and recycling water—Nicaraguan producers learn how to coordinate their production efforts to produce new products or develop better methods. This shared knowledge and understanding helps to coordinate learning and substantive changes tied to upgrading.

Local Connecting: Network Creation and Coordinating for Resources

As important, the producers create, re-create, or join networks that provide support as they upgrade their production systems. Connections increase among and between them and other organizations as they interact with and adopted new practices associated with the new food and environmental regulations. The local network develops as novel activities related to new norms are being implemented. In particular, there is a combined influence between the use of new procedures for testing, collecting, processing, conserving, and evaluating, and the emergence, creation, and expansion of networks. The collective competence to produce in a new way develops alongside new connections and emergent networks of local producers and public and private organizations.

These examples illustrate that the changes do not occur in isolation; there is an active creation of new associations to support the shift to sustainable or safer products. The standards enable coordination among producers and between them and different organizations as they jointly address the challenges or implement new actions that involve multiple actors. There was a difference in the initial presence of collective organizations between the dairy and coffee cases. However, both shared a fervent organizing and reorganizing while attempting to adjust their practices: new associations with local producers, or from other zones, and national and foreign organizations. The new relationships contributed to knowledge circulation, and also generated crucial resources (financial, technical, commercial) that supported the pursuit of competitiveness with social and environmental goals. These resources were not necessarily preexisting; rather, they were generated interactively as new relations developed and grew. Network connections are commonly highlighted in the literature on clusters.[138] However, in these cases, they did not result automatically by being part of a cluster; they emerged and grew while adjusting and changing the production organization.

The new norms connect with local development strategies to generate supportive conditions for enabling the shift to a new production system. New ties among producers, and between them and Nicaraguan government agencies, and foreign aid organizations (government and NGOs) facilitate the flow of resources. By being part of these networks, small producers in rural areas can overcome isolation, identify resources, and solve problems, while enabling collective reworking of old and new practices.[139] Both cases discussed show formation or reorganization of associations, cooperatives, or other networks of organizations to create technical services, training programs, provide financing, and build infrastructure.

The focus of new or recreated networks is on building know-how and generating resources to support local product and process innovations using new standards as a guide. The ability of small producers to build their knowledge to achieve local innovation depends on increasing the connections among them and different specialized organizations (local and foreign). For example, specialized technical services develop as gaps with new norms become explicit. The networks of horizontal relations between producers—as well as links to organizations that can provide technical and financial resources—develop and help producers deal with the challenges and pressures of new norms.

As production and products improve, the poorer producers expand their market channels, diversify products and customers, and create new networks for commercial activities. This, in turn, has helped small producers to overcome the negative effects of fluctuating commodity markets, exploitative intermediaries, and dramatic price instability to foster economic development. These changes in the local productive practices have transformed the way producers commercialize their products so as to increase their incomes, competitiveness, and well-being. This upgrading process differs from discussion in the recent literature highlighting the role of retailers and buyers in agrifood chains.[140] The reality of smallholder production systems is usually characterized by vulnerability and exploitation from intermediaries. Their historical traditional channels are also exploitative and highly unstable in terms of income. The assumption is that upgrading depends on buyers in the chain, minimizing the local efforts of producers to upgrade independently of the buyers. This study shows that small producers actively organize networks and engage in upgrading, developing their own strategies to build and rebuild local capabilities.

Conclusion

The interactions between regulation that has as a goal consumer safety or environmental protection and local efforts to improve competitiveness seem to be creating opportunities for collective learning that supports organizational changes in an ongoing development processes. Rewarding regulation facilitates upgrading when indigenous producers in developing countries engage in active efforts to build their collective capabilities with local strategies that foster organizational learning processes to improve their products and production organization. Regulation is not a

given, as bringing about the changes necessary to upgrade involves the participation and coordination of multiple actors to create resources that support the changes: producers; associations; government; NGOs and private organizations, local and foreign. Regulation can guide, however, the coordination of actions among these varied actors, thus facilitating the changes associated with upgrading and improved competitiveness and sustainability.

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Author Biography

Paola Perez-Aleman (paola.perez-aleman@mcgill.ca) is associate professor of strategy and organization at McGill University. Her research focuses on enterprise development and its links to wider socioeconomic processes. Her current projects focus on innovation and local enterprises in Latin America, and on the dynamics of shifting to sustainable production. She has published in *Industrial and Corporate Change, California Management Review, World Development, Business and Politics, Cambridge Journal of Economics, Proceedings of the National Academy of Sciences*, and *Organization Science*. She holds a BSc from the University of California at Berkeley, and a PhD from the Massachusetts Institute of Technology.