

# Analysis of local productive systems: the case of the province of Cotopaxi, Ecuador

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## Abstract

This paper analyzes local productive systems by identifying their business structure, and the role played by the main sectors of economic activity in the territory of Cotopaxi-Ecuador as the subject of study. It highlights the Andean-Latin American approach to integral, territorial, and sustainable development, based on the triangulation of regional analysis techniques (specialization and location coefficients, cluster analysis, and Rasmussen's method), to characterize the dynamics of the local productive system, as well as lines of improvement to strengthen the system. The results indicate the presence of two provincial clusters, a high degree of regional specialization in traditional activities that have little impact on the province's productivity, and the presence of two key economic sectors.

**Keywords:** development; local productive system; productive specialization; cluster; productive sectors.

## 1. INTRODUCTION

Starting in the 1970s, the global economy underwent a series of transformations in industry (mainly in the textile, steel, and metallurgical sectors), in technological production and in market dynamics (increased competition), leading to a change in the organization of productive processes, transitioning from Fordist production (mass production) to post-Fordist production (flexible production), thus fulfilling the specific requirements of each territory (Flores Ruiz, 2010; Koch, 2017).

The disadvantages of the Fordist model can be summarized in three main negative factors: the first is related to the employment factor and the introduction of technologies that replace the traditional labor force, leading to a reduction in the hiring of workers, whatever their qualifications; second, the bankruptcy of small companies in the market because they are not able to compete with economies of scale and low production costs; and, finally, the presence of the China effect, which results in the global delocalization of production and the use of extremely low paid labor (Valli, 2018). The importance of local productive systems for economic development lies in their potential to respond to the external factors indicated above, key elements of the post-Fordist model (Rendón and Forero, 2014).

Meanwhile, in the search for development of the territory, governments encourage initiatives that allow them to use their endogenous resources and find solutions to their needs and problems (Alburquerque, 2016; Vázquez, 2018). In the case of Ecuador, the National Development Plan was created in 2007 as a document to bring together guidelines and challenges for the materialization and radicalization of a plurinational, intercultural State, leading to Quality of Life or *Sumak kawsay* for its people. During the period 2017-2021, the Toda Una Vida National Plan was being built using a territorial approach based on the Andean-Latin American vision of development, in particular *Sumak kawsay* and Latin American structuralism, which proposes guidelines and public policies with three central themes: first of all, the guarantee of rights throughout the life cycle; secondly, an economy at the service of society; and thirdly, the participation of society and state management in the fulfillment of national objectives (National Ministry for Planning and Development, 2020). In this regard, one of the development strategies linked to the guidelines of Ecuador's central government is the configuration of local productive systems based on efficiency, value-added generation, and innovation, as an effective response to external market forces.

This case study covered the province of Cotopaxi, located in the central region of the Ecuadorian highlands, belonging to planning zone 3 and composed of 7 cantons and 45 urban and rural parishes. This province was selected for the study because it has a medium level of participation in the country, which allows it to be used as a pilot study to compare it with more economically advanced territories and others that are less fortunate. The projected population for the year 2020 was 488,716 inhabitants. Cotopaxi contributed 1.88% of the Gross Domestic Product (GDP), with a value of USD \$9,558,915.70 for 2018 and a GDP per capita of USD \$4,984.10. Furthermore, in 2020, Gross Added Value was USD \$1,793,901, and Intermediate Consumption was USD \$1,157,948 (Banco Central del Ecuador [BCE], 2022).

Cotopaxi has exploitable natural resources for agricultural, industrial, and service production. It also has production chains focused on the specific nature of its territory, a primarily young population, and active indigenous social organizations. However, it has a notable weakness, mainly in its productive structure and business fabric, due to limited public-private investment in the territory and inadequate prioritization of key strategic, productive sectors. The weakness in its productive structure and business fabric leads to missed business opportunities, greater vulnerability to external market forces, and a high percentage of underemployment in the province (Gobierno Autónomo Descentralizado (GAD) Provincial de Cotopaxi, 2021; Secretaría Nacional de Planificación y Desarrollo, 2015).

