CHOICES

AAEA Agricultural & Applied Economics Association

Volume 35, Quarter 4

Functional Foods: Fad or Path to Prosperity?

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JEL Classifications: A13, M13, O13, Q01, Q12, Q13, Q16, Q17, Q18
Keywords: Functional Foods, Product Research & Development, Niche markets, Specialty markets, Value chain development

Consumption of functional foods—foods that purport to have additional health benefits beyond basic nutrition—has grown worldwide, particularly among health-conscious consumers from developed countries and as trendy items found in restaurants and specialty stores in middle- and high-income neighborhoods of Latin America. Once consumed almost exclusively in rural communities in Latin America, quinoa, açai, maca, and chia have effectively been positioned in international markets thanks to their high levels of protein (quinoa and chia); vitamins, unsaturated fatty acids, and minerals (maca); and antioxidants (açai). Blue maize, native cacao, and native potatoes are also being repositioned from commodity to specialty local markets under the functional foods umbrella for providing a high level of antioxidants (blue maize, native cacao, and native potatoes) and vitamin C, iron, and zinc (native potatoes).

Enhanced market access through value chain development is a key tool in improving small-scale producers' incomes and spurs rural development through improved market participation for value-added products (Mutebi Kalibwani et al., 2018). The "boom" in the consumption of functional foods has the potential to provide small-scale producers in Latin America with access to higher-value domestic and international markets. These market opportunities could strengthen the livelihood options and well-being of small-scale producers and their households who have continued to produce these functional foods. This theme seeks to illustrate how understanding changes in consumer behavior can help to link small-scale producers of quinoa, blue maize, native cacao, native potatoes, açai, maca, and chia to domestic and global markets.

According to Ricketts, Turvey, and Gómez (2014), value chain approaches to development require commitment and collaboration from multiple stakeholders responding to different incentives, motivations, and responsibilities. The articles in this theme illustrate the role that the private and public sectors play to support producers, their associations, and rural small enterprises to conduct activities such as product research and development, product differentiation, and access to financial and extension services. The examples presented in this theme demonstrate that more efforts are required not only to improve production but also to strengthen the value chains of functional foods to secure their sustainability once the boom ebbs.

Blare, Corrales, and Zambrino begin the discussion analyzing the case of local cacao in Mexico and Peru. They explain how high-quality chocolate produced with native cacao varieties by local manufacturers has penetrated local markets targeting upper-income neighborhoods of Mexico City and Lima and provides an

Articles in this Theme:

additional opportunity for these smallholders beyond export markets.

Devaux, Hareau, Ordinola, Andrade-Piedra, and Thiele illustrate the experience of the International Potato Center (CIP) on repositioning Andean native potatoes—potatoes of diverse shapes, colors and sizes that provide an important source of vitamin C, antioxidants, iron and zinc—in high-income market niches as a differentiated product. The authors provide insights on how transforming native potatoes into a source of competitive advantage for Andean farmers could improve their well-being.

Andrango, Johnson, and Bellemare explore the dynamics of quinoa in the world market. Applying product cycle theory, they argue that the quinoa market in the United States and the European Union may have reached the maturity stage. The authors discuss possible business strategies for Andean producing countries (Bolivia, Ecuador, and Peru), such as product differentiation, denomination of origin, and branding.

Blare, García-Medina, López, and Pérez illustrate the case of native maize and its repositioning in the domestic market. The authors explain how increasing demand for blue-pigmented products with elevated levels of antioxidants has repositioned blue maize in the Mexican market. The article analyzes the blue maize value chain in central Mexico to understand the potential market for this product. The analysis provides insights about the market opportunities and challenges farmers face.

Peña-Lévano, Adams, and Burney end this theme by providing information on production and the growth of global markets for three superfoods largely produced in South America: açai, chia seeds, and maca root. The authors illustrate how the penetration of these products in the international market has provided South American producers with the opportunity to improve their livelihood options and well-being. Finally, they argue that government support and economic growth could determine producers' ability to retain their leadership in the production of these products.

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CHOICES

AAEA Agricultural & Applied Economics Association

Volume 35, Quarter 4

Functional Foods: Fad or Path to Prosperity? Data Visualization

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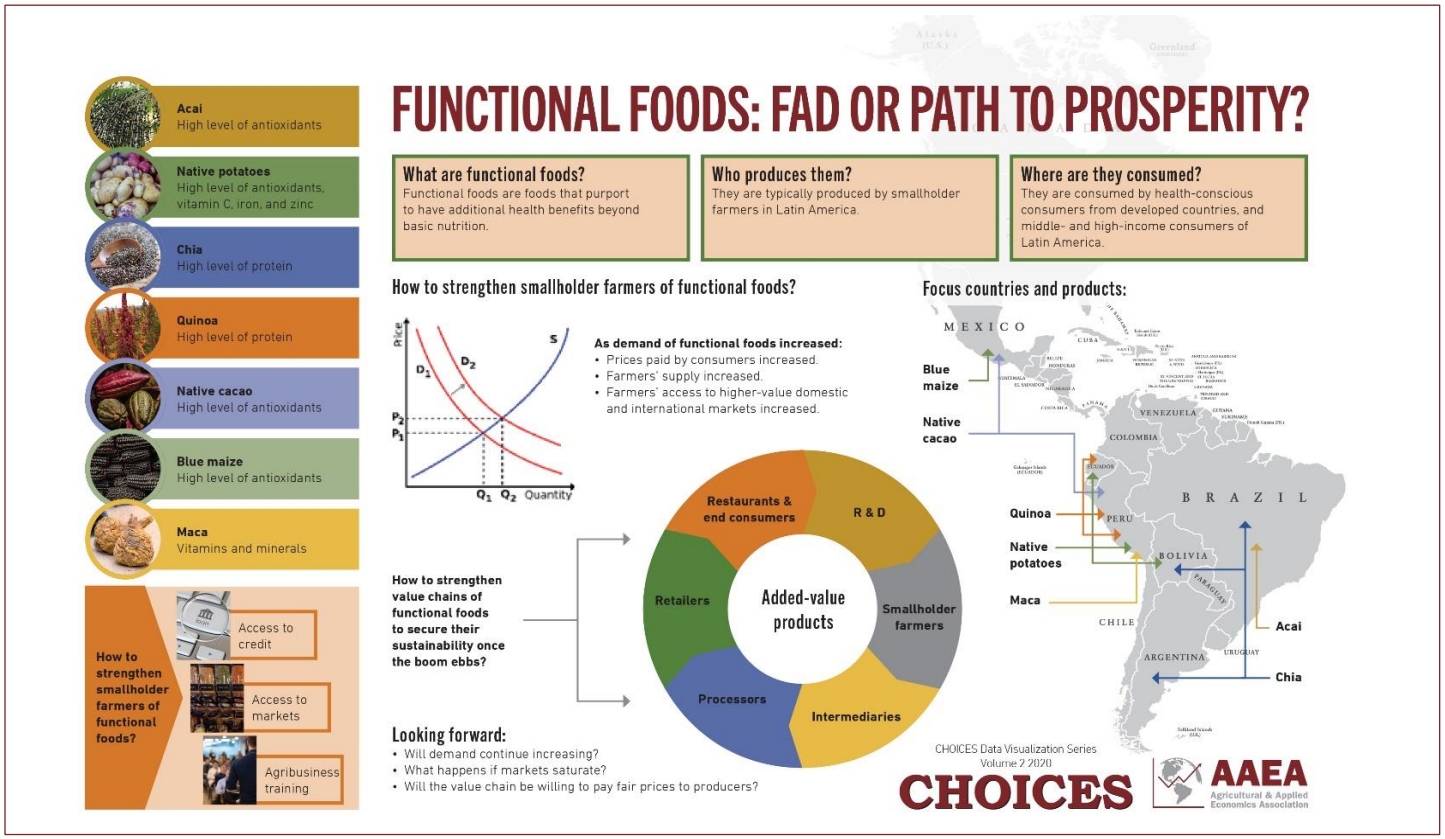
JEL Classifications: N/A
Keywords: N/A

Background

Demand for functional foods (açaí, chia seeds, maca, native blue corn, native cacao, native potatoes, and quinoa) has increased in recent years creating new market opportunities at the domestic and international levels for smallholder farmers in Latin America. This situation has led to an increase in the prices received by farmers, which has enhanced the household income and wellbeing of some families and motivated them to increase production. This visualization illustrates the roles the private and public sectors have played in supporting producers to access these markets, through product research and development and improving access to financial and training services. As these markets mature, there is a growing demand for providing value-added products. The development of these products, however, cannot be left to farmers alone. Research and coordinated action throughout the value chain (intermediaries, processors, retailers, restaurants and end consumers) is necessary to develop products that not only generate profits but also (and more importantly) meet the needs of end consumers. This visualization aims to spark interest among researchers, development practitioners, policy makers, and other stakeholders in ensuring the sustainability of these markets for functional foods once the current boom ebbs.



Data Source

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CHOICES

AAEA Agricultural & Applied Economics Association

Volume 35, Quarter 4

Can Niche Markets for Local Cacao Varieties Benefit Smallholders in Peru and Mexico?

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JEL Classifications: A13, Q01, Q13, Q17, Q18
Keywords: Agricultural development, Latin America, Rural development, Specialty markets, Value chains

Revolution in Cacao Markets in Latin America

Cacao markets—like those for coffee and several other commodity crops—have seen a growing demand for differentiated, high-quality products. Now, traders are directly purchasing the beans from farmers, paying premiums for the most sought-after varieties, those that are classified as fine or flavor by the International Cocoa Organization ICCO (Blare and Useche, 2014; ICCO, 2016). Many local cacao varieties in Latin America meet this standard and are highly sought after in international, regional, and even local markets (Gayi and Tsowou, 2016; Cornejo et al., 2018). Growth in these local markets is notable in the region's major cities, like Mexico City and Lima, with new chocolate shops and brands becoming prevalent in upper-income neighborhoods (Aybar Huayanay, 2018). In fact, Peruvian chocolate makers expect its national market for high-end chocolates made from its own cacao to grow by 20% between 2018 and 2021 (Flores, 2019). This market for local cacao varieties may indeed be an opportunity for smallholders and their organizations as buyers seek out these local varieties of cacao conserved by smallholders, who make up 95% of Latin American cocoa producers (CBI, 2018; Fountain and Huetz-Adams, 2018).

Due to consumers' growing social awareness and demand for sustainably and ethically produced chocolates, buyers have become more concerned not only about sourcing quality cacao and but also about supporting the rural communities that produce this cacao (Blare and Useche, 2014; Barrientos, 2016; WCF, 2018). The changes in the market have become so prominent that some of the large cacao traders, including ECOM, Olam, Nestlé, Hershey's, Mars, and Pronatec, have created units to source these high-quality products for gourmet chocolate makers. This article evaluates this growing market for local cacao varieties in Peru and Mexico. We examine how smallholders are becoming involved in these new value chains for this fine or flavored cacao and the challenges they face in further exploiting these markets. We compare the development of these markets in Peru and Mexico and provide insights into what actions can be taken to ensure that smallholders can take advantage of these opportunities.

Expansion of Specialty Cacao Markets in Peru

Peru has a long history of cacao production. In fact, the Peruvian and Ecuadorian Amazon is the genetic origin of cacao (Fountain and Huetz-Adams, 2018). As of 2018, it was the eighth largest cacao producer in the world and third largest in Latin America, behind Brazil and Ecuador, producing 134,000 metric tons (MT) of cacao (FAO, 2020a). Cacao production in Peru has grown six-fold in the last 20 years, from just over 22,000 MT of cacao in 1998 (Figure 1). The area dedicated to cacao production went from a little less than 34,000 hectares in 1998 to over 160,000 hectares in 2018 (FAO, 2020b). While the department of Cusco had been the historical center of cacao production up until the late 1990s, the center of production in Peru shifted to the Amazon region in the early 2000s due to a United Nations–led alternative crop program. This program encouraged farmers to switch from coca to cacao production in the Amazonian departments of San Martin and Ucayali, as part of the pacification agreements in the 1990s and early 2000s (Salzer, 2015). This region went from producing virtually no cacao in the late 1990s to the department of San Martin producing 42% of all cacao in Peru by 2016 (León Carrasco, 2018).

