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Value-chain configuration and socio-economic performance into fruit networks: an outlook on long-run insights

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ABSTRACT

The diversification of agri-food products through emerging chains has a fundamental economic role in Ecuador. Socio-economic and productive factors are still affecting their progress and performance. Also, the current growth of market opportunities at the local and international level is a driver to support them. Therefore, this study aimed to analyze social and production aspects to understand the dynamic across the Peruvian groundcherry (*Physalis peruviana*) chain stages. The goal was to introduce the chain dimensioning to contribute with relevant insights. We performed the research applying a framework that accounts with chain configuration and descriptive tools. The boundaries clustered pre-production, production and post-production actors. We executed surveys at the supply chain levels to identify strengths and weaknesses based on specific socio-economic and productive variables. The paper points out that diversification of marketing channels and the strengthening of organizational structures are the main long-term strategies to reinforce the Peruvian groundcherry chain. The main contribution is the application of the chain configuration as a tool to assess food chain performance comprehensively.

Keywords: Peruvian groundcherry, dimensioning, performance, associative structures, rural extension.

RESUMEN

*La diversificación de los productos agroalimentarios a través de las cadenas emergentes tiene un papel económico fundamental en el Ecuador. Los factores socioeconómicos y productivos siguen afectando su progreso y desempeño. Además, el crecimiento actual de las oportunidades de mercado a nivel local e internacional es un motor para apoyarlas. Por lo tanto, este estudio tuvo como objetivo analizar los aspectos sociales y de producción para comprender la dinámica de la cadena de la guayaba (*Physalis peruviana*) a través de sus etapas. El objetivo fue introducir el dimensionamiento de la cadena para contribuir con ideas relevantes. Realizamos la investigación aplicando un marco que considera la configuración de la cadena y herramientas descriptivas. Fronteras establecidas para el estudio agrupó a los actores de la preproducción, producción y posproducción. Realizamos encuestas en los niveles establecidos para identificar fortalezas y debilidades basadas en variables socioeconómicas y productivas específicas. Los resultados señalan que*

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la diversificación de los canales de comercialización y el fortalecimiento de las estructuras organizativas son las principales estrategias a largo plazo para reforzar la cadena de guchuva. La contribución principal fue la aplicación de la configuración de la cadena como una herramienta para evaluar el rendimiento de la cadena alimentaria de manera integral.

Palabras clave: guchuva, dimensionamiento, desempeño, estructuras asociativas, extensión rural.

INTRODUCTION

In the last decade, the growth of exports of crops has been significant in Latin American countries (Franko, 2018). These exports are mainly fresh products such as flowers, fruits, vegetables, and cereals (Central Bank of Ecuador, 2016). This trade activity has increased because of the growing demand for developed countries (Streeten, 2016; Reardon, 2015). This aspect evidences demand changes towards healthy diets where consumers look for nutritious food (Augustin *et al.*, 2016). Currently, most of the Latin American countries have implemented policies promoting fruit and vegetable exporting crops (Furtado, 2018). The Inter-American Development Bank – IDB, has played a role as a key partner in generating foreign trade and creating new sources of employment (IDB, 2018). However, medium and long-term adjustments will determine the economic positioning of this sector over time (Rosero, 2010; Delgado *et al.*, 2015; Franco-Ángel and Urbano, 2016).

Previous research has pointed out some socio-economic and marketing issues of the fruit and vegetable sector (Phukan *et al.*, 2017). The consequences of agro-exports growth, the high dependency on industrial fertilization (Capa and Rouse, 2015; Viteri, 2018), are examples of such issues (Martinez-Valle, 2017). Furthermore, the persistence of minimal profit margins for farmers (Thiele *et al.*, 2011; Useche and Blare, 2013), and the vulnerability of peasant families (Alvarado and Rebaï, 2018; Hallam *et al.*, 2004; Barrera-Mosquera *et al.*, 2010; Barrera *et al.*, 2005) are concerns evidenced. Researchers claim that food chains who fail to adopt long-term strategies tend to suffer a severe downturn and to impact negatively on social well-being (Sands and Ferraro, 2010; Sellaheva and Martindale, 2010).

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The progress of Ecuadorian agri-food chains can also suffer from the absence of appropriate governance mechanisms (Notarnicola *et al.*, 2012; Romero and Wollni, 2019). Such issues are mainly related to the market power imposed by large companies in the supply chains (Ruiz, 2018), the coordination level between actors, and the way of how are distributed the costs and benefits between the supply chain stages (Romero and Wollni, 2019; OEC, 2017; Central Bank of Ecuador, 2018; Ministry of Agriculture of Ecuador, 2014). Therefore, these aspects should also be considered when assessing the performance of fruit and vegetable supply chains (Vega-Quezada *et al.*, 2017).

The Peruvian groundcherry network is an emerging chain located in the Highland region, which is characterized by the expansion of production units (Senplades, 2015). This chain employs around 2000 of rural workers who participate in activities such as soil-conditioning, transportation, and transformation of raw material (Romero and Wollni, 2018). Also, 98% of firms involved are SMEs (Sarango-Lalangui *et al.*, 2018) which look for an opportunity for a superior market positioning. This paper presents an attempt to evaluate the socio-economic and productive performance of Peruvian groundcherry chain through the dynamic of its primary and support activities, and horizontal and vertical configuration. Research conducted for this study shows that the task of capturing the characteristics of the existing Peruvian groundcherry chain and its impacts brings methodological challenges and also interesting insights that could be applied as long-term strategies.