Pursuant to the foregoing, the objective of this research is to analyze the local productive system of the province of Cotopaxi-Ecuador, identifying its business structure and the role played by the main sectors of economic activity in the territory, based on the triangulation of regional analysis techniques, establishing a complete characterization of its productive dynamics. This article contributes, on the one hand, to the empirical literature, highlighting the Andean-Latin American approach to integrated, territorial, and sustainable development in the economic, social, and environmental

spheres for the study of local production. On the other hand, based on the results of this work, lines of improvement can be developed to strengthen the local productive system of Cotopaxi, considering its specific endogenous territorial features.

Previous papers have been prepared regarding the territorial dynamics of the province and its development potential, for example, the Territorial Development and Management Plan presented by the Cotopaxi Province Autonomous Decentralized Government (GAD) (2021) and the study by Al-Faro *et al.*, 2007, explaining the historical reasons for land use, socioeconomic characteristics, the organization of its population and the processes for participation of the indigenous communities; with other aspects including population and especially its organizational process. The work of Jeréz (2013), which characterizes the province's economic and social situation and contrasts the GAD Cotopaxi's skills, is also noteworthy. However, none of the previous studies have addressed the characterization of the local productive system of the province based on the triangulation of regional analysis techniques as developed in this research.

The paper has been divided into four sections. The first section presents the Andean-Latin American perspective of development and productive systems. The second describes the methodology applied to detect and identify the local productive system of Cotopaxi and explains the sources used. The third develops the results obtained from the triangulation of the different methodological techniques. Finally, the fourth section establishes the main conclusions derived from this research.

## 2. ANDEAN-LATIN AMERICAN POINT OF VIEW REGARDING DEVELOPMENT AND PRODUCTIVE SYSTEMS

The study of the evolution of the concept of development, in general, and of the paradigms of development in Latin America, in particular, reveals the multi-causality and multidimensionality of the concept and the increasingly complex but enriching trajectory of this process, as well as the commitment of thinkers and schools of thought and the effort to establish better living conditions, whether from the emerging idarian vision of the first peoples of the Andean world to the alienating, orthodox, heterodox foreign points of view, passing through constructions much more typical today, such as Latin American structuralism and the perspective of development from the *Sumak kawsay* (Bértola, 2015; Gudynas, 2011).

In this respect, the trajectory for development in Latin America is marked by inequality and unequal distribution of production and income, the concentration of wealth, and increasing poverty. There have been decades of efforts, expenditure, and investments of all kinds, with an elusive final result that hints that the road to development still has a long way to go (Acosta, 2006; Pérez-González and Castillo-Eslava, 2017; Veltmeyer, 2010).

Given the above, this paper proposes development as a process and a personal and collective way of life and a permanent work in progress, characterized by the deployment and synergic interaction of capacities and potentialities of a given territory, oriented towards a quality of life freely chosen by the inhabitants of the territory (which includes economic, social, endogenous territorial and environmental spheres), and which allows and promotes personal well-being in society, equality, equal opportunities, cultural diversity and a harmonious relationship with nature (Flores-Tapia, 2019).

The dynamism of the current economic, social, technological, and institutional context makes comprehensive, territorial, and sustainable productivity and competitiveness one of the aspects of particular concern for guiding territorial and national public policies (Bielschovsky, 2009). Moreover, the new conditions of the productive systems linked to innovation, quality, human talent, creativity, networking, systems, design and differentiation of goods and services and logistics, etc., fortunately also allow the territories to carry out a new active role and opens up the possibility of promoting integral sustainable development. Hence the need to theorize on the link between growth and local productive systems and, on that basis, to build public policies linked to specific territorial matters using, among other collective actions, new forms of productive organization based on this Andean-Latin American vision characterized by a comprehensive, endogenous and sustainable territorial development approach in the economic, social and environmental spheres.

In this respect, the new forms of productive organization have given rise to multiple interpretations, such as industrial districts (Becattini, 1979), innovative *milieux* (Groupe de Recherche Européen sur les Milieux Innovateurs, GREMI), flexible specialization (Piore and Sabel, 1984), economic sociology (Granovetter, 1985), new industrial spaces (Storper and Scott, 1988), the theory of innovative environments (Aydalot, 1986; Maillat, 1995), industrial clusters (Porter, 1998), local productive systems (Garofoli, 1986) and the knowledge economy (Cooke, 2002).