Much of this increased production in Peru was due to adoption of the hybrid CCN-51 variety, which—although resistant to diseases and more productive—does not have the flavor characteristics of local cacao varieties. The planting of this more productive cacao variety increased yields by a third from around 600 kg/ha in the late 90s to over 800 kg/ha in 2018 (FAO, 2020b). However, the widespread adoption of this variety led to the degradation of Peru's status as a source of the

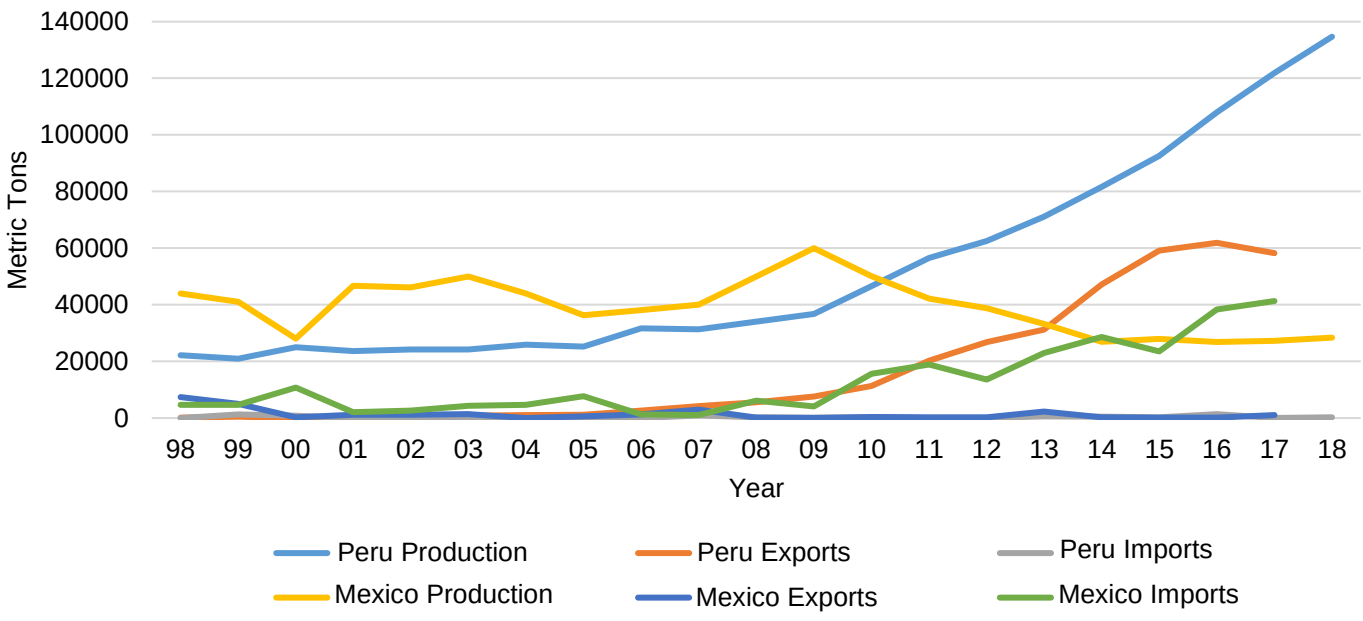
highest-quality, fine, or flavored cacao. In 2008, the International Cocoa Organization (ICCO) classified 100% of Peru's exports as fine or flavored cocoa. In 2011, the ICCO downgraded Peru's share of fine or flavored cacao to 90% of total production (ICCO, 2015). As more and more of the CCN-51 variety came into production, the ICCO once again reclassified Peru's cacao production as being only 75% fine or flavored (ICCO, 2016).

Even with the downgrading, Peru has the potential to further expand into the growing market for fine or flavored cacao because of the local cacao varieties still grown by its farmers. Two of the best-known varieties are cocoa *porcelana*, with a honey flavor, found on Peru's northern coast in the Piura department and cacao *chuncho*, with a floral and fruity flavor, grown in the Amazon area of the Cusco department. European chocolate makers have been directly purchasing cacao *porcelana* for about 2 decades. Over the last 5 years, international traders have made connections with farmers and their organizations in Cusco to source cacao *chuncho* (Morelos et al., 2015). This growing international demand has been coupled with an explosion of Peruvian chocolate makers. Just a decade ago one, well-established firm, Iberia, had supplied nearly all of Peru's chocolates since the early 1900s with cacao sourced from Cusco. At the last cacao and chocolate fair in Lima in 2019, over 50 Peruvian chocolate makers targeted Peru's growing middle class. As Peru's per capita income increased 2.5 times, from 1,956 USD in 2000 to 6,977 USD in 2019, Peruvian consumers now have the means to purchase higher quality chocolates at higher prices (World Bank, 2020).

This growing national consumption is reflected in the falling export volumes of cacao, starting in 2016 (Figure 1). Even as cacao production rose from about 108,000 MT in 2016 to 122,000 MT in 2017, exports fell from around 62,000 MT to 58,000 MT in 2017, with the domestic market absorbing 20,000 MT of cacao. A majority of Peru's cacao, 57%, was exported in 2016 but only a minority, 48%, was exported in 2017, while imports remained negligible. The expanding market has allowed farmers to a receive a price much higher than the actual world market price, from two to four times the market price (Homann, 2016). From interviews we conducted in 2018 with six Peruvian chocolate makers, three international buyers, and three farmer co-operatives in Piura, Cusco, and San Martin, we found that buyers paid farmers at least twice the going market price for these local cacao varieties. Sometimes, the farmers' organizations, especially those that supply the highly sought-after cacao *porcelana* in Piura, can set their own prices; they have oligopsony power. However, as more farmers enter these lucrative markets, this pricing power may diminish as new plantations come into production in next 3–5 years.

Farmers or their associations still must complete the proper postharvest activities in fermenting and drying their cacao to have access these markets, but they face difficulties in meeting these quality requirements. They lack the infrastructure and knowledge to complete this

Figure 1. Cacao Production and Exports in Peru and Production, Exports and Imports in Mexico from 1998 to 2018



Source: FAO (2020b).

process, so buyers have had to invest in co-operatives' capacities to complete post-harvesting activities or build their own facilities. There is also a growing concern about the high concentrations of cadmium in Peruvian cacao, which is concerning as the European Union started limiting the levels of cadmium that it will accept in the cacao it imports. Higher cadmium concentrations have been found in products originating from Latin America, particularly in the Andean countries (Abt et al., 2018). A recent study has shown that 40% of Peruvian cacao beans studied had cadmium readings above the accepted European standards (Arévalo-Gardini et al., 2017).

Prospects for Mexican Local Cacao Varieties

Cacao has been an important part of Mexican culture since the Mayans used it in ceremonial drinks and is still used in many traditional dishes (Marcano et al., 2007; Badrie et al., 2015). Cacao production in Mexico, as in the rest of Latin America, is dominated by smallholders (Franzen and Borgerhoff, 2007). With at least 37,000 producers in Mexico and a national production of approximately 28,000 MT in 2018 (SIAP, 2016), it is the world's 14th largest producer (FAO, 2020a). The southern state of Tabasco produces the most cacao: 17,000 MT in 2016 (SIAP, 2016). Tabasco and its neighbor Chiapas produce more than 99% of the cocoa supply in the country (SAGARPA, 2010).

Production has declined over the last few years from a high of 50,000 tons in 2003. This decline is due mostly to falling yields, which went from over 650 kg/ha in 2007 to 490 kg/ha in 2018 (FAO, 2020b). Diseases, frosty pod and witches' broom, and a failure to renew plantations' trees has lowered productivity (SAGARPA, 2010). Farmers have been discouraged from investing in these plantations because of declining cacao commodity prices (40% decline from January 2010 to July 2020) and higher input costs. Further, aging farmers, who were on average 57.9 years old, and a labor shortage in the region due to migration pressures provide few prospects for smallholder families to see a long-term future in their plantations and invest in them (Díaz-José et al., 2013).

Nearly all the cacao produced in Mexico is consumed domestically. In 2019, exports totaled only 4% of Mexico's cacao production, just 472 MT (SIAVI, 2020). In fact, much of the cacao needed to meet Mexico's national needs is imported. National production satisfies only 41% of the country's demand (SAGARPA, 2017). Many small and medium enterprises throughout Mexico process this cacao (70 large and medium-sized firms and around 250 small firms with 10 or fewer employees) and are important to Mexico's rural economy, as they employ approximately 7,200 people. However, more than 90% of processors have yet to enter the lucrative market for high-quality cacao products, chocolates, and drinks. They are dedicated to producing low-cost products with intense price competition (Beganović, 2010).

Even with these challenges in production and in the traditional and commercial markets, there is hope that the Mexican cacao farmers will be able to expand their presence in these specialty markets with the associated price advantages. Gourmet chocolate makers in the United States and Europe are seeking out local, Mexican cacao varieties and are willing to pay a premium for them (García-Alamilla et al., 2013). In fact, the ICCO classifies 100% of Mexicans cacao as fine or flavored (ICCO, 2016). Export prices have ranged between 1.80 and 4.00 USD/kg, much higher than national prices and the international commodity prices reported by the ICCO (SIAP, 2019). Managers from two farmers' co-operatives in Chiapas claim they received double the international price for their cocoa in 2019, 4.80 USD/kg in the export markets versus 2.40 USD/kg paid in the national market. Opportunities also exist for high-end cacao products in Mexico's cities. These managers in Chiapas also pointed out that elite, national markets pay 2–3 times more than they receive in export markets.

Taking Advantage of These Opportunities

Peru and Mexico are at very different stages of taking full advantage of these specialty cacao markets. The Peruvian government, international donors, NGOs, and international research centers have promoted cacao as a rural development strategy in the Amazon. For instance, the USAID office in Peru established the *Alianza Cacao* project to support the planting and marketing of fine or flavored cacao (Morelos et al., 2015). While Peru has become concerned about its reputation among exporters of producing fine or flavored cacao, due the widespread adoption of hybrid varieties, Mexico has maintained this classification by conserving its local cacao varieties, desired in these high-end international and national markets. However, few institutions outside of some environmental NGOs that support cacao agroforestry practices have yet to fully realize the potential of these markets and support farmers, their associations, and rural enterprises in accessing them.

While efforts to develop the cacao value chains often have an eye toward export markets, the large national market for cacao products in Mexico, including an expanding market for quality chocolates, and the rapidly growing market in Peru provides real opportunities for smallholders and national processors. Earlier studies in Colombia and Ecuador have pointed out the limited opportunities for all farmers to take advantage of these specialty export markets due to their stringent requirements and logistical challenges (Abbott et al., 2018; Villacis, Alwang, and Barrera, 2020). While there may be limited opportunities in the export markets, our analysis of the cacao markets in Peru and Mexico points to a nascent but rapidly growing local market for chocolates made from local cacao varieties. These

markets have the potential to be at least as lucrative as these export markets, providing an opportunity for smallholders and rural communities to capture additional value in the cacao value chain by offering cacao to national consumers.

The growing middle class in Latin America provide an ideal customer base to market these products, especially because of the cultural ties that these consumers have to these products. There is an opportunity for this market to expand as chocolate consumption remains relatively low in Peru and Mexico compared to other countries in the region. In 2018, the average Mexican only consumed 750 g of chocolate annually and the average Peruvian just 500 g of it each year, while the average Brazilian and Chilean consumed 1.5 kg and 2.5 kg of chocolate annually, respectively (*La República*, 2018; Vega, 2019). Such national markets are particularly attractive to Peruvian farmers as they are challenged to meet the new cadmium requirements in the European Union. These national markets may supplicate some of this lost market until farmers can implement production methods to produce cacao that meets the EU standards, which may take several years (Arévalo-Gardini et al., 2017). However, recent market disruptions due to the COVID-19 pandemic should be considered, as consumers may opt to spend their dwindling income on staple food products and not on luxury items like gourmet chocolates.

This analysis of the value chain for local cacao varieties in Peru and Mexico revealed some of the well documented challenges in connecting smallholders with lucrative markets. Farmers' and their associations have limited access to credit, which inhibits their ability to invest in their plantations and post-harvest infrastructure, and insufficient training opportunities not only to address production challenges but also to develop post-harvest and marketing skills. Assisting farmers and small business who are used to selling in informal markets to become compliant with tax and sanitary regulations, especially for export markets, is a difficulty that has been noted many times in the literature and often mentioned by buyers in both countries (Beg et al., 2017; Donovan, Blare, and Poole, 2017; Rueda et al., 2018). However, the exporters, processors, and chocolate makers in these specialty cacao markets believe they can overcome these challenges. As these specialty markets allow them to pay much higher prices, they feel these price premiums will more than compensate for the additional transaction costs incurred by farmers in becoming formalized and organized. Only time will tell if this bet pays off. In order to access these markets and obtain these prices, major investments are required by these businesses, farmers, and their organizations in collection and post-harvest infrastructure. Individual farmers produce their cacao in small quantities, creating a complex logistical challenge. Co-operation all along the value chain—including among financial institutions, transportation services, extension providers, and researchers—is needed to deliver the high-quality cacao that meets buyers' standards. Even with all these challenges, the promises of this expanding market are an opportunity that cannot be ignored, as they have the potential to enhance the well-being of many smallholder farmers and rural communities.

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Acknowledgements:
The authors are grateful to all interviewees who shared their insights, time, and knowledge. Financial support for data collection included the CGIAR program on Forests, Trees and Agroforestry (FTA), the Institute of Geography at the University of Bern, and El Colegio de la Frontera Sur (ECOSUR).

CHOICES

AAEA Agricultural & Applied Economics Association

Volume 35, Quarter 4

Native Potatoes: From Forgotten Crop to Culinary Boom and Market Innovation

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JEL Classifications: O13, O32, Q16
Keywords: Agricultural research, Agriculture, Markets, New product development, R&D

Once neglected by urban consumers, Andean native potatoes are now essential ingredients for some of the most sophisticated gastronomy of the world. From colored chips to delicacy vegetables and even liquors, new products are making their way into high-income market niches. At the same time, native potatoes continue to fulfill their basic role of providing food security for many rural households in the Andes, who were responsible for domesticating them. Today, these families continue to plant native potatoes in diverse varietal mixtures which could contribute to longer term adaptation to climate change.

The International Potato Center (CIP) found an opportunity for repositioning potato as an added-value cash crop. CIP has accomplished this by expanding its use for processing and by encouraging sales of improved and native potatoes to satisfy preferences of consumers in emerging markets in small and large cities and export markets.

In this article, we examine how potatoes—particularly native potatoes—can improve livelihoods among poor farmers in Peru, highlighting the role of biodiversity as a resource to link small producers with markets. We offer examples with an approach to foster pro-poor innovation in value chains, the Participatory Market Chain Approach (PMCA), which was originally developed to increase the competitiveness of small-scale potato producers by taking advantage of the diversity of native potatoes. These native potato varieties have been successfully marketed to consumers who link them with Peru's cultural heritage and who wish to support traditional, small-scale farming with relatively low external inputs.