MATERIALS AND METHODS

We collected the data in the inter-Andean zone composed by Cotopaxi, Tungurahua and Chimborazo provinces. Peruvian groundcherry chain has had attention from different sectors, because of its farming structure, inequality in irrigation water, loss of moors, and instability of market prices. We applied a methodology that involved socio-economic, production, exporting and rural policy aspects. Also, we highlighted the structuring mechanisms at the horizontal and vertical level, as explained below:

Food chain mapping. We applied the value chain scheme developed by Hawkes & Ruel (2010) to determine the groups of actors and relevant activities. Also, we identified the flows of less and greater importance, that is to say, the route followed by Peruvian groundcherry production and flows of supporting resources.

Identification of value chain actors. We use the information from the last census (2015) conducted by the Ministry of Agriculture (MAG). Also, we analyze the post-production actors using the record of SMEs and large companies submitted by the Ministry of Industries and Productivity (MIPRO).

Sample size description. We estimated the sample size of producers using the continuous variable “number of producers registered by MAG” within the area mentioned above. We applied the Sukhatme formula (Sukhatme, 1957) at the 95% confidence. The sample of producers was composed by 41, 53, and 45 producers from Cotopaxi, Tungurahua, and Chimborazo respectively. We used a report published by MIPRO that includes companies linked to the Peruvian groundcherry chain to analyze the post-production stage.

Descriptive analysis. We conducted interviews and surveys validated by Cronbach’s alpha. Firstly, we executed a workshop with stakeholders to select performance variables from a predetermined list. The list had production and socio-economic variables. Also, we considered export and rural policy implications. Afterwards, we performed an analysis using statistical descriptive tools.

Scanning of the configuration. We applied the measuring outline published by Gereffi and Fernandez-Stark (2016) to identify the horizontal and vertical configuration of the Peruvian groundcherry agri-food chain.

RESULTS AND DISCUSSION

Food chain mapping

The starting point of Peruvian groundcherry chain consists of support activities (figure 1). Agrocalidad and Iniap are the institutions that carry out 60% of operations of this stage. Examples of those operations are the supply of fertilizer subsidies, the sharing of technical information through