Based on the previous studies referred to above, this article seeks to deepen the importance of the configuration of local productive systems for the development process in the territories, with particular emphasis on the dynamics of the local productive system of Cotopaxi, by applying various regional analysis techniques and establishing lines of improvement aimed at strengthening this territorial system.

The term local productive system was introduced by Garofoli (1986) as a concentrated model of companies in their geographic area, with similar products or products sharing the same production phase. Based on this definition, other academic contributions have been proposed by scholars of local productive systems, including Vázquez (2001), Cividades (2001), Albuquerque *et al.* (2008), Flores-Ruiz (2010), Alderete and Bacic (2016), Andreotti and Enzo (2016), Barzotto *et al.* (2017), Kuryliak *et al.* (2017), Moflih (2017) and Bellandi and Santini (2019), who agree that these systems integrate areas with the participation of organized and closely related companies resulting from local initiatives and specialize in some productive activity. Likewise, a local productive system can be a mechanism that directly influences the territory since it seeks to respond to market demands through new forms of production organization (including technological processes, innovation, and the participation of local agents).

In this respect, it is essential to point out the formation of clusters and territorial networks in local productive systems. Porter (1998, p. 203) defines clusters as "geographic concentrations of interconnected companies, specialized suppliers, service providers, universities, standardization institutes, trade associations that compete but also cooperate." These geographic concentrations are helpful in local development processes and make it possible to counteract the effects of globalization, which generally place small and medium-sized companies at a disadvantage in the market (Martínez-Marín *et al.*, 2020).

Likewise, the functioning of local productive systems leads to a network of companies concentrated in a specific territory, which generates a multiplicity of interconnections in internal markets and, in turn, propitiates spaces to facilitate the exchange of production (Hernández *et al.*, 2018). According to Albuquerque *et al.* (2008, p. 35), "a network of companies can be defined as the system of relationships or contacts that link the companies or participants with each other, and the content thereof may relate to material goods, information or technology." Indeed, these are businesses linked

voluntarily to achieve a common goal, which they would find very difficult to achieve individually (Paunero *et al.*, 2007; Coe and Yeung, 2019). This approach identifies the interaction between companies and interterritorial vertebration as two key elements in consolidating systems for local production and contributing to the territories' development.

An analysis of the history of development in Latin America reveals different modalities, mechanisms, scenarios, contexts, policies, and results in the countries in the region. However, Flores-Tapia *et al.* (2022) identify six paradigms or models of development in which the evolution of the concepts of development reviewed throughout the history of economic thought in the previous sections takes shape and include: primary export development, state-led industrialization, market fundamentalism, the great moderation, developmental progressivism, and the new Washington Consensus. However, in recent decades, alternative and complementary concepts to the paradigms above have emerged, such as sustainable, territorial, regional, local, endogenous, and human development.

Furthermore, in the case of Bolivia and Ecuador, a specific concept is taking shape, which the Constitution of these nations calls *Buen Vivir* or *Sumak kawsay*, understood by Gudynas and Acosta (2011) as a renewed concept of development that implies the expansion of individual and collective potentials to be discovered and promoted. And if development requires equity and equality, these will only be possible with democracy (not simply an electoral ritual) and with freedom of expression as true guarantees for economic efficiency and the achievement of Good Living, both a path and an objective.

Empirical evidence shows that many stagnant, less economically developed countries fail to overcome the inequality trap (Castillo, 2017) and the vicious circle of poverty. It is, therefore, worth asking what they can do to improve their living standards and how other countries, particularly the richer ones, can cooperate and assume responsibilities; for example, based on the 2030 Agenda for Development (Economic Commission for Latin America and the Caribbean [ECLAC], 2016; Sen, 1988, 2009).

