



The industrialization of potatoes and the socioeconomic development of family farming in Lima, Peru

La industrialización de la papa y el desarrollo socioeconómico de la agricultura familiar en Lima, Perú

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Abstract

Objectives: To analyze the factors that influence the industrialization of the potato and its role as an innovation for the socioeconomic development of small family farming in Lima, Peru. *Methodology:* This study is based on different information sources from public organizations in Peru to show that the industrialization of potatoes in Lima, Peru contributes to the socioeconomic development of family farming. On this basis, recommendations are made for a business model through cooperatives oriented mainly to family farming. *Results:* The determining factors that influence the industrialization of potatoes in Lima are, the use of certified seed and varieties suitable for processing, compliance with good agricultural practices in potato farms and the permissible limits of presence of agrochemicals in the tuber, the adaptation to the normative framework of DL 1062 Food Safety Law, allowing to enter a market that demands food with sanitary guarantee, which can be achieved through a cooperative organization of farmers. *Conclusions:* The industrialization of potatoes constitutes a business opportunity to increase the supply of processed potatoes through cooperatives, generating added value for small fresh potato producers in Lima.

Keywords: Processed potato, innovation, development, agricultural cooperatives, family farming

Resumen

Objetivos: Analizar los factores que influyen en la industrialización de la papa y su rol como innovación para el desarrollo socioeconómico de la pequeña agricultura familiar en Lima, Perú. *Metodología:* Este estudio se basa en diferentes fuentes informativas de los organismos públicos del Perú para demostrar que la industrialización de la papa en Lima, Perú contribuye con el desarrollo socioeconómico de la agricultura familiar. Sobre esta base se formulan recomendaciones de un modelo de negocio a través de cooperativas orientado principalmente a la agricultura familiar. *Resultados:* Los factores determinantes que influyen en la industrialización de la papa en Lima son, el uso de semilla certificada y de variedades adecuadas para procesamiento, el cumplimiento de las buenas prácticas agrícolas en las parcelas de papa y de los límites permisibles de presencia de agroquímicos en el tubérculo, la adecuación al marco normativo del DL 1062 Ley de inocuidad de alimentos, permitiendo incursionar en un mercado que demanda alimentos con garantía sanitaria, lo cual puede lograrse mediante una organización cooperativa de agricultores. *Conclusiones:* La industrialización de la papa constituye una oportunidad de negocio para incrementar la oferta de papa procesada a través de cooperativas, generando valor agregado para los pequeños productores de papa fresca en Lima.

Palabras clave: Papa procesada, innovación, desarrollo, cooperativas agrarias, agricultura familiar

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Introducción

Potatoes are the third most important food crop in the world, in terms of human consumption. Peru is the center of the origin and domestication of the potato, where more than 3 500 varieties of potatoes have been developed between native and improved (de Haan et al., 2010). Potatoes are the main crop of family agriculture and play a significant role in family economies, basically in the mountains, where its cultivation involves more than 712 000 families, generating around 33 million wages according to the latest National Agricultural Census (Instituto Nacional de Estadística e Informática, 2013).

It is the second most important agricultural product in terms of value, after rice and the first in terms of volume, participating with 10.7% of the Gross Value of Agricultural Production (Instituto Nacional de Estadística e Informática, 2013).

One of the most important problems that negatively impacts potato industrialization is not having sanitary guarantees in potato production, the lack of suitable varieties for processing with good dry matter content and low in reducing sugars, due to access to quality seeds, seasonality of production, differences in productivity per hectare in the regions and the reduced number of processing plants equipped for the industrialization of potatoes (Arcos et al., 2020).

Within this perspective, it is considered that the added value through the industrialization of fresh potatoes constitutes a business opportunity for the associated producers in agricultural cooperatives, generating socioeconomic development for the members and their environment through commercialization in the market. national and foreign. The potato has decisively contributed to the Peruvian gastronomic boom, being the main ingredient of a great diversity of regional stews of growing acceptance and national and international recognition (Ordinola et al., 2017).