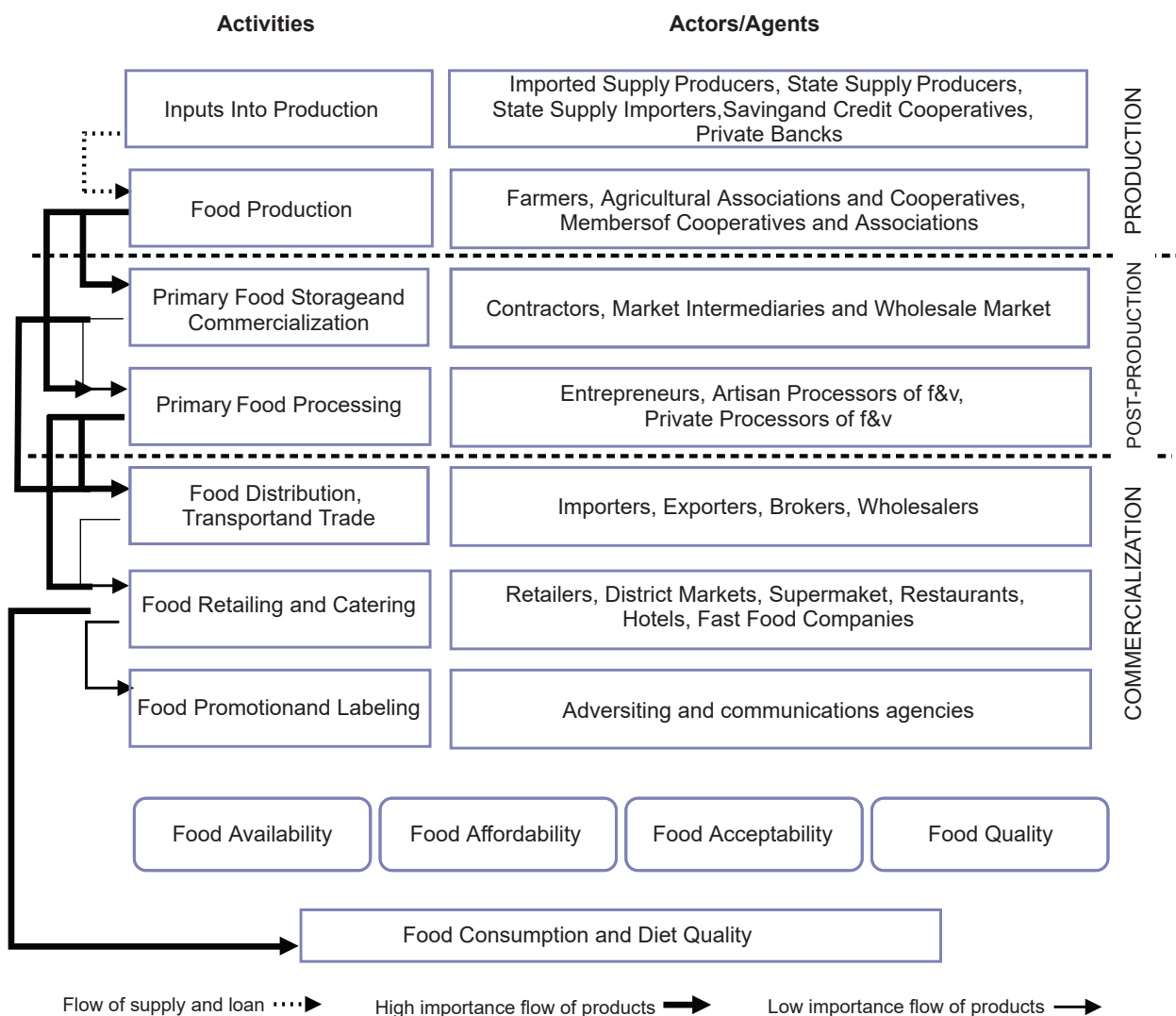


Figure 1. Agents, activities and flows identified in the Peruvian groundcherry agri-food chain.

conferences, and the observation of Good Agricultural Practices. Also, we observed that 75% of public and private financing entities support the production and post-production activities through funding programs to SMEs, entrepreneurs and peasant producers.

Furthermore, we observed that the production stage includes individual producers, private associations and farming firms. These actors start with the high-value flows (raw material). Then, they deliver the production flows to intermediaries, middlemen within the commercialization centers at the local and district level. Examples of those commercialization centers are wholesale outlets located at Ambato and Riobamba cities. The next observation was that private processors and startups transform the raw material into goods with high value-added using general machinery and technology. More than 50% of processed Peruvian groundcherry belongs to the canning and dried categories. Processing actors also trade their business portfolio to retailers, which constitutes a highly significant marketing flow because of the potential opportunity to consolidate brands and firm reputation.

Moreover, the observations point out that actors involved in the commercialization stage were importers, exporters, retailers, and advertising agencies, among others — for instance, Corporación La Favorita S.A. and Corporación El Rosado S.A. are retailers with high national participation in the Peruvian groundcherry chain. Likewise, we noticed that the chain needs further support to extend its involvement overseas. This

general overview will be more detailed in the descriptive analysis section through the outline of each chain level.

Identification of value chain actors

Information reported by MAG (2016) points out that 0.95% of fruit and vegetable producers are involved in the Peruvian groundcherry production within the central zone (table 1) (Ruiz-Cedeño, 2016). The province with the largest Peruvian groundcherry production surface is Tungurahua.

Information of Senplades (2017) showed that 7112 firms participate in the industrial sector of the mentioned zone (table 2). Tungurahua has 52.53 % of firms, Chimborazo accounts with 25.73%, whereas Cotopaxi presents 21.73%. Also, we noticed that 4.51% of firms process fruits and vegetables, and 0.75% transform Peruvian groundcherry into goods with value-added.

Descriptive analysis

Pre-production stage

The results point out that national government prioritizes the strengthening of peasant family farming. The strategies applied are the development of rural economy, the redistribution of production facilities such as seeds, training, irrigation systems, and the launching of agro-technological programs (Houtart, 2014; Santacoloma-Varón, 2015).

Quantity	Province		
	Cotopaxi	Tungurahua	Chimborazo
Agricultural producers	183,530	170,220	248,130
Fruit and vegetable producers	44,010	36,660	69,152
Peruvian groundcherry producers	129	189	153
Area of Peruvian groundcherry (ha)	259.69	329.09	274.52

Table 1. Peruvian groundcherry producers and area of Peruvian groundcherry production by province.

Source: Ministry of Agriculture - MAG (2016).

	Cotopaxi	Province	
		Tungurahua	Chimborazo
Type of firm	Microenterprises	1397	3194
	Small businesses	84	357
	Medium-sized enterprises	16	61
	Large firms	5	18
Fruit and vegetable processing firms		54	176
Peruvian groundcherry processing firms		15	27

Table 2. Participating companies in the industrial sector and Peruvian groundcherry chain within Cotopaxi, Tungurahua and Chimborazo provinces.

Source: National Secretariat of Development -Senplades (2017).

Besides, public entities administered by the Ministry of Agriculture, are responsible for transferring knowledge on production techniques to producers and provide agricultural inputs such as fertilizers, organic matter, and treated seeds. Also, public universities such as the Technical University of Ambato and University of the Armed Forces, lead programs aimed to improve production performance, plant genetics, and processing technology. Such programs are about the efficiency of land and water use, the enhancement of packaging materials and designs, additives usage, and marketing performance (Hernandez and Bustillos, 2016; Rodríguez Moreno, 2018; Mutebi Kalibwani *et al.*, 2018).

Production stage

Socio-economic findings. We determined that producers are between 29 and 52 years old. Most of them are men (58%), the prevalent education level is the secondary (39%), and 27% of respondents have finished the bachelor. Also, 37% of producers are cooperative partners, and 30% are association members. Furthermore, 58% of producers finance the production through their savings, and 38% are subject to bank debts (table 3).

Moreover, during the interviews, we noticed that indeed farmers with a bachelor are pending of business contract stability with buyers, and the aspect of fair selling prices. The training and academic preparation of these farmers allow them to negotiate with downward actors effectively. However, not all of them are willing to adopt specific strategies such as the merge of Peruvian groundcherry producer to establish a market orientation association aimed to expand volumes of Peruvian groundcherry.