The Potatoes of Peru

In Peru, production and consumption of potatoes have grown significantly, reaching 83 kg per capita consumed annually in 2017 compared to the average per capita consumption in Latin America of 25 kg (FAO, 2020). The renaissance in potato output and area planted in Peru over the last 20 years has been a remarkable development in the region, traceable to public and private policies, investments in rural infrastructure, expansion of supermarket trade, and a strong relationship with the gastronomy sector to promote Andean food and products.

Advances in poverty reduction in Latin America in recent decades have largely by-passed the remote and mountainous areas of the Andes, where families live with limited assets in terms of land, capital, and market access. More than 4,000 varieties of potatoes are still grown in this part of the world, where they have been planted for 7,000–10,000 years. Andean farmers in Bolivia, Ecuador, and Peru grow native potatoes adapted to high altitudes, consuming and selling them to meet household needs. Potato biodiversity and social capital created among its growers represent unique resources that partially compensate for small-scale farmers' limited assets. Promoting collective action among farmers and strengthening interaction with market agents and agricultural service providers can transform native potatoes into a source of competitive advantage (Meinzen-Dick, Devaux, and Antezana, 2009).

The terms "native potatoes" and "native varieties" are used to denote landraces or local potato varieties that have been developed by domestication and selection of very diverse local genotypes which are highly valued by Andean farmers. Native varieties differ from "improved varieties," the latter being the products of formal potato breeding programs deliberately seeking particular standards and traits, such as broad adaptation, high yield, and resistance to pests or diseases. The tubers of native varieties are visually appealing and come in all shapes, colors, and sizes. They constitute a relatively good source of vitamin C, antioxidants, iron, and zinc, offering a new world of possibilities for fighting poverty and malnutrition while securing food supply in the Andes (de Haan et al., 2019). Conserving native potatoes *in situ* (in farmers' fields) and *ex situ* (in genebanks) is supported by research and development institutions

such as CIP.

Because native potatoes grow better at higher altitudes (above 3,300 meters above sea level), where small-scale farmers predominate, CIP decided to focus on them in a regional initiative, Papa Andina, to support development based on market innovations. Focusing on native potatoes was a "poverty filter" to give a competitive advantage to the poor Andean farmers who grow them (Thiele and Devaux, 2011). This approach brought together research organizations and value chain partners with a goal of enhancing an array of complementary technological and institutional innovations.

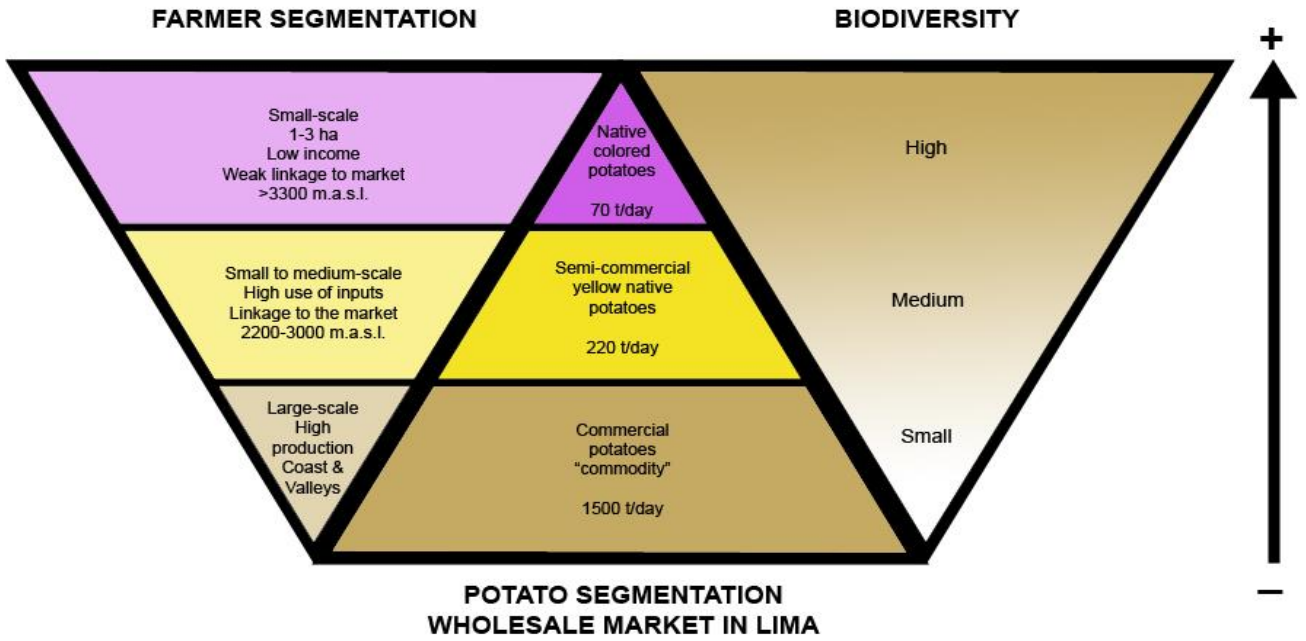
Market Development for Native Potatoes in Highland Peru

Until the early 2000s, most large farmers in Peru cultivated a handful of improved potato varieties for sale in urban markets, while smallholders primarily grew native varieties for home consumption, selling little in nearby local markets. Small-scale farmers' high transaction costs, poor connection to markets, limited access to information, and low negotiation capacity limit their access to larger, more dynamic markets in major cities that could be more profitable (Escobal and Cavero, 2012). The few native potatoes available in large cities were mostly consumed by households who had migrated from rural to urban areas.

From a market perspective, the Peruvian potato market is segmented into three main sectors: white improved potatoes or commercial potatoes, yellow native potatoes, and colored native potatoes (Figure 1). White potatoes are primarily grown for cash by large-scale farmers, who have a comparative advantage because of scale, market, and information access. Linked to the preferences of urban consumers, yellow native potatoes are well positioned in the national market and can be described as semi-commercial. They also have potential for export to Peruvians living abroad, mainly in the United States. Last, colored native potatoes represent the highest biodiversity level but were, until recently, still an unexploited resource with potential to be promoted in local supermarkets as a gourmet product linked to specific visual, nutritional, and cultural characteristics. Increasing concerns about food quality and safety have also stimulated demand for locally grown foods, including native potatoes from the high Andes (Ordinola et al., 2011; Shimizu and Scott, 2014).

Addressing small-scale farmers' marketing constraints was an important entry point for CIP's Papa Andina initiative. National macroeconomic and agricultural sector policies that began in the 1990s in Peru had created a favorable context for this type of approach. The policy developments were complemented by increasing international recognition of Peruvian cuisine and a new image of potatoes as a source of national pride—both of which stimulated domestic demand. Meeting this demand for native potatoes meant

Figure 1. Segmentation of the Potato Market in Lima, Peru



Source: Based on Ordinola et al. (2011).

improving product presentation and quality as well as ensuring a regular supply to consumers year-round.

Product development: The Participatory Market Chain Approach (PMCA)

PMCA is a flexible innovation approach that brings together smallholder farmers, market agents, researchers, and other service providers in a structured process to identify and exploit potential business opportunities that benefit farmers as well as others who participate in the value chain (Bernet, Thiele, and Zschocke, 2006). It involves a sequence of activities usually implemented over 12–18 months. Initially, research and development (R&D) professionals play key roles facilitating the process. Later, as value chain actors build trust between each other, agree on common goals, and become more actively engaged, R&D professionals recede from the leading role and support the process and methods.

PMCA has three distinct phases. During phase 1, R&D professionals conceptualize and identify the value chain through a value chain diagnostic and map the actors, their interests, and challenges. Phase 2 aims to generate and assess alternatives for improving marketing in specific selected products (in this case native potatoes). This phase involves group work by value chain actors and service providers with the support of R&D professionals. In phase 3, development work begins on promising commercial innovations. Early successes may encourage individuals and groups to continue interacting and innovating in the future. As a result, this interplay can generate other types of innovations, such as technological adjustments for farmers, new product development, and novel changes to create an enabling institutional environment.

From 2001 to 2010, the regional Papa Andina initiative aimed to improve the competitiveness of Peru's potato sector, working with more than 20 public, private, and non-governmental organizations to stimulate potato production and marketing (Devaux, Ordinola, and Horton, 2011; Ordinola et al., 2011). The implementation of PMCA, led by CIP, identified commercial innovations working with supermarkets, processing companies, culinary schools, and the media to raise the profile and uses of new products of native potatoes for high-value markets domestically and for potential niche markets abroad. This work triggered innovation processes that benefited participating farm families and Peru's potato sector as a whole, improving market access for smallholder farmers and generating recognition of their role in the conservation of the native potato diversity. This PMCA also provided a diverse group of stakeholders in the native potato value chain with their first opportunity to explore options and develop innovations that could mutually benefit farmers, processors, chefs, and sellers at different market stages.

During the implementation of PMCA, CIP worked with several local agricultural service providers to meet the technical needs of farmers and processors to capitalize on new market opportunities. CIP and Peru's national potato program (through the Instituto Nacional de Innovación Agraria, INIA) identified and selected 61 native potato varieties suitable for processing, including them in the official registry of varieties managed by the National Service of Agrarian Health (Servicio Nacional de Sanidad Agraria, SENASA). This registration allowed the release of these native potatoes as commercial varieties. More effective pest and disease control measures and systems for improving the quality of native potato seeds were also developed. Small-scale farmers could then grow native potatoes more efficiently and access quality seed. A multisector working group emerged to establish Peru's "National Potato Day," which has been celebrated annually on May 30 since 2005.

Two new products were released in the market: Tikapapa, the first Peruvian brand of high-quality gourmet, fresh-bagged native potatoes, and Jalca Chips, the first brand of colored native potato chips. The success of these products stimulated other entrepreneurs to develop additional new products and, over time, innovation has become a prominent feature of value chains for native potatoes. Several new fresh and processed potato products were developed, including packaged, high-quality, and traditionally freeze-dried native potatoes and an instant "Andean mashed potato." Interest from large-scale market players led to the creation of an array of new potato-based products and different brands of native potato chips of superior quality, ranging from products of multinationals such as Frito Lay and the Peruvian-based Gloria Group to those produced by small local companies in response to markets' diverse demands. CIP continued to support the development of Peru's potato sector and innovation processes, working with policy makers, engaging in public awareness and policy incidence, and building capacity for local organizations.

The initial success attracted the interest of other organizations to promote the use of native potatoes as a gourmet product for export markets. AGROPIA, a farmer organization in the Huancavelica region, with the support of Agronomes et Vétérinaires Sans Frontières (AVSF) and the non-government organization Centro de Desarrollo Integral de Comunidades (CEDINCO), supported the production and sales of colorful blue and red potato chips that were introduced in the European organic and fair trade markets under the brand Ethiquable (https://www.ethiquable.coop/). After obtaining Fair Trade certification in 2012, AGROPIA also earned an organic farming certification to penetrate the international and national markets in high-end sectors. With the support of the local municipality of Huancavelica, this initiative made it possible to revitalize the production of native potatoes in this mountainous

territory as a strategy to fight poverty. Today, the 150 family members of AGROPIA are earning higher incomes thanks to the high prices offered by the fair-trade export markets and high-value national niche markets.

As another innovation in the private sector, the company Inka Crops (http://www.inkacrops.com/) exports native potato processed products and coordinates with approximately 25 farmers' associations in the regions of Junín and Huancavelica in the highlands of Peru. Its destination markets are the United States and Europe under the Peruvian Potato Chips brand, and Inka Crops is the currently main exporter of native potatoes (Agraria.pe, 2020).

In these contexts, the PMCA "triggered" an innovation process whereby the second and third generation of innovations, which emerged after the PMCA exercise, continued to evolve and were often more important than those developed during the initial application of the PMCA approach (Figure 2).

Outcomes of PMCA

The suite of complementary and new interventions significantly increased the supply of and demand for native potatoes in Peru, opened export markets for new products, and generated benefits for small-scale producers, processors, and other actors along the value chain. By 2010, farmers growing native varieties were selling 28% of their harvest compared to 60% for those growing improved varieties. However, this represented a 40% increase in native potatoes sales since 2000, compared to a 5% increase for improved varieties over the same period. Since farm-gate prices had also increased, especially for native potatoes, total value of production for potatoes rose during the period. Between 2000 and 2011, the value of sales of improved and native potato varieties increased by 67% and 159%, respectively. An estimated 70,000 farmers are selling native potatoes (Horton and Samanamud, 2013). More recently, the World Bank estimated that the value of total native potato exports in Peru (snacks, frozen, dehydrated, and fresh) increased from USD 821,000 in 2010 to USD 2.5 million in 2015, following the increased trade between the Andean region and export markets. Nearly 70% of this value came from the snack category, which would include potato and native potato chips, among other products (World Bank, 2017; Málaga, Avila-Santamaria, and Carpio, 2019).

The Revalorization of Native Potatoes in Ecuador

The experience in Peru was mirrored by the public and private sectors in Ecuador. CIP, the private company INALPROCES, the national agriculture research institute (INIAP), and the farmer organization CONPAPA collaborated to develop market opportunities based on the country's wealth of native potato varieties (Devaux et

Figure 2. PMCA's Influence on Innovation in New Potato Products in Peru

Source: Author's own elaboration.

al., 2020). Together, they began identifying native potatoes adequate for processing that could be produced and supplied by CONPAPA. Two colorful varieties obtained by INIAP were chosen for producing quality potato chips: INIAP-Puca Shungo (Red Heart) and INIAP-Yana Shungo (Black Heart). The main characteristic of these chips was an intense reddish or purple coloration in their flesh, indicating the richness of antioxidants that differentiates them from better known improved varieties. Colorful native potato chips became available for sale in 2011 in more than 30 countries in Europe, North America, and the Middle East under the brand name Kiwa (Acosta, 2018). This commercial innovation also catalyzed a range of technological innovations, including the production of high-quality seed and training services for farmers. For its native potato chips endeavor, the business model promoted by INALPROCES has won several awards, including the Anuga Food Fair "Taste 11 Award" for top innovation in 2011.