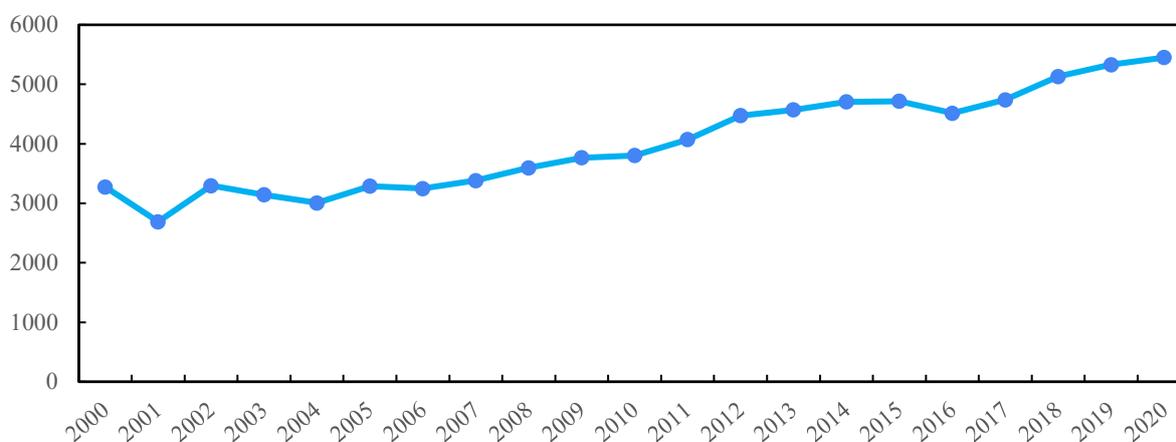
The objective of the work was to analyze the factors that influence the industrialization of potatoes, as an important innovation for the socioeconomic development of small family farming in Lima.

The growth of the supply of potatoes in Peru

The fresh potato production in 2019 was 5.3 million tons, showing a sustained growth, in the period 2000-2019, with an annual average increase rate of 2.6%; although in a shorter period, such as, for example, between 2011-2019, the dynamism of production growth accelerates at an annual average rate of 3.4%, as can be seen in Figure 1 (Ministerio de Agricultura y Riego, 2020). Currently Peru is the first potato producer in Latin America, a fact that has been maintained since 2008 (Food and Agriculture Organization, 2008; Moscoso & Oré, 2020).

Figure 1

Evolution of fresh potato production in Peru, 2000-2020 (per 1000 t)



Source: Ministerio de Agricultura y Riego (2020).

In Peru, potatoes can be produced all year round, most of the production is obtained in dry land and in the country's highlands, so its cultivation depends on the rains (Ordinola et al., 2017). The white potato harvest on the coast takes place from August to January; Currently in Majes, Arequipa it is harvested in February and March, allowing availability of the tuber to supply potato processing plants throughout the year; the current demand is for varieties with industrial aptitude, according to market demands. Until now, comparative advantages and potato agribusiness have not been taken advantage of in Peru, and we are among the least developed in Latin America, since less than 7% of national production is processed (Table 1).

Table 1
Production and use of potatoes in Peru (2019)

| Potato use | Volume, t | Percentage |
|-------------------|-----------|------------|
| Fresh consumption | 3 580 000 | 67.29 |
| Losses | 780 000 | 14.66 |
| Seeds | 594 000 | 11.17 |
| Processing | 365 300 | 6.87 |
| Export | 650 | 0.01 |
| Total | 5 319 950 | 100 |

Source: Ministerio de Agricultura y Riego (2020).

Potato processing began in Peru 700 years ago with the “tunta” or “moraya” products in the southern area of Peru, later “tocosh”, and dried potato, has been processed, with Puno being the department with the highest “tunta” production (Fonseca et al., 2011). With the appearance of grilled chicken restaurants in the 1950 decade, the processing of chopped potato into strips, both white and native, began, then the yellow potato puree for export. In recent years, the processing of colored pulp native potato chips began, then vodka and currently, native potato-based medicinal alcohol (Montero & Pino, 2020). The potato for frying, however, occupies the first place with more than 330 000 t per year (Table 2).

Imported processed potato

The importation of fresh potatoes is prohibited, in order to prevent the entry of phytosanitary diseases that can affect the national

Table 2
Potato processing in Peru (2019)

| Industrial use | Volume, t |
|---------------------|-----------|
| Potato for frying | 330 000 |
| Tunta | 20 000 |
| Dry potato | 10 000 |
| Potato (tocosh) | 5 000 |
| Flakes (chips) | 200 |
| Others ¹ | 100 |
| Total | 365 300 |

¹ Vodka, alcohol and derivatives.

Source: Ministerio de Agricultura y Riego (2020).