Production findings. Most of the producers (60%) consider the growing demand of Peruvian groundcherry at the local and international level as the primary driver to expand crops. The current worldwide trade opportunity is an immersive interest for those who are growing Peruvian groundcherries. The most promising segments are European markets. However, the results also pointed out that 55%

of respondents have more than 3 ha of land, but the Peruvian groundcherry crops cover just between 0.1 and 1.4 ha on average. The supply of Peruvian groundcherry also is motivated because of the high fragmentation of traditional markets such as potato, maize, and onion. However, we determined a production stage with limited downward coordination, 42% of the producers own land with high diversification of crops, 56% produce by conventional methods, and just 31% operate through partnerships.

In the production stage also we determined a low density of Colombian and Kenyan Peruvian groundcherry genotypes unlike the situation of Peruvian crops (figure 2). The phytopathological affections and lack of adaption were the main reasons (Galvis *et al.*, 2015). The Ecuadorian genotype is by far the most common in production units. According to Brito (2015) and Carrillo-Perdomo *et al.*, (2015) in Ecuador, there are approximately 20 varieties of Peruvian groundcherries with the potential to be commercial crops. Further, we could notice that color, size, and shape are attributes employed to differentiate commercial varieties from non-commercial ones.

The persistence of knowledge gaps related to the management of Peruvian groundcherry varieties in a proper way is still a challenge for producers. Iniap (2016) reported that unfortunately there had been a downturn of plan breeding of Peruvian groundcherry varieties. The expansion of Peruvian groundcherry crops have been affected and thus farming families of this chain. Therefore, we observed a relevant fail of the National Plan of Agricultural Support 2013-2017. This policy considers small producers as a priority, and it was designed to facilitate the accessibility of farmers to agronomic assets (Brito, 2015). However, we believe that a monitoring plan should be implemented to reinforce the law applying.

Based on our observations we determined 12.9 t/ha of Peruvian groundcherry yields on average (figure 3). Our reference is Colombia as the current leader in Peruvian groundcherry production. We compared our result with the one reported by Carrillo-Perdomo *et al.*, (2015) and Fischer

	Maximum	Mean	Std. Deviation	Range
Age	52	45	5	29Y-35Y=0, 36Y-40Y=1, 48Y-48Y=2, More than 52Y=3
Cooperative partners	1	0.88	0.329	Yes = 1, No = 0
Association member	1	0.79	0.409	Yes = 1, No = 0
Gender	1	0.82	0.387	F = 1, M = 0
Education level	3	1.55	0.645	School=0, HighSchool= 1, University= 2
Income level (USD)	2	1	0.816	Less than 700/month=0, 701 to 1700= 1, More than 1700= 2

Table 3. Description of socio-economic variables analyzed in the producers sample.

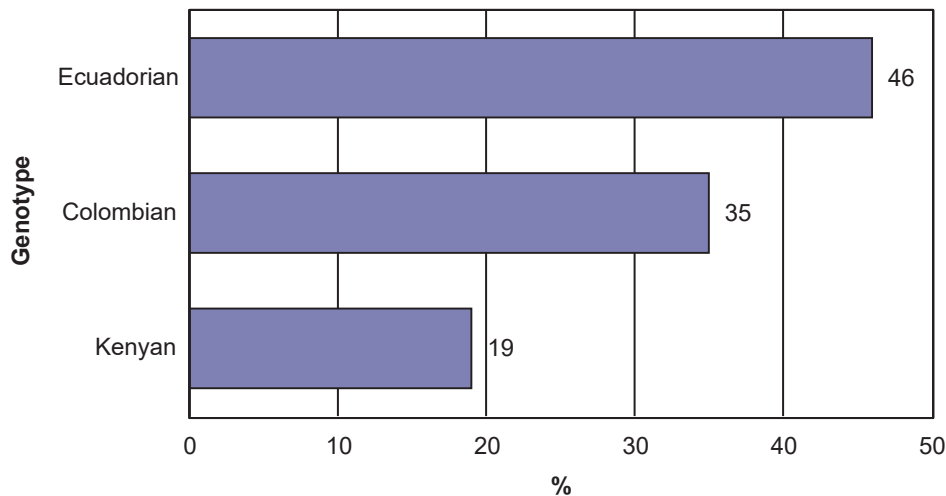


Figure 2. Percentage observed of Peruvian groundcherry genotypes grown in Ecuador.

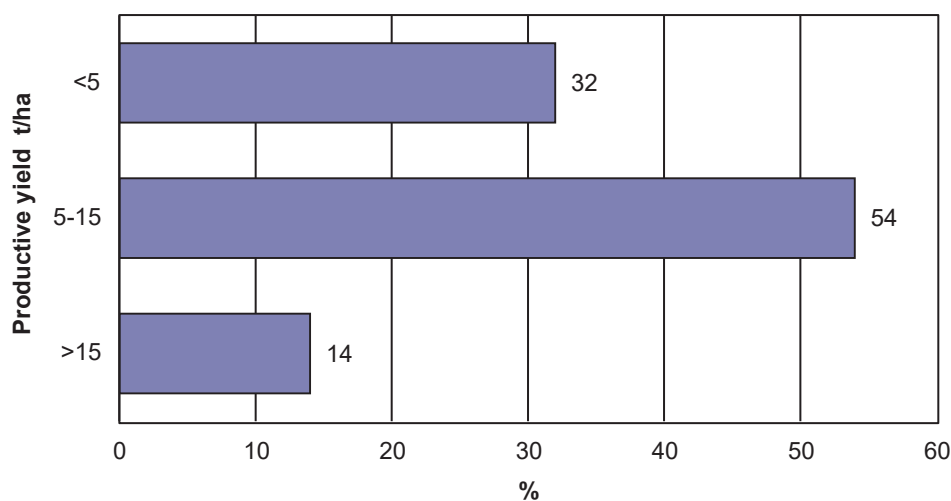


Figure 3. Productive yield (t/ha) determined in the Peruvian groundcherry agri-food chain.