From Staple to Specialty: Can the Native Potato Boom Survive?

A major lesson to be gleaned from CIP's Papa Andina initiative is to increase the competitiveness of value chains so Andean farmers can build new livelihood strategies using potato genetic diversity.

The promotion of biodiversity as a poverty filter to build competitive advantage for small-scale producers and help them link to markets achieved the goals of revalorization and cultural change about potato biodiversity. The recognized experience with the native potatoes in the Andes was shared by CIP and triggered similar processes in other regions and with other crops, in parallel with increasing awareness and demand for functional foods worldwide. Colored potatoes and potato chips, for example, are now seen in markets as distant as the United States, Canada, and Europe.

The PMCA contributed to revalorization and use of native potatoes. Consequently, urban consumers now identify native potatoes as a part of Peruvian cultural identity and a source of national pride for Peru and other Andean countries. The willingness to pay for products that help to conserve biodiversity has increased significantly and represents an incentive for farmers to continue growing native potatoes. On the other hand, value chain opportunities for native potato varieties should continue to be identified but they alone are not sufficient to conserve agrobiodiversity. Therefore, in addition to value chain development, a complete set of conservation interventions must be implemented simultaneously. Some examples include seed fairs, local seed banks, and payments for agrobiodiversity conservation schemes (Tobin et al., 2018).

There has certainly been impressive market development for native potato varieties and processed products, and innovation continues to develop in this area. This is especially visible in the gastronomy sector in Lima and other major cities in the Andean region, as well as niches in other countries that have been exploited by private companies. Sales of native potatoes in different forms have increased, and they are now seen as a delicacy by high-end consumers. However, native potato production managed by small-scale farmers still faces constraints to respond to the market development and opportunities continue to be lost. Productivity and processing quality can be affected by harsh growing conditions, and strong seasonality limits consistent supply.

The current crisis due to the coronavirus pandemic has created additional challenges. The gastronomy sector, a major driver of the development of the native potato value chain, has been hit the hardest, and it is still uncertain when and how it will recover. Value chains have been disrupted and rural communities have applied strict lockdowns to avoid spread of COVID-19 in their areas. Transporting products from the Andean region to larger cities and metropolitan areas has been restricted and market access continues to be a major concern. However, the effects of COVID-19 do not drive native potatoes back to square one, since many of the accompanying institutional innovations and the preferences of consumers for these products will remain. Many exporting companies and supermarkets have respected contracts and continue buying native varieties. Once the "new normal" becomes clear, rural Andean farmers will need additional investments and support to overcome bottlenecks similar to those they faced before to recover income and wealth that is currently being lost.

The actual contribution of native potato value chains to large-scale poverty reduction in the Andes is still not known with certainty. However, improved market access and higher prices for native potatoes have allowed many farmers to improve their livelihoods, an enduring legacy of these amazing potatoes, which are such a part of Andean heritage.

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Acknowledgements:
This research was undertaken as part of, and partly funded by, the CGIAR Research Program on Roots, Tubers and Bananas (RTB) led by CIP and supported by CGIAR Trust Fund contributors (https://www.cgiar.org/funders). The Swiss Agency for Development and Cooperation (SDC) was a major funder of the work described in the article. The authors thank Christopher Butler for the support in reviewing and suggested edition of this article. We also thank comments and suggestions received from two anonymous reviewers.

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AAEA Agricultural & Applied Economics Association

Volume 35, Quarter 4

Quinoa Production and Growth Potential in Bolivia, Ecuador, and Peru

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JEL Classifications: Q13, Q17, Q01, O13, M3
Keywords: Quinoa, Trade, Value chain

Introduction

Quinoa (*Chenopodium quinoa)* is a pseudocereal grain domesticated and traditionally produced in the Andean region (primarily Peru, Bolivia, and Ecuador). Since colonial times, quinoa has acquired a negative connotation as a food consumed by the indigenous and the poor, limiting its consumption to rural areas of the Andes.

Beginning in the 1940s, quinoa gained attention due to its high nutritional value. Organizations such as the Food and Agriculture Organization of the United Nations (FAO) identified quinoa as a crop that could help achieve food security and campaigned to increase its consumption in the three Andean countries. An increase in the consumption of quinoa, however, did not happen until the 1980s, when consumers in high-income countries became interested in the crop, which ultimately helped upgrade quinoa from "indigenous food" to "superfood" status. As a result, quinoa consumption is no longer limited to the rural areas of the Andes, and quinoa has become a highly sought-after product in the urban areas of the Andes and in high-income countries among consumers interested in healthy, nutritious, gluten-free, and organic foods (CBI, 2020).

As the quinoa market expanded, prices increased. At the same time, researchers raised concerns about the negative effects of high prices on poor quinoa consumers (Bellemare, Fajardo-Gonzalez, and Gitter, 2018) and capital-intensive production on the environment (Risi, 2015). Producers from Bolivia, Peru, and eventually Ecuador were motivated to produce more quinoa to supply the increasing domestic and international demand. As a result, production and exports have significantly increased in these countries, creating incentives for new competitors to enter the market.

Recent trends in production, prices, imports, and exports suggest the global quinoa market is currently mature in major markets such as the United States and the European Union. Andean producers may not see prices return to the highs of the mid-2010s, and the market may experience a decline if demand in the US and EU weakens. However, there may be potential for continued growth in other parts of the world, including China, Japan, Australia, and Russia. The success of such an expansion will depend heavily on successfully meeting international standards related to food safety, organic production, and labeling.

International Demand and Prices

Imports and Prices

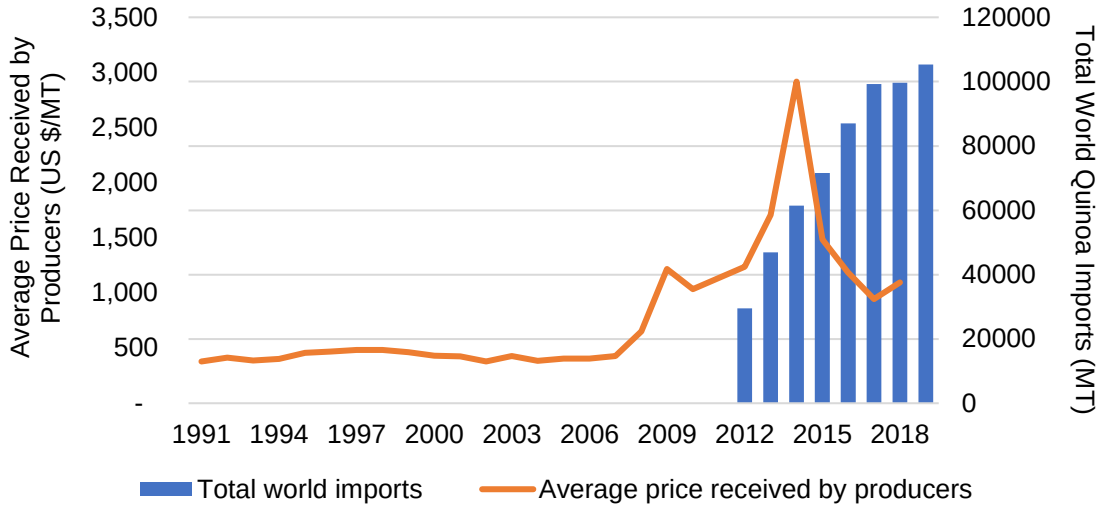
As the international demand for quinoa—measured by total world imports—increased, prices also increased. Figure 1 shows the relationship between prices received by Andean quinoa producers and total world imports. Prices remained steady in the 1990s and early 2000s. Between 1991 and 2007, quinoa prices increased by only 7.81% in Bolivia and 20.52% in Peru (FAO, 2020b). From 2008 to 2014, prices soared by 304.75% in Bolivia and 407% in Peru (FAO, 2020b). Imports increased sharply from 2012 to 2016. Imports have continued to increase since, but at a slower rate (Figure 1).

Figure 2 shows the major importers of quinoa in 2019. The United States imported 30% of the total world imports and the European Union imported 43%. Other important importers were Canada (8%), Australia (3%), Chile (3%), and Brazil (2%). Russia, Japan, the United Arab Emirates, Argentina, and New Zealand together accounted for the remaining 9% (ITC, 2020).

Exports

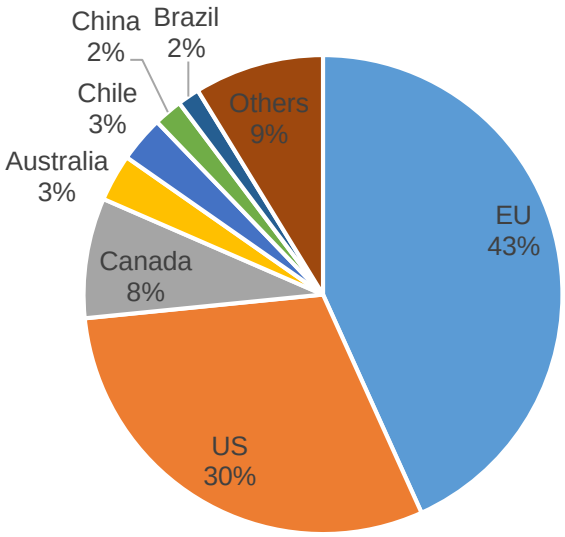
In the last decade, exports of quinoa and the number of exporting countries have increased. In 2012, 25 countries exported 43,646 metric tons (MT) of quinoa, compared to 114,439 MT exported by 53 countries in 2019 (ITC, 2020). Historically, Bolivia has been the major exporter of quinoa worldwide. Since 2014, however, Peru has taken the lead, exporting on average 1.5 times more than Bolivia (Figure 3) (ITC, 2020).

Figure 1. Average Price Received by Producers (US $/MT), 1990–2018, and Total World Quinoa Imports (MT)



Note: Trade data for quinoa are available since 2012, when the specific HS code for quinoa was created. Before 2012, quinoa was reported in the category "Buckwheat, millet, canary seed and other cereal (excluding wheat and meslin, rye, barley, oats, maize, rice, and grain sorghum)" (Coelho, Deriaz, and Tokas, 2020; ITC, 2020).
Source: Average prices are from FAO (2020b); total imports are from ITC (2020).

Figure 2. Quinoa Major Importers in 2019



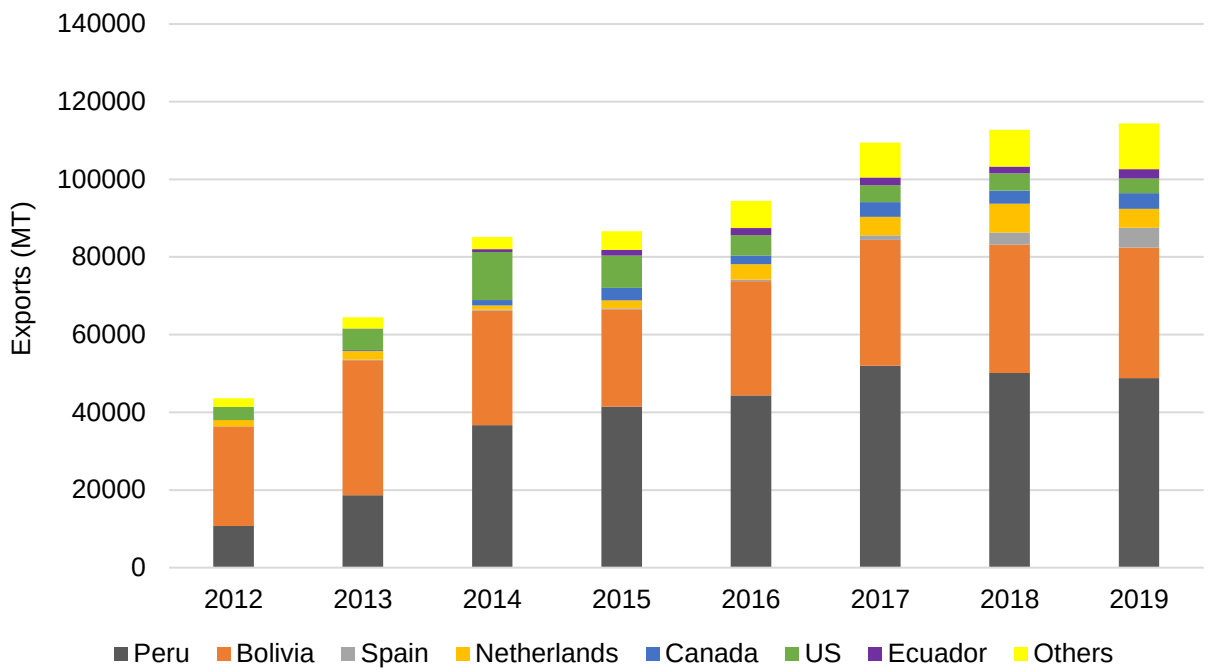
Source: ITC (2020).

In 2019, Bolivia, Ecuador, and Peru accounted for 74% of the international market of quinoa—43% from Peru, 29% from Bolivia, and only 2% from Ecuador. Newly producing countries accounted for the remaining 26%: Spain and the Netherlands contributed 5% and 4% of the market, respectively. Canada exported 4% and the United States 3%, while France, Germany, Belgium, and Italy together accounted for 10% of total world exports (Figure 3) (ITC, 2020).