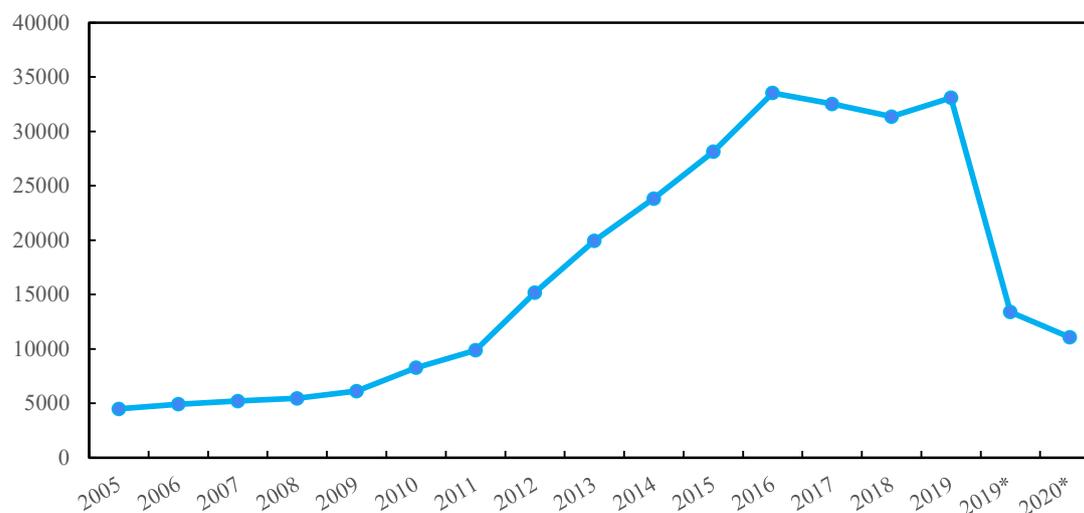
cultivation. However, processed or transformed potatoes are imported (Table 3). The comparative advantage that Peru has is the production of multiple varieties of potato, and that production can be carried out throughout the year, which allows raw material to be available continuously (Shimizu & Scott, 2016). Likewise, the increase in production has allowed Peru to produce 5.3 million tons in 2019.

The strong growth in demand for processed potato products (chips, potato chips) in North America, in certain European countries and also in certain parts of developing countries (Scott et al., 2001) has helped to drive the industrialization process of potatoes in Peru.

As of 2011, imports of processed potatoes have increased rapidly (Figure 2), as fast food chains in the country are expanding and incorporating some chains of grilled chicken of national origin, which has as input the fried potato. For this reason, restaurant chains and chicken shops use imported frozen pre-fried potatoes, because they can be refrigerated for 6 months to be fried at any time.

The varieties used to produce peeled and cut potatoes by the processors have been the white varieties for their relatively low cost, the most regular shape in the tuber and superficial eyes, in addition to the white color of the pulp. This combination of characteristics results in a final product that is produced with less waste, similar to imported potato chips due to its size and color, at a more affordable price (Scott & Ocampo, 2013).

Figure 2
Import of frozen pre-fried potato in Peru (t)



Source: Ministerio de Agricultura y Riego (2020). * January-April.

Table 3
Import of processed potato in Peru (2014-2019)

| Type of processed potato | Volume per year (t) | | | | | |
|--|---------------------|-----------|-----------|-----------|-----------|-----------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
| Potato starch | 15 295.57 | 20 963.91 | 15 854.62 | 20 447.80 | 23 936.50 | 18 697.25 |
| Prepared or frozen preserved | 1 184.07 | 28 130.60 | 33 522.75 | 32 521.89 | 31 351.93 | 33 080.08 |
| Prepared or conserved without freezing | 797.43 | 816.71 | 755.46 | 838.21 | 910.58 | 899.06 |
| Frozen potatoes | 0.05 | 0.01 | 6.79 | 11.52 | 16.75 | 19.22 |
| Potato flakes | 875.19 | 623.25 | 673.66 | 809.60 | 678.76 | 849.71 |
| Total | 18 152.30 | 50 534.48 | 50 813.27 | 54 629.03 | 56 894.52 | 53 545.31 |

Source: Ministerio de Agricultura y Riego (2020).

The restaurants and grilled chicken shops that use imported processed potatoes are those oriented to economic sectors of level A and B. In 2013 imports were registered for a volume of 20 000 tons, by 2015 it rose to 28 000 t and in 2016 it registered the higher peak with 33 500 t of frozen pre-fried potato (Table 3). One of the most important forms of import is frozen pre-fried potatoes, under the tariff heading 20.04.10.00.00 to which a duty is applied tariff of 6% Ad Valorem CIF.