et al., (2014), who stated 14.5 ton/ha of Peruvian groundcherry yields in Colombia. Thus the production systems and infrastructure of both countries are very similar and competitive each other. Another important aspect worth noting is the yield variation depending on the production system. In open field, yields range between 10 and 13 t/ha, whereas greenhouse systems yields between 15 and 25 t/ha. Therefore, this result indicates that presumably, the most significant challenges are after the production. For example, we observed that just 35% of Peruvian groundcherry producers employ post-harvest mechanisms to reduce losses.

Performance findings. We determined a gross farming profit of USD 11,500/year (± 150 USD/year). Also, the net income of farmers was USD 6,600/ha/year (± 50 USD/year).

We compared the results with those reported by Orjuela Castro *et al.*, (2017) who stated the Colombian gross profit between USD 5,000/ha/year and 8,000/ha/year during 2014 and 2015. According to Altamirano (2010), Peruvian groundcherry production is profitable and its IRR (internal rate of return on investment) ranges between 13 and 25%. For instance, MAG (2016) reported that the profitability of Peruvian groundcherry crops is of 18%. Also, it mentions that indeed the sum of fix and variable costs to produce one hectare of Peruvian groundcherry is USD 6000 in the initial year (Cordova, 2017). The predicted yields under good weather conditions are around 13000 kg/ha/year, and with a price of USD 1.00/kg, each hectare would generate a gross income of USD 13,000/year. Then subtracting the production cost would result in a gross profit of USD 7000/

year. Therefore, we determined a contribution margin of around USD 0.46/kg.

Post-production stage: processing firms

We start the analysis considering that doubtless, the production is competitively performing itself. Thus, we discuss the possibility of steering the potential long-term strategies to the post-production stages.

Economic findings. We observed that the Ministry of Production - MIPRO had recorded 56 companies operating in our chain. We determined that 53.73% of those firms work in Tungurahua, 24.64% in Cotopaxi and 21.63% in Chimborazo. Further, 98.43% are SMEs, and 1.57% are large firms. Also, 40.10% are raw material processors, whereas 60.90% combine the processing with marketing activities. The most common processed food categories were canned, dried and ready-to-eat ones. Besides, we found that 69.20% of firms work with retailers of Peruvian groundcherry goods and only 10.40% are exporting companies. It is important to highlight that the main foreign Peruvian groundcherry markets are those of the United States and the European Union (Monteros Guerrero, 2016; PROECUADOR, 2016; PROECUADOR, 2017). Thus, we observe the processing stage which is represented by SMEs needs support to improve their performance. Such support would be in aiding the diversification of their product portfolio. Also, the possibility of building links with public entities specialized in foreign trade logistics and market opportunities. However, we note gaps in the Ecuadorian Industrial Law 2016-2025 (MIPRO, 2016), which focuses on improving efficiency through the supply of energy, but it has neglected the market positioning of the small industry.

Logistic findings. We determined that 39.10 % of firms own transport facilities, whereas 60.90% outsource this service through local van and truck cooperatives. Also, we

observed that 89% of the firms depends on the deliveries of Peruvian groundcherry from producers; thus there is no competition between both stages. Besides, we noticed that 48% of suppliers are middlemen, and 52% are full-time farmers. An important aspect to highlight is public investment in roads during the last 10 years. The government objectives have also been aimed at improving productivity through functional road networks. However, we believe that the diversification of channels through short marketing circuits in the main cities can be more efficient in terms of logistics and therefore it will strengthen the market performance of small industry and producers.

Trading findings. 45% of processing firms consider trading price as the decisive factor during the purchasing process of Peruvian groundcherries (figure 4). Also, the respondents indicate that physical aspects such as yellow hue, hardness, consistency, physical skin damage, and weight are the most relevant quality criteria. Problems with low fruit quality drop the chance of negotiation to 49% probability. Moreover, we found that only 40% of the companies do not present difficulties to market fresh and canned Peruvian groundcherries. Additionally, 64% of company's production is channeled to local markets and 36% trade overseas.

In the case of processors as sellers, the situation is somewhat different. The 57% of processing firms point out that doubtless, the customer requirement is the crucial aspect during the selling process of their products portfolio (figure 5). The respondents also indicate some significant trends in customer preferences. Such preferences are innovative, functional, tasteful and sustainable products (figure 6).