Peru

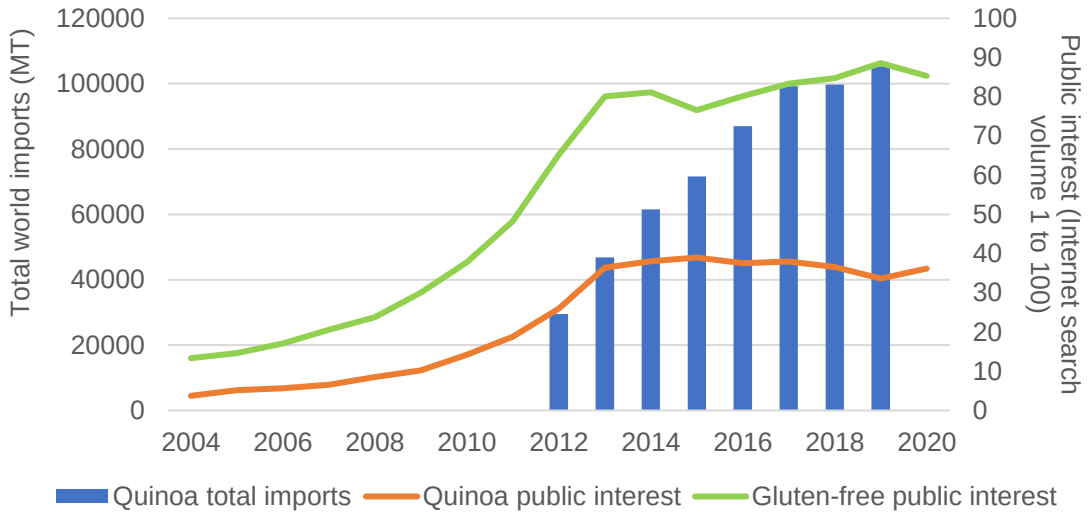
In 2002, Peru's foreign policy started focusing on opening new foreign markets, establishing commercial relationship through new trade agreements (MINCETUR, 2020). For instance, Peru has free trade agreements in force with the United States and Canada since 2009, with Japan since 2012, and with the European Union since 2014 (Soto, 2015). This strategy benefited the quinoa sector. Peru went from exporting 10,712 MT of quinoa to 21 countries in 2012 to 48,781 MT to 61 countries in 2019. Peru not only increased quinoa

Figure 3. Major Quinoa Exporting Countries, 2012–2019



Source: ITC (2020).

Figure 4. Worldwide Public Interest in Quinoa, 2004-2020 and Total World Imports of Quinoa, 2012-2019



Source: Interest in quinoa is from Google Trends (2020); total world imports is from ITC (2020).

exports by 355.38%, but also diversified its trading partners (ITC, 2020). In 2019, the major destinations for Peru's quinoa were the United States (33%) and the European Union (36%). Other partners were Canada, Brazil, Chile, Mexico, Australia, Russia, and Israel.

Bolivia

Bolivia started exporting its signature variety, Quinoa Real, in 1974 (Gamarra et al., 2019). While Bolivian exports of quinoa increased from 25,662 MT in 2012 to 33,677 MT in 2019, its share in the international market declined from 59% to 29%. During the same period, Peru's market share increased from 24% to 43%. Unlike Peru, Bolivia has developed few trade partnerships. Between 2012 and 2019, Bolivia exported approximately 83% of its quinoa to the United States and the European Union only (ITC, 2020), exhibiting a high level of dependency on those two markets.

Ecuador

Until 2016, Ecuador imported quinoa to meet its domestic and international demand (SIPA, 2018). Currently, Ecuador's production exceeds domestic demand, leaving enough surplus to supply the international market. Similar to Bolivia, Ecuador has few trade partners. In 2019, 30% of total exports went to the European Union, 23% to Canada, 23% to the United States, 21% to Israel, and 3% to other countries (ITC, 2020).

Demand, Prices and Life Cycle

The "quinoa boom" occurred from 2011 to 2015. The remaining question is what would happen next. Using the concept of product cycle (Grossman and Helpman, 1991; see Belton, Reardon, and Zilberman, 2020, for an application to seafood), this section explains the dynamics of the quinoa market and sheds light on potential opportunities and challenges quinoa producers and sellers may face.

A product's cycle is defined through the relationship between the quantity sold and sales (and profits). This cycle has four stages—introduction, growth, maturity, and (eventually) decline. As quinoa penetrated the international market (as evidenced by imports and prices), consumers have changed their behavior, and many have adopted (or not adopted) the product. Figure 4 shows the relationship between imports, measured in metric tons (ITC, 2020) and public interest in quinoa and gluten-free products, measured by the volume of Google searches (Google Trends, 2020). We propose that the dynamics of imports, prices, and public interest in quinoa can help understand the life cycle of quinoa as a product:

1. Introduction stage (2004–2010). In the early 2000s, quinoa was a novelty food in high-income countries and emerged as a gluten-free and high-protein product. Prices and profits were low during this period. Only two countries, Bolivia and Peru, were major suppliers of quinoa. Worldwide public interest in quinoa, measured in volume of Google searches, slowly increased during this stage (note that public interest in quinoa is similar to interest in gluten-free products).

2. Growth stage (2011–2015). A period of strong growth. Imports rapidly increased in the United States, Canada, and the Western European countries, causing world prices of quinoa to soar. In 2013, Western European countries imported 96% more quinoa compared to 2012 and 117.8% more in 2014 than in 2013. Public interest in quinoa grew strongly.

3. Maturity stage (2016–present). Although imports of quinoa in Western Europe, the United States, and Canada continued to increase, the rate growth slowed. The average growth rate of imports from this region was 8.87% from 2016 to 2017, -4.15% from 2017 to 2018, and 3.78% from 2018 to 2019 (ITC, 2020). Similarly, public interest in quinoa (as indicated by Google searches) has been steady since 2016. Prices started to decline as supply from established and new producing countries increased and Spain, Italy, France, Germany, the United States, and Canada entered the market. Apart from the three Andean countries, quinoa production data from other countries are limited. Given that the area planted per producer is low, quinoa production is more likely to be lumped into general categories such as "cereals" or "grains." Bazile, Jacobsen, and Verniau (2016), however, reported only eight countries cultivated quinoa in the 1980s, compared to more than 75 countries in 2015.

4. Decline stage: A stage characterized by a decline in sales and profits. There is no evidence that quinoa has reached this stage yet.

As quinoa has reached its maturity stage in some countries, quinoa producers may need to design new business strategies to avoid reaching the decline stage. The following section identifies the global market opportunities and barriers for the quinoa market.

Trade Opportunities and Barriers

Opportunities:

1. New markets: Countries such as China, Japan, Australia, and Russia are increasing their consumption of quinoa. China's quinoa imports, for instance, increased from 20 MT in 2014 to 2,044 MT in 2019 (ITC, 2020). These countries are still in the introduction or growth stage and could be the next market quinoa producers and processors need to explore.

2. Value added products: Quinoa is primarily exported as a grain. Value-added quinoa products such as flour, energy bars, or soups may be attractive for existing and new markets (CBI, 2020), but many of these products are made in importing countries such as the United States. Peru already produces energy bars, popped quinoa, and quinoa flakes. However, these products are only sold in local and regional markets because processing plants have limited capacity to produce large volumes or their equipment is not sophisticated enough to produce a product that meets international standards (Fairlie, 2016).

3. Organic quinoa: The product life cycle analysis presented above applies to conventionally

produced quinoa. European consumers, particularly those concerned about health and the environment, are increasingly interested in organic quinoa (CBI, 2020). Thus, the market for organic quinoa is still growing.

Barriers

1. Organic certification: To export organic quinoa to the European Union, the United States, and Canada, producers need to obtain an internationally recognized certification following accepted standards. The certification process can be long and expensive, increasing costs by 10%–20% compared to conventionally grown quinoa (Coelho, Deriaz and Tokas, 2020). In addition, production costs for organic quinoa are almost double those of conventionally produced quinoa (Fairlie, 2016). Due to potentially higher yields and organic price premiums, however, organic quinoa production can be profitable for producers (Fairlie, 2016).

2. Pesticide residue limit: Producers need to follow pesticides limits indicated by the Codex Alimentarius Maximum Residue Limit (MRL), which sets international food standards (CBI, 2020). With production of quinoa expanding to the coastal area of Peru, the use of pesticides has intensified (Soto, 2015; Latorre and Jacobsen, 2017). As a result, Peruvian exports could be threatened if farmers continue to heavily rely on pesticides for pest control.

3. Branding: According to CBI (2020), European buyers are interested on supporting commitment to social and environmental impact of the business. Quinoa has been recognized for a sustainable type of production. Thus, the use of a sustainable label could help quinoa producers capture premium prices. Expansion of production area to the plains of the Altiplano, however, is raising concerns as the production practices used in this area are capital intensive (Risi, 2015) and may threaten the opportunity to consider quinoa under the sustainable label.

4. Food safety standards: Exporters are required to comply with the food safety standards of importing countries. In 2019, the World Health Organization (WHO) adopted the Standard of Quinoa as part of the Codex Alimentarius (Coelho, Deriaz and Tokas, 2020). Andean countries may need to invest in modern equipment to produce value-added products meeting food safety standards.

5. Labeling regulations: Countries require foreign products to meet labeling requirements, including product name, physical condition, list of ingredients, consumption date, place of origin, exporter, and importer contact information (CBI, 2020). In addition, the label should include any certification logo. New production practices in Andean countries, however, could prevent them from using labels such as organic, all natural, and fair trade.

Production

Recall that Peru, Bolivia, and Ecuador have traditionally been the major producers of quinoa worldwide. Until the early 1990s, production of quinoa remained steady. Since quinoa's popularity increased in the international market, the three Andean countries have used different strategies to meet the increasing demand and capture the benefits of higher prices.

Peru

Quinoa can be produced in different agroclimatic zones (Fairlie, 2016), which allowed Peru to not only strengthen the regions where quinoa has been typically grown but also to expand its production to the coastal region (Dirección General de Políticas Agrarias, 2017). The area of quinoa harvested in Peru almost quadrupled, from 8,081 ha in 1990 to 28,889 ha in 2000. This increase in the harvested area led to an increase in production of 350.3%, from 6,260 MT to 28,191 MT. As the area allocated to quinoa continued rising, production increased 45.8% over 2000–2010 and 179.3% over 2010–2015 (Figure 5).

In addition to area expansion, Peru invested resources in research and education. The introduction of enhanced varieties and farmers' training on best management practices led to productivity gains. Quinoa yields increased by 26% from 1990 to 2000, by 19.2% from 2000 to 2010, and by 14.4% from 2010 to 2018 (FAO, 2020a). Peru produced 86,011 MT of quinoa in 2018, 21.6 % higher than Bolivia's production but only using half as much land as Bolivia (FAO, 2020a). Currently, Peru is the leading producer in terms of volume and productivity.

The expansion of quinoa production into the coastal area has raised concerns related to environmental impacts because producers in this area are using more pesticides for pest and diseases (Soto, 2015; Latorre and Jacobsen, 2017). This situation has led to the reduction of exports. In 2014, three shipments of quinoa from Peru were found to have pesticide residues above the maximum threshold, preventing them from entering the United States (El Comercio, 2014a). Additional research is needed to evaluate potential environmental impacts that could compromise the sustainability of quinoa production in the coastal area (Latorre and Jacobsen, 2017) and the international reputation of the Peruvian quinoa.

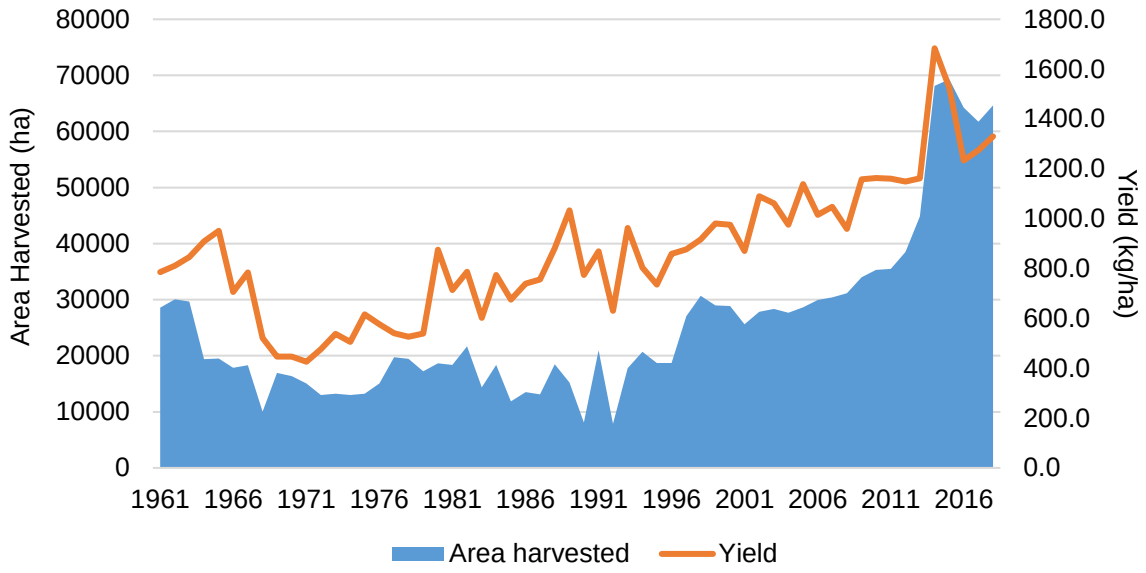
Bolivia

Quinoa has always played an important role in Bolivian

culture. Before the 1980s, this crop was primarily produced for the local market (Gandarillas et al., 2015). Quinoa was usually planted in the foothills, hill slopes, and mountains of the Bolivian Altiplano under an agropasture system (Gandarillas et al., 2015; Del Barco-Gamarra, Foladori, and Soto-Esquivel, 2019). Since the 1980s, quinoa production has expanded to the plains of the Altiplano and other nonquinoa production regions. Currently, seven out of the nine departments in Bolivia plant quinoa.