One of many challenges requires making the necessary transition, incorporating the human dimension and the study of inequalities into economic reflection (Stiglitz, 2012, 2016; Sen, 2009; Stiglitz and Rodriguez, 2007). Even neoclassical economists point out that "this journey through the life of the world's poorest countries reminds us of the importance of having sufficient income to fulfill basic needs, as well as the fact that life is more than market income" (Samuelson *et al.*, 2010, p. 542). Along this line of thinking, other thinkers emphasize the need to consider other factors such as health, life expectancy, level of education, literacy, and gender equality, together with usual factors of economic analysis such as per capita income and consumption to assess the actual situation of a country (Martinez and Paris, 2017; Sen, 2009; Gallego and Mira, 2004).

### 3. METHOD

The main works relating to the identification of local productive systems in a given territory include research by Semitiel and Noguera (2004), Giner *et al.* (2006), Garcia and Castellanos (2007), Vidal and Pezoa (2016), Martinez and Corrales (2017), Martin and Tripl (2017), Ghayoomi *et al.* (2020), which use different types of regional analysis techniques such as multivariate analysis, input-output tables, the Chenery and Watanabe indices, geographic concentration indices, as well as the methodology of Peeters *et al.* (2001).

This paper builds on previous contributions by using three regional analysis techniques (cluster analysis, calculation of specialization and location coefficients, and application of the Rasmussen method), the most important contribution being the combination of these methodologies, which permits the triangulation of information and a complete view of the economic and business structure of the same territory.

As far as identifying the business structure of the province of Cotopaxi is concerned, a cluster analysis is used as a multivariate statistical technique that seeks to group variables to achieve maximum homogeneity in each group and the most significant differentiation between groups (De la Fuente, 2011; Villardón, 2015). A type of agglomerative hierarchical clustering is chosen, applying the "farthest neighbor" method, also known as *Complete Linkage*. Although it is possible to use other methods such as closest neighbor, average between groups, centroid method, median method, or Ward's method, the farthest neighbor method is selected because it allows the formation of groups that do not separate during the process. In addition, this method considers that the distance or similarity between two groups is calculated using a strategy of maximum distance or minimum similarity between its components (Gallardo, 2016).

When the K-th step is performed, and the  $n-K$  clusters are formed (equation 1), the distance and similarity between clusters  $C_1$  (with  $n_1$  elements) and  $C_2$  (with  $n_2$  elements) would be equation (2):

$$d(C_i, C_j) = \text{Max}_{x_l \in C_i, x_m \in C_j} \{d(x_l, x_m)\} \quad l = 1, \dots, n_i; m = 1, \dots, n_j \quad (1)$$

$$s(C_i, C_j) = \text{Min}_{x_l \in C_i, x_m \in C_j} \{s(x_l, x_m)\} \quad l = 1, \dots, n_i; m = 1, \dots, n_j \quad (2)$$

Since the study seeks to determine the business structure of Cotopaxi based on a cluster analysis, the database of the Single Taxpayers Registry (Servicio de Rentas Internas, 2019) is used, which has been processed according to the following criteria: commercial establishments that participate in the 16 economic activities registered in the province, active taxpayer status, obligation to keep accounts updated to the year 2019. According to the foregoing, the study assumes the existence of 327 companies in the territory and the presence of 16 economic activities.

With regard to the study of the provincial productive structure, specialization coefficients are used, while the location coefficient is used to identify sectoral geographic concentrations as regional analysis techniques (Boiser, 1980). In the first case, the calculation of the specialization coefficients —  $Q^R$  — reflects the degree of similarity of the regional economic structure with the economic structure of the comparison pattern-Nation. The coefficient can take values between 0 and 1. It is used as a measure of "regional specialization" when its value is close to 1 or of "regional diversification" when the indicator is 0 or close to 0 (Lira and Quiroga, 2009; Gutiérrez *et al.*, 2018).

The following equation was used to calculate the specialization coefficient:

$$Q^R = \frac{1}{2} \sum_{i=1}^n \left| \frac{V_{ij}}{\sum_{i=1}^n V_{ij}} - \frac{\sum_{j=1}^n V_{ij}}{\sum_{i=1}^n \sum_{j=1}^n V_{ij}} \right| \quad (3)$$

Where:

$v_{ij}$  = value of sector  $i$  of canton  $j$ .

$\sum_{i=1}^n V_{ij}$  = value corresponding to the total for the canton.