The evolution of Peruvian groundcherry commercialization in fresh and processed formats has been remarkable. It has quickly spread through local and district markets. The intervention of SMEs, trading companies and exporters has been vital to this chain. However, considering its nature,

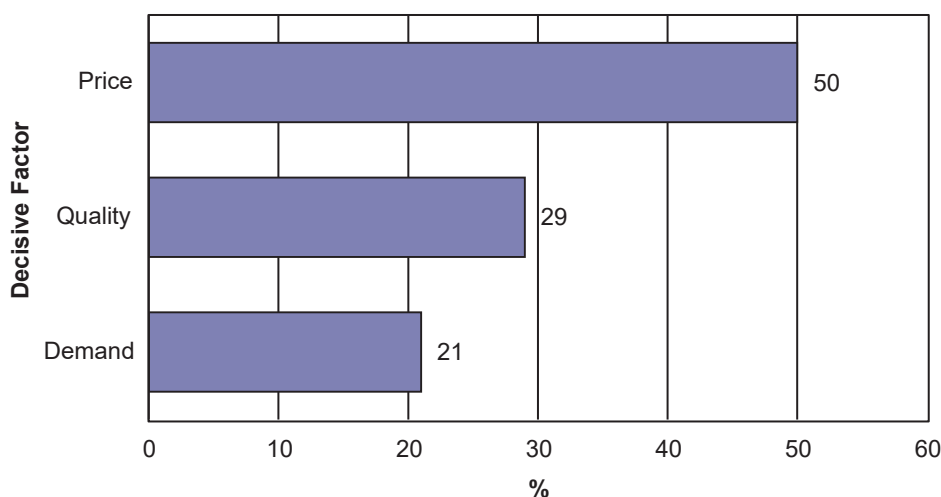


Figure 4. Influencing factors of Peruvian groundcherry in purchasing process by processors.

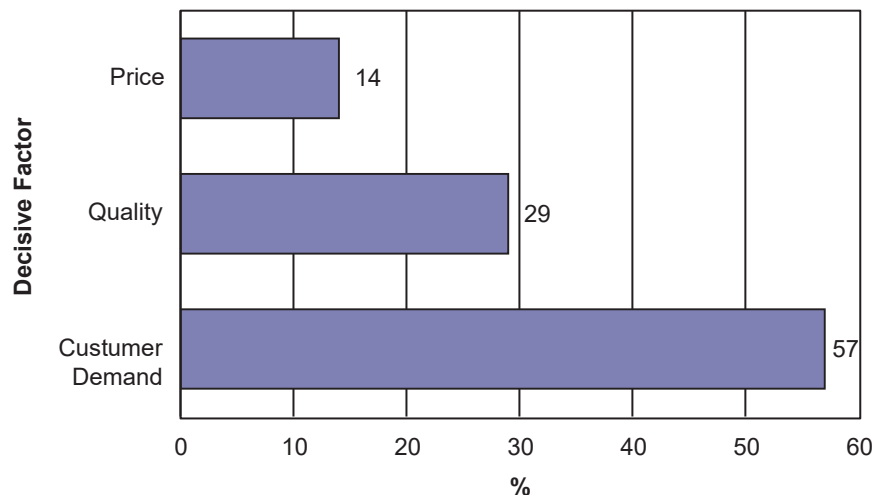


Figure 5. Influencing factors of Peruvian groundcherry in the selling process by processors.

Peruvian groundcherry chain needs mechanisms to coordinate the flow of goods efficiently by accounting social, economic and environmental aspects jointly. The following section explains the performance and role of formal distributors and their impact over the chain performance.

Post-production: distributors

Economic findings. We observed that the Ministry of Production - MIPRO had classified these actors as medium and large firms. Also, 65% of the finance activities are with their capital plus bank lending, while 35% use the stock exchange to involve new investors. Medium firms own a wealth between 5 and 10 million dollars, whereas large companies own between 70 and 100 million dollars. Also,

we observed that commonly corporations manage the food distribution businesses, and they are investing intensively to expand their marketing chains (MIPRO, 2016). Also, each distributor has developed a differentiation strategy against its competitors. Such approaches are a function of market barriers preventing the entry of foreign retailers and service philosophy. Also, the analysis revealed that 65% are Medium enterprises, whereas 35% are large companies. Also, 53% use after-sale service to be closer to the final consumer.

Logistic findings. We determined that 80% of firms own truck fleet, whereas 20% outsource this service through regional truck cooperatives. Also, we observed that 90% of firms depends on the deliveries of Peruvian groundcherry

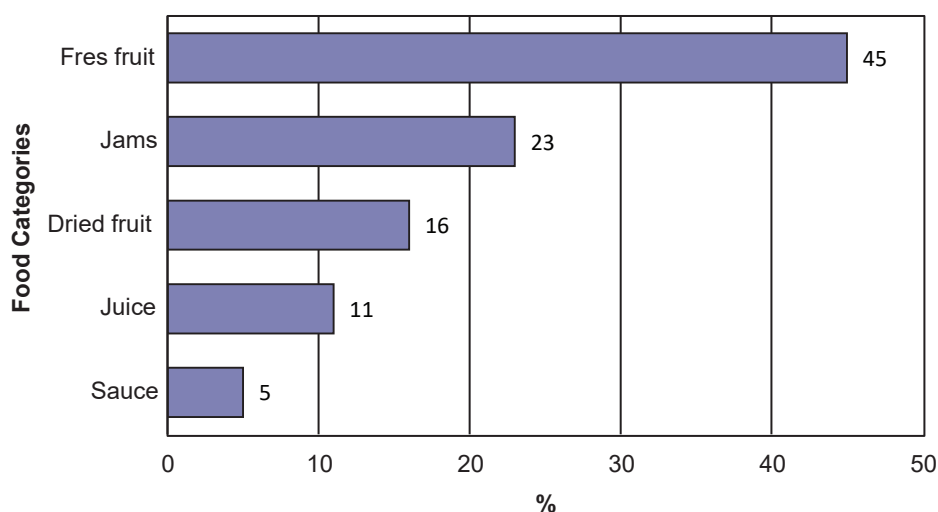


Figure 6. Categories observed of Peruvian groundcherry-based products preferred by consumers.