Destination of processed potatoes and restaurant chains in Peru

An increasing consumption of French fries has been observed since 1990 with the multiplication

of fast food outlets in urban areas of the Andean region (Devaux et al., 2010). The appearance of a series of international fast food companies, are consolidating in the country under franchise contracts, Kentucky Fried Chicken, Burger King, McDonald's, among others as well as a series of national restaurant chains, whose requirements for operating in the country is conditional on the use of original inputs from the company's parent company, with certain characteristics in size, weight, quality, and color, which, if not complied with, can lead to the suspension of purchase contracts. The increase in the demand for processed potatoes is due to various factors, confirming that the most important phenomenon in the demand for processed potato foods is

due to the change in consumption patterns of consumers in Latin America (Scott et al., 2001). One of these inputs is the frying potato, which must be prefried and frozen, in order to facilitate its transport and handling over time (Moscoso & Oré, 2020).

Table 4
Origin of potato imports in Peru, by country (2019)

| Country | Volume, t | Percentage |
|-----------------|-----------|------------|
| Total | 33 080.08 | 100.00 |
| Holland | 23 290.16 | 70.41 |
| Belgium | 2 648.82 | 8.01 |
| Argentina | 805.98 | 2.44 |
| USA | 1 701.18 | 5.14 |
| Canada | 1 128.34 | 3.41 |
| Other countries | | 10.59 |

Source: Ministerio de Agricultura y Riego (2020).

Business Model through Agricultural Cooperatives

The objective of the agricultural cooperatives is to improve the quality of life of the members and their environment through the commercialization in the national and foreign market of various fresh and industrialized agricultural and livestock products, based on principles of good agricultural practices in harmony with the environment. Matos et al. (2019) consider that an agricultural cooperative develops an inclusive business when it is fulfilled that, there is a link between small producers in a value chain, economic and social value is created for the people involved, it is generated by the small producers' own initiative, by an actor in the production chain and/or by established regulations.

The Lima and Ica regions produce around 30% of all annual potato shipments to Lima; thanks to the varied ecological conditions that exist in Peru, fresh potatoes are harvested throughout the year and in the case of the Coast, all the production is of improved white potatoes

(Shimizu & Scott, 2016). With the exception of the annual importation of some 30 000 t of frozen pre fried potato, almost all of the potato for human consumption in Peru is of national production (Scott & Ocampo, 2013).

Peru currently does not guarantee the production of fresh white potatoes in the coastal region, with permissible limits for agrochemicals, due to the absence of sanitary controls for the production of an innocuous potato. The results of Velasco et al. (2019) show that the most important losses occur in the production stage and that the most frequent occur due to inadequate crop management practices. Potato-producing farms in the Lima region show weak economic sustainability, implying that this could constitute a threat to sustainable potato production on the central coast (Contreras et al., 2018). It should also be considered, on the other hand, that the Andean region does not have enough processing plants and industrial machinery for the transformation of potatoes on a large scale. There are few formal companies dedicated to processing on an industrial scale: one in Ecuador, six in Peru, two in Bolivia (Devaux et al., 2010). In this case, imported equipment makes it possible to compete in the international market, with Peru being the first producer of fresh potatoes in Latin America, although with the advantage of Argentina, Colombia and Chile in the industrialization of potatoes.

In relation to the above and due to the extensive cultivated area in Peru, we have sufficient capacity to industrialize potatoes, but it is necessary to organize the supply through cooperatives, generating "field schools" to promote good agricultural practices such as the use of varieties suitable for processing and certified tuber-seed, respecting the permissible limits of agrochemicals in the tuber, by complying with good agricultural practices for industrialization, which demands food with sanitary guarantee. In this way, the internal demand for processed potato from supermarket chains, restaurants and grilled chicken restaurants would be met, with the possibility of entering the international market, promoting agricultural development through the creation of productive employment, increasing the income of small agriculture and poverty reduction, notably favoring social

inclusion.

Generating new varieties of potato for the industry implies that research and development have to go hand in hand (Gutiérrez-Rosales et al., 2007), to obtain effective impacts at the level of small farmers associated through agricultural cooperatives, promoting that the partners participate in competitive funds for the installation of primary processing plants with industrial equipment for pre-fried potatoes, potato chips and baked potatoes, for the various preferences of the population segment by age groups. The potato production chain has supply capacity due to favorable genetic biodiversity, optimal climate conditions to promote the revaluation of the peruvian potato, allowing diversification and fusion in the international food restaurants that exist in Peru.

Conclusions

Within the exposed analysis, imports of frozen pre-fried potatoes are oriented to a market niche, basically fast food chains. Carrying out a food business under the terms of an agricultural cooperative requires a health guarantee and certain requirements to comply with all contractual protocols and conditions, such as fast food establishments. Public and private institutions have contributed in the last five years to raise the concept of the potato, both in its valuation and in its dissemination and consumption.

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