$\sum_{j=1}^n V_{ij}$  = value corresponding to the sector total.

$\sum_{i=1}^n \sum_{j=1}^n V_{ij}$  = value corresponding to the provincial total.

In the second case, the calculation of the location coefficients — $Q_{ij}$ — is intended to represent the relationship between the share of sector  $i$  in region  $j$  and the share of the same sector in the national/regional total. Consequently, it is used as a measure of "relative or interregional specialization," where the degree of concentration is associated with a range between 0 and 1 (Boiser, 1980). If  $Q_{ij}$  is greater than or equal to 1, there is specialization in economic activity  $i$ , whereas if  $Q_{ij}$  is less than 1, there is no economic specialization in  $i$ . Likewise, the higher the value of  $Q_{ij}$ , the greater the degree of specialization (Ramírez, 2012; Martínez *et al.*, 2019). It is calculated as follows:

$$Q_{ij} = \frac{\frac{V_{ij}}{\sum_{j=1}^n V_{ij}}}{\frac{\sum_{i=1}^n V_{ij}}{\sum_{i=1}^n \sum_{j=1}^n V_{ij}}} \quad (4)$$

The prioritization of key economic sectors in Cotopaxi is obtained by applying the Rasmussen method, which quantifies the direct and indirect effects on an economy and also allows for intersectoral comparisons, taking into account the weightings of the different economic branches (Iráizoz, 2006). In order to apply the Rasmussen method, the provincial input-output matrix needs to be estimated, which is constructed using the RAS Method (bi-proportional adjustment method). The studies of Schuschny (2005), Ramos *et al.* (2017), Wang *et al.* (2017), and Flores-Cevallos (2018), where the following adjustment to the  $A^k$  matrix is established, are used to obtain the provincial input-output matrix:

$$A^k = \prod_i r^i A(0) \prod_j s^j = RAS \quad (5)$$

Based on this input-output matrix, the inverse Leon-Tief matrix is calculated:

$$(I - A)^{-1} Y = X \quad (6)$$

Where;

$I$  = identity matrix.

$A$  = matrix of provincial technical coefficients.

Based on the Leontief inverse matrix, the dispersion measures are calculated to identify the key sectors in the Cotopaxi economy using the Rasmussen method.

The dispersion power, according to Pino (2004, p. 74,) "[...] describes the relative extent over which an increase in the final demand for the products of industry  $j$  is dispersed through the system of industries" and is calculated as follows:

$$PD_j = \frac{\frac{1}{n} \sum_i \alpha_{ij}}{\frac{1}{n^2} \sum_i \sum_j \alpha_{ij}} \quad (7)$$

Where;

$n$  = Number of elements of row ( $i$ ) or column ( $j$ ).

$n^2$  = Total number of matrix elements.

$\sum_i \alpha_{ij}$  = Sum of the elements of the column.

$\sum_i \sum_j \alpha_{ij}$  = Sum of all elements of the matrix.

On the other hand, the dispersion sensitivity "expresses the extent to which the system of industries weighs on industry  $i$ " (Pino, 2004, p. 75) and is calculated as follows:

$$SD_i = \frac{\frac{1}{n} \sum_j \alpha_{ij}}{\frac{1}{n^2} \sum_i \sum_j \alpha_{ij}} \quad (8)$$

Where:

$\sum_i \alpha_{ij}$  = Sum of the row elements.

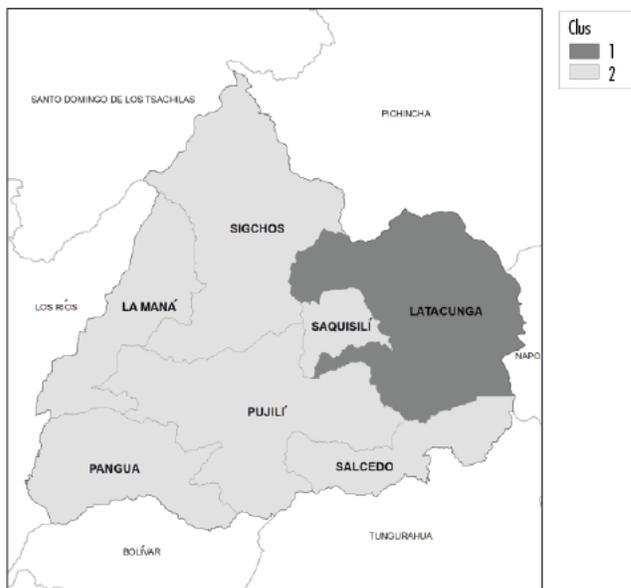
$\sum_i \sum_j \alpha_{ij}$  = Sum of all elements of the matrix.