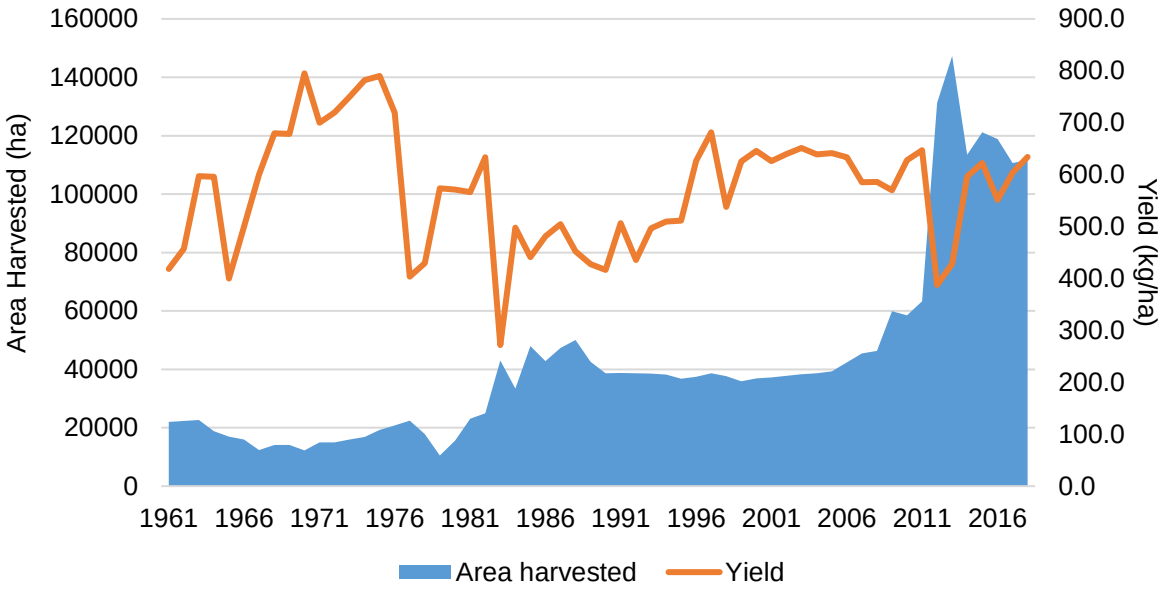
The area of quinoa harvested increased from 15,640 ha in 1980 to 38,615 ha in 1990. Bolivia barely changed its area allocated to quinoa during the 1990–2000 period. To supply the increasing international demand, the area harvested increased from 39,302 ha in 2005 to 58,496 ha in 2010, a 48% increase. Production soared from 25,201 MT in 2005 to 36,724 MT in 2010 and 63,075 MT in 2013, when 147,312 ha were harvested (Figure 6), the largest amount of land allocated to quinoa production. In 2018, 111,605 ha of quinoa were harvested, producing 70,763 MT, an increase of 12.19% (FAO, 2020a).

Figure 5. Peru Quinoa Area Harvested and Yield, 1961-2018



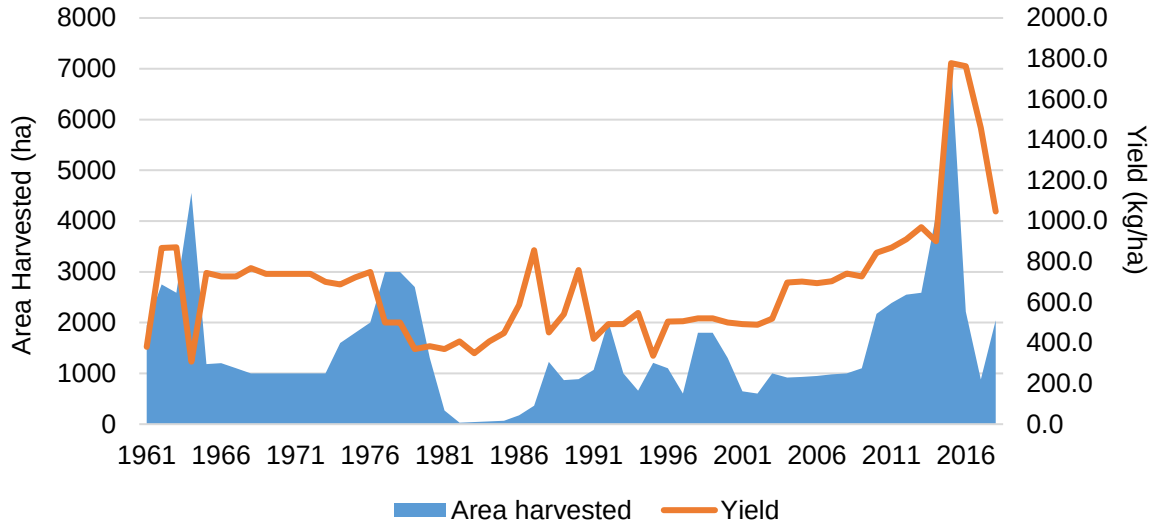
Source: FAO, (2020a).

Figure 6. Bolivia Quinoa Area Harvested and Yield, 1961-2018



Source: FAO (2020a).

Figure 7. Ecuador Quinoa Area Harvested and Yield, 1961-2018



Source: FAO, (2020a).

The expansion of quinoa into the plains of the southern Altiplano has resulted in a decline in yields (Figure 6) because of using a capital-intensive (higher use of pesticides and machinery) production system in highly erodible soils (Gandarillas et al., 2015). Between 2000 and 2018, quinoa yields in Bolivia were, on average, 47% lower than in Peru and 21.23% lower than in Ecuador (FAO, 2020a). Concerns about agro-ecological and social vulnerability in this area are increasing (Winkel et al., 2015; Del Barco-Gamarra, Foladori, and Soto-Esquivel, 2019). Additional research is needed to evaluate these potential issues.

Ecuador

In Ecuador, quinoa is a secondary crop produced by smallholders in the highlands region (SIPA, 2018). In 2015, the area harvested reached 7,148 ha (Figure 7), the highest amount of land this country has allocated to quinoa, producing 12,707 MT (FAO, 2020a). This area represented only 5.90% and 10.31% of the area harvested in Bolivia and Peru, respectively. Because prices in Ecuador plummeted by 55% in 2015 (Enriquez, 2018), the area harvested decreased to 2,048 ha in 2018, leading to a production decline of 83% (FAO, 2020a).

Other Countries

France, Germany, Spain, and Italy have recently begun cultivating quinoa. Spain has become the biggest quinoa producer in Europe. Other countries cultivating quinoa in Europe are Poland, Bulgaria, Portugal, and Czech Republic (CBI, 2020).

In the United States, quinoa was introduced by Colorado State University as a crop that could be adapted to the Rocky Mountain region. Washington State University is also investigating the crop's adaptability to the Pacific Northwest region (Peterson and Murphy, 2015).

Value Chain

In the Andes, quinoa has typically been produced by small-scale producers. Due to their scale of production, they lack (i) the capacity to export or commercialize the product in larger markets, (ii) the bargaining power to negotiate better prices and other conditions, and (iii) the ability to meet the quality and safety standards of larger and more demanding markets (Fairlie, 2016).

The market for quinoa has experienced notable changes. Before the "quinoa boom" of the mid-2010s, producers generally sold their quinoa on the local market, which allowed them to market the crop when they needed cash. As the foreign demand for quinoa increased, producers have been encouraged to work in associations or to sell their production to aggregators in order to meet volume and quality requirements (Fairlie, 2016, El Comercio, 2014b).

Associations collect the grain from members and conduct standard post-harvest activities (including cleaning, washing, and packing) needed to market the grains. In addition, quinoa, different from other cereals and grains, needs washing to remove the saponin, which gives quinoa a bitter flavor. Establishing the infrastructure for post-harvest activities is costly and may constrain small-scale farmers from entering the quinoa business.

Depending on the size of the aggregator, these collect the grain from farmers and process the quinoa or sell it to other processing plants. Generally, aggregators and processing plants are considered medium to large scale

(Fairlie, 2016).

In the coastal region of Peru, quinoa is produced primarily by large-scale farmers, which employ more technology for the production and processing of quinoa. Many of the large-scale farmers have the installed capacity to complete all of their own post-harvesting handling and processing (Fairlie, 2016).

Policies

The governments of Bolivia, Ecuador, and Peru have supported the quinoa sector by promoting research and development in quinoa through their National Institutes of Agricultural Research (INIAF-Bolivia, INIAP-Ecuador, and INIA-Peru). These institutes have developed improved varieties of quinoa that are adapted to the climatic conditions of the regions where quinoa is currently produced in each country (Peralta and Mazón, 2015; Risi, 2015; Soto, 2015).

Peru

The National Secretary of Plants and Animal Health (SENASA) conducts rigorous monitoring on pesticide residues, heavy metals traces, and mycotoxins to assure the quality of the product. SENASA trains quinoa producers, processors, and exporters. In addition, the government supported the creation of a Quinoa Taskforce to provide quinoa stakeholders—producers, processors, and private and public institutions—with a space to discuss current challenges and design strategies to expand the consumption of quinoa (Fairlie, 2016). Local governments also promote training and extension activities.

Bolivia

Bolivia has benefited from the work of international organizations and its government, which has conducted research related to quinoa since the 1970s. Bolivia proudly commercializes its Quinoa Real variety and is seeking to protect it through a designation of origin (Risi, 2015).

Ecuador

In the last decade, the government also provided producers with inputs and production loans to help recipients increase their production and motivate nonquinoa producers to switch from other traditional crops to quinoa production (SIPA, 2018). Processors and aggregators, on the other hand, usually receive aid from foreign organizations because the investment for infrastructure is high. The government has not played an important role in processing and marketing, as evidenced by Ecuador's late entrance to the foreign market.

Price Effect on Consumers

There is a concern that high quinoa prices, driven by the increase in foreign demand, may be hurting the nutrition of poor quinoa consumers in the Andes (Blythman, 2013; *The Economist*, 2016). Higher prices make quinoa less affordable for Andean consumers, who may either allocate the same level of expenditure to buy less quinoa than they did before the quinoa boom or allocate a higher level of expenditure to buy the same amount of quinoa, limiting their ability to afford other types of nutritious food (Stevens, 2017). Some evidence in the literature, however, concludes that higher quinoa prices benefited both quinoa consumers and producers (Stevens, 2017; Bellemare, Fajardo-Gonzalez, and Gitter, 2018).

These results can be explained in three ways. First, the majority of quinoa consumers in the rural areas of the Andes are also producers. Thus, they have profited from higher prices, which has enabled them to access other types of foods—fruit, vegetables, and, following Bennett's Law, meat—making their diets more diverse (Gandarillas et al., 2015). Second, consumers who are not producers are not hurt because quinoa represents a small share (no more than 4%) of the average household's food expenditure (Stevens, 2017). Last, Bellemare, Fajardo-Gonzalez, and Gitter (2018) speculate that there may have been a trickle-down effect from the increased welfare of net quinoa producers to net quinoa consumers.

Conclusion

Over the last two decades, demand for quinoa increased dramatically, leading to a sudden increase in price, which culminated in the quinoa price spike of 2014. Producers from Bolivia, Peru, and eventually Ecuador were motivated to produce more quinoa to supply increasing domestic and international demand. Farmers in these countries expanded both production area and intensity. The governments in these countries have supported quinoa production through research and development for enhanced varieties and access to credit and inputs. Nevertheless, support to processors and exporters has been limited.

Because quinoa is being produced more intensively, environmental concerns have been raised. In Bolivia, expansion into the southern Altiplano may have caused losses in productivity and land may have become more eroded. In Peru, use of pesticides in the coastal region may have not only caused harm to the environment but also may have violated the pesticide use restrictions of the United States, the European Union, and the Canadian markets. There is limited evidence to support these concerns and future work in this area is needed.

Recently, international prices of quinoa have declined, back to their pre-2010 levels. To remain competitive, Andean countries need to open new markets and explore the market for value-added products. These strategies will help quinoa producers thrive in the current stage of quinoa's product life cycle.

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Acknowledgements:
The authors thank Elizabeth Canales and Joel Gruver for the support in reviewing and suggested edits to this article. We are also thankful for comments and suggestions from two anonymous reviewers.

CHOICES

AAEA Agricultural & Applied Economics Association

Volume 35, Quarter 4

Opportunities in Blue Maize Markets for Smallholder Farmers in Central Mexico?

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JEL Classifications: Q01, Q12, Q13
Keywords: Latin America, Native maize, Niche markets, Rural development, Specialty markets

Growing Demand for Blue Maize

The widespread adoption of more productive hybrid yellow and white maize varieties starting in the 1950s and the introduction of machines to make tortillas in the early 1990s fundamentally changed the diet of urban Mexicans. Local restaurants went from offering a colorful array of tortillas made from native maize to a near uniform white tortilla made from hybrid maize (Massieu Trigo and Lechuga Montenegro, 2002). The lack of price premiums for the native maize varieties encouraged many farmers to replace these native maize varieties with more productive hybrid varieties. Even though these hybrids require larger investments to purchase seeds and agrochemicals, they are much more productive and require less labor from these labor-constrained households (Lerner and Appendini, 2011). However, some Mexican smallholders resisted this trend. They conserved their local, native maize varieties that their families had grown since precolonial times, using this grain mostly for household consumption with limited quantities sold in local markets for tortillas and other traditional dishes (Bordi, 2006; Fernández-Suárez, Morales-Chávez, and Gálvez-Mariscal, 2013; Díaz Mora, 2016; Boué et al., 2018).