products from producers and processors. However, they have the fruit farming intention in long term perspective. Besides, we noticed that 78% of suppliers are SMEs, and 22% are full-time farmers. They have strict policies to negotiate directly with formal firms. However, they mentioned the existence of some procedures to avoid intermediaries that affect final consumer pricing.

Trading findings. Decisive factors in pricing Peruvian groundcherry products are the established strategies and the possibility of product portfolio expansion. Similarly, the pricing to final consumer depends on the profit margins predetermined by the board of directors. Also, we found that in supermarkets the price of fresh fruit ranges between USD 2.00 to 3.00/kg, whereas the processed one ranges between USD 6.00 to 9.00/kg, depending on the category. Furthermore, we observed that distributors are not interested in entering the upward stages at short and medium term.

According to the Market Power Control Agency - SCPM, the retailing structure in Ecuador is highly concentrated (figure 7). The HHI Index has presented values higher than 2.500 during the last 15 years. The government has invested resources and established protection policies in favor of small companies and producers. However, it is necessary to develop measures to help small actors to participate competitively and with greater efficiency.

Foreign trade

The Ministry of Foreign Trade is the public institution in charged to develop and apply trade and investment policies in Ecuador. This body is in charge of establishing synergies with institutions of neighboring countries to increase national companies participation in international markets. Additionally, it links public and private sectors, coordinates

foreign trade at the stage chain levels and provides guidelines for short, medium and long term commerce strategies (Espinoza *et al.*, 2016; Iizuka and Gebreyesus, 2017).

Since 2000, Peruvian groundcherry exports presented a growing trend of exporting volumes with a growth 13% per year on average. Exporter companies and SMEs have faced rigorous revisions because of the international markets regulations. Public authorities have worked on Good Agricultural Practices to increase competitiveness. However, more than 40% of exporters have faced losses at some point in the trading process. The main competitors of Ecuador are Colombia, Zimbabwe, Kenya, and Peru (Castro-González *et al.*, 2015).

Scanning of the configuration

Research on the configuration of agri-food chains has generated significant interest because of the possibility of reveal potential synergies. A relatively new stream of research examines the contribution of this approach to performance and sustainability (Magalhães Teixeira, 2016; Carlino *et al.*, 2017).

Horizontal configuration. The initial level is responsible for the provision of inputs. The second one receives more than 60% of the contributions from Level 1. We observed that the success of Peruvian groundcherry chain depends on the farmer capability to implement associative structures able to have a market orientation. Level 3 serves as intermediary between the production and processing stages. We determined that 36% of the production is channeled through this stage. Level 4 includes processors. The mainstream of products are canned and dried fruits. Level 5 is responsible for distribution to local or international markets, and consumers.

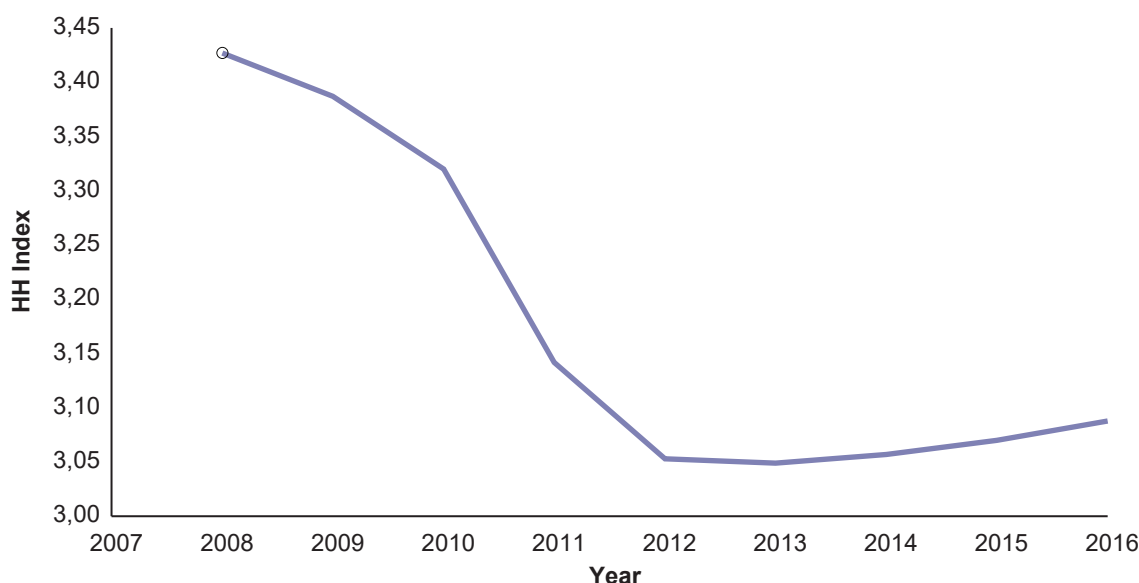


Figure 7. The behavior of HH Index of the retailing sector in Ecuador from 2008 to 2016.