Finally, a key sector of the economy is understood as a sector with an above-average drag effect, both on other sectors and vice versa. This condition is fulfilled for: a Dispersion Power  $PD_i > 1$  and a Dispersion Sensitivity  $SD_i > 1$  (Pino, 2004).

#### 4. RESULTS

The application of the cluster analysis using Statgraphics Centurion software identifies the formation of two clusters in the province (see Figure 1).

Figure 1. Cotopaxi cluster analysis



Source: Compiled by the author.

Based on the seven observations (cantons) proposed in the study, two clusters are created in the province. The procedure for forming clusters begins by analyzing each observation in separate groups; then, the two most similar observations are combined to start a new group. When recalculating the distance between groups, the two closest or most similar groups are combined (Gutiérrez *et al.*, 1994). This process is repeated until the two groups are formed.

The first cluster comprises the canton of Latacunga and the other, the cantons of La Maná, Pujilí, Salcedo, Saquisilí, Pangua and Sigchos (see Figure 1). This result highlights the presence of territorial variations in the business structure of the province. On the one hand, the canton of Latacunga comprises 55% (180) of the total number of companies in Cotopaxi and, in turn, registers a more significant number of establishments in wholesale and retail activities, repair of motor vehicles and motorcycles; Transportation and storage; Other service activities; Financial and insurance activities; Manufacturing industries; Agriculture, livestock, forestry, and fishing, mainly. On the other hand, the rest of the cantons as a whole account for 45% of the total number of companies in the province, with Sigchos canton accounting for 2.8% (a figure that highlights the large gap between the centers and the peripheries).

Based on the entrepreneurial behavior and the promotion of the specific endogenous provincial characteristics, the formation of new potential clusters for the economic dynamization of the territory may be considered. An example of this is the cluster formed by the cantons of La Maná and Pangua, which specialize in banana and plantain production. The manufacturing industry cluster is also noteworthy, particularly in producing hides and skins from slaughterhouses, including shaved skins, located in the Salcedo canton. Finally, mention should be made of the cluster formed by the cantons of Pujilí, Sigchos, and La Maná in relation to social services and social welfare activities for the elderly and people with disabilities.

Meanwhile, concerning the analysis of the provincial economic structure, the results of the calculation of the specialization coefficient highlight the presence of regional diversification in each canton in the province since the calculated coefficients are closer to 0 than to unity (see Table 1).

Table 1. Provincial specialization coefficients 2019

	<i>Latacunga</i>	<i>La Maná</i>	<i>Pangua</i>	<i>Pujilí</i>	<i>Salcedo</i>	<i>Saquisilí</i>	<i>Sigchos</i>
$q^k$	0.07	0.27	0.38	0.33	0.08	0.23	0.30

Source: Compiled by the authors based on the BCE database (2019).

Based on the foregoing, the need to promote the process of regional specialization is emphasized, and its importance lies in taking advantage of the specific territorial characteristics of each canton and, therefore, the generation of economic development at the provincial level (Rodríguez *et al.*, 2017).

On the other hand, the calculation of provincial location coefficients shows a high degree of productive specialization with respect to agriculture, livestock, forestry, and fishing activities; electricity and water supply; public administration; education (see Table 2).