Demand for native maize, especially blue maize, in Mexico has expanded beyond these local markets over the last 3 years. Now, high-end restaurants and supermarkets in Mexico City and other regional cities in central Mexico offer blue tortillas, chips, and other products (De Miguel 2019). This trend reflects both a nostalgia for traditional Mexican foods and a recognition of the potential health benefits from blue maize. Antioxidants responsible for the blue pigmentation have been proven to lower risks for coronary disease, diabetes, arthritis, and cancer (Antonio Miguel et al., 2004; Cortés-Gómez et al., 2005; Salinas Moreno et al., 2013).

These new culinary trends may prove to a boon for the smallholders that have conserved these native varieties. In fact, growing demand has encouraged smallholders to expand their production and for others to begin growing it (Bordi, 2006; Lerner and Appendini, 2011; Pérez et al., 2019). However, research on blue maize demand and consumption have only explored the traditional, local markets (Keleman and Hellin, 2009; Hellin and Keleman, 2013; Boué et al., 2018). There is little information to understand the scale of these new markets, their potential for future expansion, and the opportunities for blue maize farmers to take advantage of these opportunities.

Blue Maize Production in Mexico

Before farmers started receiving much of a premium for blue and other colored native maize varieties, its production had been falling, raising questions as to whether smallholders would be able to scale up production to meet this exploding new demand. With the overwhelming growth in hybrid production for white maize, used mostly for human consumption, and yellow maize, used in livestock feed, colored maize, most of which is blue maize, made up only a small portion of overall Mexican maize production: just 0.3% of the 27.8 million metric tons (MT) of maize harvested and 0.4% of the 7.5 million hectares planted to maize in 2017.

Between 2010 and 2017, the area planted to colored maize fell by 36.9% from 49,100 hectares to 32,000 hectares and production by 6.8% from 76,900 MT to 71,700 MT (SIAP, 2018). Farmers did not have many marketing opportunities for colored maize until recently, so they had no incentivize to continuing growing this crop. They instead dedicated their land to hybrid white and yellow maize production. The farmers that continued to grow these traditional maize varieties did so to preserve a crop that was culturally significant to them (Arslan and Taylor, 2009). The colored maize that was produced was concentrated in central Mexico in the states of Mexico, Puebla, and Michoacán following historical and cultural patterns. This region of country is also dominated by smallholder farmers who have conserved these native, colored maize varieties (Lerner and Appendini, 2011; Boué et al., 2018).

Starting in 2015, SIAP, the statistical arm of the Mexican Secretariat of Agriculture, collected data on maize prices for blue maize (Table 1). Before 2015, blue maize statistics were aggregated with colored maize in the official statistics. These data reveal that over the last few years, farmers were able to earn significantly more for blue maize in comparison to white and yellow maize. In fact, in 2017 (the last year that data were available), farmers received 21.6% more for blue maize than they did for yellow maize, the maize variety used as a reference in commercial contracts and on the board of trade; the narrowing in prices in 2016 represents supply level changes between the varieties within Mexico rather than movements in international markets, as maize prices for human consumption in Mexico remain disarticulated from international markets (Motamed, Foster, and Tyner, 2008).

Experiences in the Blue Maize Value Chain

To analyze the blue maize markets, we interviewed 37 vendors in seven regional and local markets, five chefs of high-end restaurants, five supermarket distributors in the Mexico City Metropolitan area, and two large industrial processors between January and April 2019. We collected information on the products they offered, promotional strategies, volumes purchased over the last 3 years, their relationship with farmers, purchasing requirements, limitations in supply, storage capacity, and their provision of technical assistance to the farmers.

Table 1. Maize Prices in Mexico by Color, 2015-2017 (USD/MT)

Year	Yellow	White	Colored	Blue	Percentage More for Blue Than for Yellow
2015	203.46	217.11	204.91	240.63	18.3%
2016	177.10	184.16	184.59	190.32	7.5%
2017	180.70	192.07	197.88	219.67	21.6%

Source: SIAP (2018).

Table 2. Characteristics of the Principle Markets for Blue Maize in Mexico

	Local Markets	Haute Cuisine Restaurants	Large Processors
Sourcing	Self-production or from nearby farmers	Individual farmers, Informal farmers' associations	Individual farmers, accredited farmers' cooperatives, intermediaries
Buying arrangement	Infrequent purchases in local markets with no official receipts or record keeping	Verbal agreements established at planting and confirmed at harvest with farmers required to provide official invoices	Formal contracts established a few months before the harvest stating the price and quantity sold with the seller providing an official invoice
Prices (USD/kg)	0.31–0.34	0.52–0.73	0.42–0.52
Volume per buyer	A few kilograms	1–7 MT	800–4,000 MT
Services provided to the farmers	None	Transportation Technical assistance Accounting services	Transportation Technical assistance
Expectations	Prices will continue to rise with more buyers from the cities	Growing national & international market, especially to Europe	Growing national & international market, especially in the U.S.

Notes: 1 kg = 2.2 lb.

Local Markets

In local markets, smallholders sell a few kilograms of maize, mainly directly to small processors, local millers, or tortilla makers, in local markets in rural communities or wholesale markets in regional cities. All sales are informal, with no receipts and few records kept. These farmers grow, market, and sometimes mill the maize into flour, the main ingredient used in traditional dishes or tortillas. Women often complete these processing activities, which provides them with an additional income source. They can earn 2–3 times more than they would by selling grain in the market or to intermediaries, the main alternative for their grain besides self-consumption or for livestock feed. In regional markets around Mexico City, smallholders sell their blue maize at a higher price than white maize, on average 40% more (0.25 USD/kg for white maize compared to 0.35 USD/kg of blue maize). Consumers and farmers in these local markets have developed a long-term commercial relationship. Over the last 3 years, the farmers' client base has been growing especially as chefs from high-end restaurants in Mexico City and other large regional cities have frequented these markets seeking out these colored grains and byproducts such as maize flour or blue husks to make handicrafts (Table 2).

High-End Restaurants

Since 2016, a growing demand for restaurants serving traditional Mexican foods made from local ingredients has led to a boom in high-end restaurants offering such products. A part of their business model is creating an experience where their clientele feels connected with traditional, smallholder farmers in support of conserving native maize varieties and spurring rural development. Many are encouraging their farmer suppliers to obtain organic certification, as their customers are demanding organic products. To achieve this objective as well as increase the supply of blue maize to meet the exploding demand for blue maize products, some of the restaurants have started partnering with research centers, NGOs, and governmental institutions to provide extension services to these farmers.

The restaurant managers we interviewed purchase blue maize directly from maize farmers with whom they have a long-term relationship, allowing them to base their commercial relationship in trust without the need for written contracts. These direct relationships allow restaurant managers to work closely with farmers and address any challenges in meeting the grain quality requirements. Such open communication was critically important when the business relationship was first established. Farmers comply in providing quality grain and restaurants pay above market prices, consistently buy their maize, pay on time, and provide transportation for the grain. According to the farmers, receiving twice the local market price for their maize is enough to incentivize them to comply with these standards and maintain the relationship.

Even with all this goodwill, many challenges inhibit the development of this market. Farmers' lack bank accounts and are unable to provide official invoices, which limits restaurants' ability to make large purchases from them. One of the restaurant managers we interviewed described how he assisted farmers in opening bank accounts and used his own accountants to support farmers in issuing the proper receipts. Restaurants are further challenged by having nowhere to store the grain, forcing them to make weekly or biweekly purchases. Farmers also do not have access to quality storage facilities; they store the maize cobs in burlap or plastic sacks. With such poor storage conditions, restaurants only have secure source of grain for 5 months, from harvest in November to March, when the grain begins to spoil. Blue maize is particularly difficult to store and spoils quicker, as it is softer than white and yellow maize (Cortés-Gómez et al., 2005).

Even with all these challenges, the blue maize market in the restaurant sector continues to grow. Over the past 5 years, the number of restaurants that source blue maize has multiplied. The most experienced chef, with near a decade of experience sourcing blue maize, commented, "At the beginning of 2016, we were the only business in this market. Now there are five of us." With such growth in demand for blue maize, farmers cannot keep up with this demand. There is a need for additional farmers to participate in these marketing arrangements. The traditional method of seed production limits farmers' capacity to produce enough to meet demand and quickly expand (Lerner and Appendini, 2011). Nonetheless, restaurant managers are optimistic about opportunities to market blue maize in their businesses. Over the next 5 years, two restaurant managers mentioned that they have plans to increase the number of clients and restaurants in Mexico and to even export some of their product, particularly to consumers with Mexican heritage in the United States.

Large Maize Flour Millers

The production of blue maize flour for large commercial markets is relatively new. The three largest maize flour millers have only been in business for the last 10 years. They claim that demand has skyrocketed over the last 3 years, straining their current capacity. Because of this growing demand and supply shortages, these businesses paid up to 40% more for blue maize than they did for white maize in 2019. They only paid 25% more for blue maize in 2016. Due to the seasonality of blue maize production and limited storage infrastructure, farmers store it and buyers make purchases annually during winter harvest in November and December. Such practices create high storage costs for these businesses, which would prefer to make purchases at least every 6 months. Just like the restaurant managers, buyers for these large agribusinesses are challenged in encouraging farmers to provide formal receipts. Additionally, they require the farmers to sign written contracts. The buyers admit that the farmers are often

leery of signing these contracts as they do not understand the complex language in them and are unfamiliar with such processes. Even though the buyers prefer to make direct purchases with farmers and their associations to avoid intermediaries and ensure farmers receive the highest prices, they continue to make purchases from intermediaries, as many farmers do not meet these legal requirements.

Like the restaurant managers, these millers are interested in assisting farmers enhance their production, so they are partnering with the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), the governmental agricultural research institution; universities; and international research centers to enhance farmers production. They are particularly interested in supporting research to develop hybrid varieties that produce homogeneous grains. Currently, each community has its own native blue maize variety with a wide variability in color and flavor qualities, inhibiting millers' ability to offer a consistent product. However, many farmers are reluctant to adopt new varieties because they are proud of the varieties that have been in their families for centuries. Even with these difficulties, the millers are hopeful. They see a growing demand in Mexico and the world for blue maize flour. One has exported 2 tons of maize flour to markets with a large Mexican diaspora in Spain and Italy in 2018 and another started keeping blue flour in its storage facilities near the U.S. border, hoping to expand into this market.

Opportunities in the Blue Maize Value Chain
There is a rapidly growing demand for blue maize in domestic markets with an opportunity to open new international markets. These expanding markets offer large price differentials for blue maize compared to other maize varieties, with expectations that this differential will grow even more.

- Consumption of blue maize continues to be an important component of Mexican culture.
- Buyers from different parts of the country seek out blue maize and its products in local markets.
- Chefs in high-end Mexico City restaurants are promoting products made with native maize. Evidence suggests that consumption of these products is expanding outside these restaurants to various establishments in middle-class neighborhoods.
- In 2018, processors started to export blue maize flour to markets in the United States and Europe with plans to further expand in these markets.
- This growing demand has led to price increase over the last 3 years. Before, blue maize was the same price as white maize. Now, blue maize is sold at twice the price or more than white maize.
- The private sector—both restaurants and larger processors—has taken a leading role in promoting rural development. They support small farmers in improving their production, implementing better post-harvest practices, and complying with tax and legal requirements.
- Boué et al. (2018) pointed out that the expansion of markets for blue maize could strengthen livelihood opportunities for rural communities and strengthen the economic independence of women who own the micro-enterprises that sell blue maize in the traditional markets and products made from this maize, especially tortillas.

Challenges in the Blue Maize Value Chain

The booming blue maize market is in transition, from supplying local and informal market to increasingly sourcing formal markets for restaurants and larger millers looking to export, creating marketing opportunity for smallholder farmers in central Mexico. However, these changes are accompanied by many challenges that must be addressed to have impact at scale.

- Inadequate storage infrastructure and little knowledge of the best post-harvest practices means blue maize is only available between November and March.
- Little formality in traditional market has created a reality in which farmers and their associations are unprepared to meet the requirements of larger processors and restaurants, which require bank accounts, formal contracts, and legally acceptable invoices.
- There is an overall lack of awareness and consistency in prices, nowhere to consult blue maize prices nor any mechanism to collect them since prices vary widely by type of buyer and place of production.
- The great diversity of blue maize varieties complicates processors' ability to produce the homogeneous flour and other products that their customers desire.
- Buyers face high transaction costs in collecting blue maize from individual farmers and in local markets instead of buying from the centralized collection centers of organized groups.

Recommendations to Improve the Functioning of the Blue Maize Vale Chain

Our research has identified potential areas for policy action. While we were able to draw some preliminary conclusions from this value chain study, evidence based on larger samples and more rigorous designs is needed to draw definite conclusions and triangulate these results. Nonetheless, the our evidence indicates there is a need for coordination among businesses and institutions that support blue maize farmers to provide technical assistance in production and marketing, encourage farmers to jointly market their crop, share price information, facilitate the construction or improvement of storage infrastructure, and provide seeds that produce homogeneous and consistent grain.

- Farmers and their organizations require training on the adoption of best production and post-harvest practices, forming and maintaining farmer organizations, and marketing their products. Such efforts must extend beyond production to include basic farm management skills such as understanding contracts, maintaining bank accounts, complying with tax and other regulations, and implementing strategic plans.

- An electronic price platform collecting pricing data from all purchasing points is necessary for the overall market transparency and fairness.

- Farmers' organizations require access to credit and other financial assistance to build or improve their storage infrastructure in order to ensure the quality of their grain and ensure they have product to sell throughout the year, smoothing out supply and price shocks during the off season.

- For farmers to take full advantage of the growing markets from the large millers, research institutions need to work with farmers to analyze their blue maize varieties and develop varieties that are more productive, are disease resistant, have a longer storage life, and meet these buyers' standards.