Level 6 is responsible for retail delivery, food services and hotels. They have direct connections with consumers and have access to updated information on trends, as well as the consumer needs and requirements (figure 8).

Vertical configuration. We determined the degree of fragmentation and the distribution of bargaining power at each vertical. The fragmented level was the second which is composed of farmers, producers, associations and agricultural cooperatives, and its bargaining power is constrained. Levels corresponding to input suppliers, processors, intermediaries and distributors are small structures. The bargaining power of the mentioned levels is higher, also their capability to differentiate goods. These factors are significant when market competition takes place. According to Espinoza et al. (2016), the agribusiness approach puts peasant farming households at a disadvantage. Therefore considering this information we presented relevant insights to develop strategies aimed to improve the well-being of chain actors in a sustainably (figure 8).

CONCLUSION AND RECOMMENDATIONS

The main actor doubtless is the government which has as a priority the strengthening of peasant family farming. Therefore, the first strategy is to reinforce state companies to prove inputs and technical training through extension programs. The second potential strategy is the intervention of academic institutions to work on ensuring efficiency at

the production level through plant breeding, for instance. A third possible strategy is to organize producers in associations with market orientation, and so they will capture national and international market stable positioning. The market of fresh Peruvian groundcherries is further dynamic and profitable. Therefore, the information on vertical and horizontal potential synergies between actors will underpin the sector through a collaborative behavior.

Also, the research presented some limitations in portraying the performance of Peruvian groundcherry supply chain entirely. Therefore, we recommend incorporating new indicators to analyze profoundly even the environmental component. The insight is to bring forward strategies aimed at a circular economy model.

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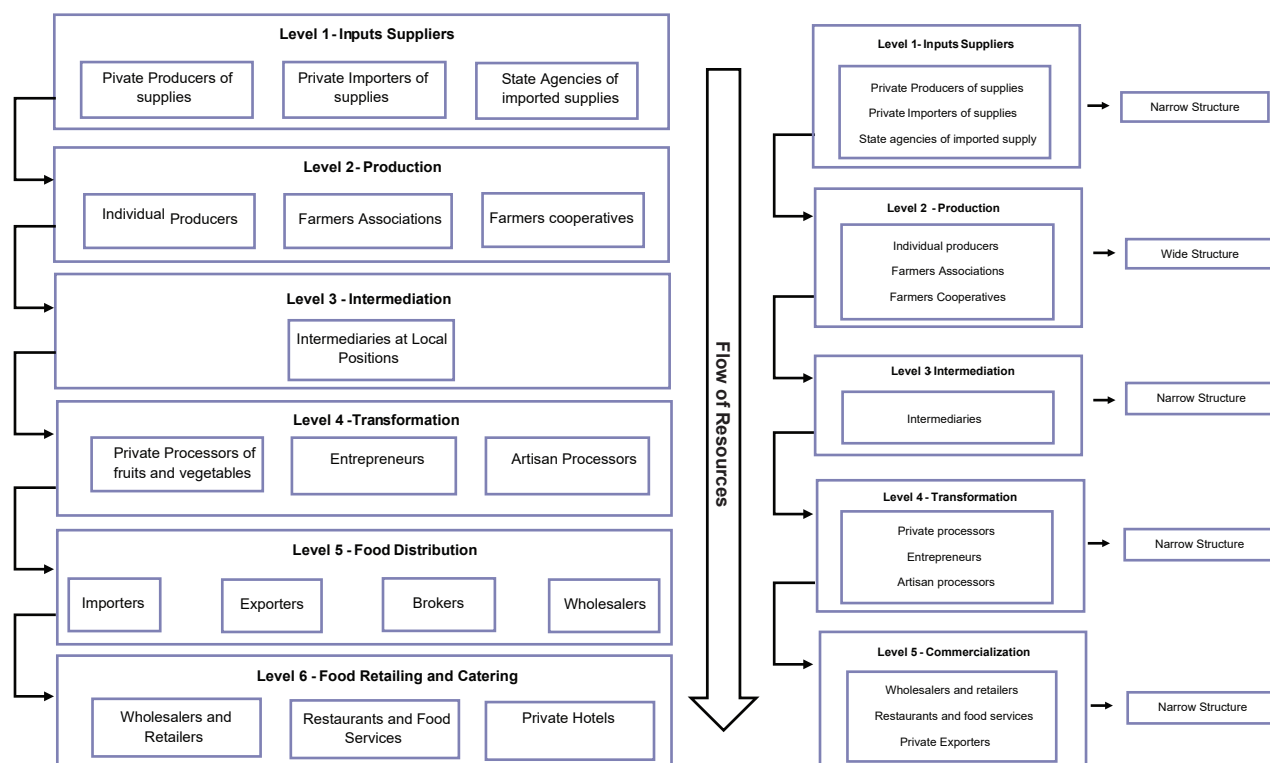


Figure 8. The horizontal and vertical configuration observed of Peruvian groundcherry chain.

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