For More Information

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Acknowledgements:
This study was funded by Mexico’s Agency for Commercialization Services and Agricultural Market Development (ASERCA) and the CGIAR Research Program on Maize.

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AAEA Agricultural & Applied Economics Association

Volume 35, Quarter 4

Latin America's Superfood Economy: Producing and Marketing Açaí, Chia Seeds, and Maca Root

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JEL Classifications: Q13, Q17, Q01, F63, F62, O13, M3
Keywords: Agribusiness, Economic development, Functional foods, International trade, Marketing, Superfoods, Sustainability

Introduction

The terms "superfood" and "functional food" are often used interchangeably to market foods with high nutritional content to health-conscious consumers, but there is a distinction. While there is no scientific definition for superfoods, marketers rely on their high nutritional content to promote them as beneficial for human health. In contrast, functional foods are foods with health benefits that have been proven through medical research. Thus, only certain foods can be called functional foods, and these claims must comply with the regulations of the countries in which they are being marketed (Biswas, 2020). This article focuses on three prominent examples of superfoods—açaí, chia seeds, and maca root—which have seen a rapid increase in interest from consumers in the United States and other major markets across the globe over the past decade. We explore their history, their nutritional value, drivers of global demand, the role of producer nations, and growth and size of the global markets.

Açaí

Background

Açaí is a dark-purple fruit with yellow flesh and an earthy, chocolate-like taste that is native to the Brazilian Amazon River delta (Colapinto, 2011). While açaí is commonly referred to as the "açaí berry," the fruit is botanically classified as a drupe (Jennings, 2017). Açaí has high levels of antioxidants, over 3 times that of blueberries. For this reason, açaí is believed to help prevent many diseases (Jennings, 2017; Picincu, 2019; Venosta, 2019). The literature suggests that açaí fruit juice can be used as an energy drink with low carbohydrate content (de Lima Yamaguchi et al., 2015). Most of its nutritional content is found in the flesh and skin, which constitute only about 20% of the fruit (Picincu, 2019). In addition, the açaí fruit has a high lipid content, making it a good source for natural oils for use in the pharmaceutical and cosmetic industries (de Lima Yamaguchi et al., 2015). In the Amazonian communities of Brazil, açaí is a major component of the diet and is consumed after the fresh fruit has been turned into pulp (Colapinto, 2011). In other markets across the world, açaí is used in a variety of foods and beverages, particularly those marketed to health and sustainability-minded consumers. In addition, açaí is often utilized as a nutritional supplement (Market Data Forecast, 2019).

Production

Brazil is the world's largest supplier of açaí, representing about 85% of the global supply (Walker, 2018). In 2016, over 1.1 million metric tons (MMT) were produced in Brazil, 98.3% of which were generated by the state of Pará (IBGE, 2017). Increasing global demand has led Brazilian suppliers to ramp up production in recent years. By 2018, Brazil's production had risen to 1.5 MMT (Alves, 2019). However, the rapid increase of international demand outpaced the increase in supply, causing açaí prices to soar in Amazonian communities, depriving local consumers of their native fruit (Brasileiro, 2009).

Açaí farming is perceived as a lucrative endeavor in Latin American countries and has led to a production boom. Local organizations and government agencies have initiated programs to educate local Amazon açaí harvesters on efficient cultivation practices, sustainability management, and development of new product ideas for açaí berries (Nature Conservancy, 2020). This has also motivated the creation of new açaí cultivars to improve fruit yield (Michail, 2019). These local efforts are seen as an effective way to reduce deforestation of the Amazon by shifting the local economy's interest away from timber and beef production (Trevisani and Pearson, 2019).

Other countries such as Colombia, Guyana, Bolivia, Ecuador, Venezuela, and Trinidad produce modest amounts of açaí (Pimentel, 2020). In Colombia, after a decades-long civil war concluded with a peace

agreement in 2016, açaí farming was promoted by the Colombian government to stimulate economic development by improving income for local farmers in the rural southern regions. In addition, the government hoped that the switch to açaí production would help conserve the Amazon rainforest because açaí farming was seen as a sustainable alternative to coca production (University of Notre Dame, 2019; Montenegro, 2020).

Marketing

Açaí was heavily marketed in major Brazilian cities during the 1980s and 1990s. Açaí's low level of sugar allowed private-sector companies to successfully advertise açaí to athletes and health-oriented consumers (Colapinto, 2011). In the United States and other developed regions, açaí was also advertised as a nutritional product that provides health benefits (such as aiding heart health). The Asia-Pacific region, which includes emerging markets such as China and India, is considered a key potential açaí market due to its increasing purchasing power and large populations. The demand in this area is fueled by pharmaceutical, cosmetic, and nutritional supplement products with açaí as an ingredient (Market Data Forecast, 2019).

Although açaí is categorized as a superfood and is widely perceived by consumers to have health benefits, there is still debate among academic researchers with regards to its contribution to human nutrition and health (Llorent-Martínez et al., 2013; de Lima Yamaguchi et al., 2015). In 2013, the U.S. Federal Trade Commission charged multiple Internet vendors with a penalty of $1.6 million due to false marketing about açaí's weight-loss benefits (Federal Trade Commission, 2013). Despite this, açaí sales continued to grow. The global açaí market was estimated at about $720 million in 2019 and is forecasted to grow to over $2 billion by 2026, with an expected annual growth rate between 11% and 12.7% (Market Data Forecast, 2019).

Chia Seeds

Background

Chia seeds, derived from the chia plant, originated in northern Guatemala and southern Mexico and were used by the ancient Aztecs and Mayans (De Falco, Amato, and Lanzotti, 2017). This superfood regained popularity during the 1990s, when chia seeds were advertised as a nutritional food by a team of North and South American scientists working together in Argentina to produce them commercially (Coates and Ayerza, 1998). Current literature shows that chia has high levels of fiber, antioxidants, and healthy fatty acids (e.g., omega-3 and omega-6), all of which have been linked to benefit human health. Still, more research is needed before these health benefits are widely accepted (Grancieri, Martino, and Gonzalez de Mejia, 2019; University of Florida Health, 2020). Nowadays, chia seeds are used as an ingredient in many products, including oatmeal, smoothies, yogurt, pudding, pancakes, muffins, and bread (Gunnars, 2018; Wilson, 2018; University of Florida Health, 2020).

Production

South America alone produces approximately 80% of the world's chia seed supply (Businesswire, 2020). The top chia seed producers are Paraguay, Bolivia, and Argentina (SIMSA Export, 2020). Bolivia's fertile land and good weather conditions allowed the nation to increase its market share in the chia market in response to the demand-induced rise in prices (Beaumont and Michael, 2016; SIMSA Export, 2020). In Paraguay, the Chaco region is the major location of chia seed production (Delphi Organic, 2020). In recent years, Mexico has increased chia production and has started exporting to the U.S. market (Mordor Intelligence, 2020). Beyond Latin America, African nations (including Kenya, Tanzania, and Uganda) and Australia have also expanded production of chia seeds (Dumas, 2015; CBI, 2019).

Marketing

Consumers with a strong preference for nutritional products constitute the target market segment for chia seeds (Mordor Intelligence, 2020). Initially, sales were directed to specialized health-food stores, but with the rise in popularity, chia seed retail has expanded to grocery stores as well. Similar to the case of açaí, chia seeds are used as an ingredient in sport nutritional products (Strom, 2012; CBI, 2019). The advertised nutritional benefits previously described have led celebrities and fashion models to promote chia seeds by including them in their diets (Fletcher, 2014). Marketing of chia seeds has proven to be successful in the U.S. market, as reflected by the increase in consumer awareness. Between 2010 and 2014, the number of U.S. consumers who indicated that they have heard of chia as a food item increased from 27% to 37% (Businesswire, 2020).

In terms of trade and demand, Germany is the main chia market, with overall consumption of more than 5,000 metric tons in 2018, particularly driven by Germany's vegan consumers and elderly population, representing almost half of the European chia imports, mainly from Paraguay, Bolivia, and Mexico (Businesswire, 2020). Other notable importers are the Netherlands, the United Kingdom, Spain, Italy, and Poland (CBI, 2019).

Consumers in the United Kingdom use chia seeds as an ingredient in pre-prepared meal products. In Italy, chia is being adopted as an ingredient in pizza, albeit slowly, as Italian consumers have a preference for the use of local ingredients in their food products. In Poland, chia seeds are perceived as a luxury ingredient, thus limiting their market expansion to a small proportion of middle- and high-income households. Other European nations, such as France, are not currently consuming chia as much as their neighbors (CBI, 2019). Outside of Europe, demand for chia seeds is expected to rise in places like India,

Brazil, and Chile. The Asia-Pacific region is the largest potential market due to the increase demand trend for superfoods. Globally, demand for chia seeds is expected to grow at an average annual rate of 5.8% over the next 5 years (Mordor Intelligence, 2020).

Maca Root

Background

Maca—a native Peruvian plant in the same family as broccoli and kale—grows best at high elevations in the Andean region (León, 1964). In particular, its roots have been consumed for centuries, first used in the traditional "Pachamanca" meal in the Inca empire era (León, 1964). Maca root has several varieties, with yellow maca being predominant in the market, while other varieties, like red and black maca, are rarer (Johannes, 2014; Transparency Market Research, 2020). Overall, maca root has high levels of vitamins, unsaturated fatty acids, and minerals (Wang et al., 2007). This superfood is often marketed as being able to provide health benefits such as (i) reducing prostate problems and stress; (ii) improving physical energy, fertility, and memory; and (iii) helping manage menopause symptoms (Wang et al., 2007; Johannes, 2014). A review of scientific studies by Wang et al. (2007) provides some evidence for these claims. Maca root can be found as an ingredient in a wide range of foods, such as baked goods, smoothies, and energy bars (Palsdottir, 2016). To a lesser degree, it is utilized in skincare products in the belief that it protects against ultraviolet rays (Palsdottir, 2016; Zielinski, 2018).

Production

During the late 1980s, maca production was scarce and limited to Peru, with no more than 50 hectares grown in the Central region. Therefore, the plant was considered an endangered species (Hermann and Bernet, 2009; Neuman, 2014). In the 1990s, the Peruvian government encouraged maca farming, which motivated land expansion and increased production to more than 6,000 hectares of harvested area by 2012 (Neuman, 2014). Maca has also been introduced in Asia in recent decades, particularly in western China, which possesses areas with high altitudes and a cold and humid climate (Chen, Li, and Fan, 2017).

A major challenge of growing maca is that the plant absorbs almost all nutrients in the soil in just 2 years of production. Afterward, land must lay fallow for 10–15 years, causing Peruvian farmers to constantly look for alternative land (Neuman, 2014). However, the rapidly growing demand is leading some farmers to decrease the fallow period to less than 5 years (Hermann and Bernet, 2009). Fertilizers are typically not used in maca farming, as they have potential to damage the root. Further, the cold climate produced by the high elevation of the Andes region reduces the need for insecticides (Maher and Kozak, 2014).

In the early 2000s, in response to concerns about biopiracy and to recognize and protect maca as an endemic plant, the Peruvian Congress created the National Commission for the Prevention of Biopiracy. This governmental organization has the goal to review any unauthorized patent on maca and other plants (Ruiz and Vernooy, 2012). Another action the Peruvian government has undertaken to combat biopiracy was ratifying the Nagoya Protocol with other nations, which specifies that countries profiting from a resource should establish benefit-sharing mechanisms with the countries where the resource in question originated (Collyns, 2015). In addition, Peru has imposed strict export regulations that aim to keep unprocessed maca from being taken out of the country without paying the appropriate taxes (Maher and Kozak, 2014).

Marketing

Maca has been marketed in the United States in powder or liquid form, both of which can be added to foods and drinks. During 2013–2014, Chinese consumer demand started to rise significantly. As reported by the Peru's Ministry of Foreign Trade and Tourism, China's exports increased from $540,000 in 2013 to $6 million in 2014. For the United States, the export value relatively decreased for the same period, from $6.8 million in 2013 to $5.5 million in September 2014 (Maher and Kozak, 2014).

During the first half of 2010, the maca market initially represented a source of income for the communities in central Peru. However, increased trade led to a surge in prices and product shortages, making maca unaffordable to locals (Neuman, 2014; Collyns, 2015). Consequently, many trade contracts between Peru and importing countries were cancelled (Maher and Kozak, 2014). Nevertheless, with increasing maca production in China in recent years, commodity prices have tumbled and the market boom has come to an end. As a result, maca farming in Peru is no longer as profitable as it used to be.

Currently, the American continent represents about 42% of the global maca consumption. Going forward, maca production faces a slow but stable upward trend, with a projected annual revenue growth of 1% from 2017 to 2023. As of 2017, the global market for maca extract was estimated to generate $56 million in revenue and is expected to grow to $59 million by 2023 (SBWire, 2018).

Conclusion

The proliferation of the three superfoods (açaí, chia seeds, and maca root) in global markets has encouraged a boom for Latin American producers and exporters. As consumers in the United States and other large developed countries have become more health conscious, effective marketing of these superfoods has led to sharp increases in demand and large price premiums. Despite a lack of empirical evidence to

support many of the health benefits these superfoods are touted for, consumer perception has seldom wavered. Consumers rely on the three superfoods not only for general wellness but also to treat a number of medical conditions such as heart disease, obesity, and infertility. While this presents a tremendous opportunity for Latin American farmers, they also face increasing competition from other countries encroaching into these markets. Whether Latin American countries are able to retain their competitive advantage in the production of açaí, chia seeds, and maca root depends on a number of macroeconomic factors such as mutually beneficial trade agreements, support from governments, well-functioning supply chains, and economic stability.

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