**Table 2. Provincial location coefficients 2019**

<i>Economic activity</i>	<i>Latacunga</i>	<i>La Maná</i>	<i>Pangua</i>	<i>Pujilí</i>	<i>Salcedo</i>	<i>Saquisilí</i>	<i>Sigchos</i>
Agriculture, livestock, forestry, and fishing	0.89	1.76	2.11	0.60	1.17	0.50	1.00
Mining and quarrying	1.32	1.30	0.00	0.00	0.33	0.00	0.00
Manufacturing	1.17	0.16	0.32	0.03	1.43	1.46	0.06
Electricity and water supply	0.73	1.37	1.01	2.63	0.77	2.27	2.15
Construction	1.02	0.52	0.39	1.86	0.95	0.62	0.76
Trade	1.07	1.25	0.44	0.48	0.93	1.15	0.32
Accommodation and catering activities	1.33	0.56	0.24	0.19	0.36	0.43	1.12
Transportation, information, and communications	1.23	0.48	0.17	0.38	0.75	1.04	0.56
Financial activities	1.11	0.64	0.35	0.44	1.18	1.06	0.47
Professional and real estate activities	1.11	0.58	0.33	0.88	0.99	0.99	0.70
Public Administration	0.74	0.88	1.60	2.21	0.98	2.81	2.68
Teaching	0.70	1.36	1.85	2.20	0.95	1.79	3.33
Health	1.17	0.26	0.86	1.65	0.62	0.00	0.00
Other services	0.99	1.58	0.03	0.81	0.99	0.84	1.14

Source: Compiled by the authors based on the BCE database (2019).

The prioritization of economic sectors using the Ras-Mussen method determined the following as key sectors in Cotopaxi: Animal husbandry and the production of wood and wood products. It also establishes the cultivation of flowers, bananas, coffee and cocoa, milling, bakery and noodle products, dairy products, mining, and quarrying, among others, as driving sectors of the economy. Furthermore, the main strategic sectors in the province are: Manufacturing of paper and paper products, Manufacturing not previously classified (NPC), Mail and communications, Education, and Entertainment, recreation, and other service activities (see table 3).

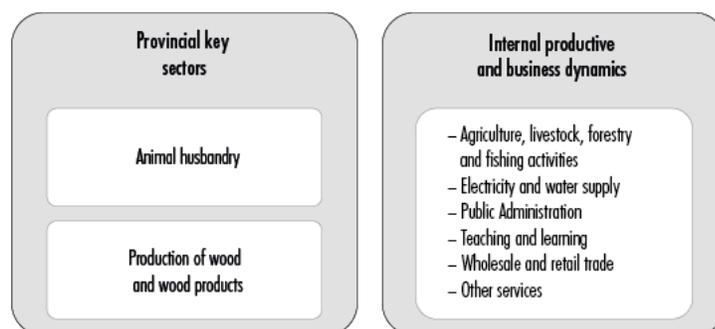
**Table 3. Prioritization of economic sectors in Cotopaxi, based on the Rasmussen method**

Order No	Productive sector	PD	SD	Sector
1	Animal husbandry	1.0	1.8	Clave
2	Production of wood and wood products	1.0	1.1	Clave
3	Cultivation of flowers	1.8	0.6	Impulsor
4	Cultivation of bananas, coffee, and cocoa	1.5	0.6	Impulsor
5	Milling, bakery, and processing of noodle products	1.0	0.6	Impulsor
6	Processing of dairy products	1.0	0.8	Impulsor
7	Mining and quarrying	1.0	0.6	Impulsor
8	Manufacturing of paper and paper products	0.6	0.9	Estratégico
9	NPC manufacturing industries	0.6	1.3	Estratégico
10	Mail and communications	0.6	0.9	Estratégico
11	Teaching	0.6	3.0	Estratégico
12	Entertainment, recreation, and other service activities	0.6	1.2	Estratégico

Source: Compiled by the authors based on data from the 2019 National Accounts of the ECB.

In turn, the result of the triangulation of the three regional analysis techniques applied during the creation of this article (cluster analysis, specialization and location coefficients, and the Rasmussen method) indicates the existence of very marked territorial differences and the presence of a center-periphery model on a provincial level, where the highest concentration of companies and productive activities are located in the Latacunga canton, the capital of the province, generating 64.33% of Gross Added Value, compared with other cantons such as Sigchos, which contributes 1.46% (BCE, 2019) (see Figure 2). This result is also established in the dynamics of the national productive system, presenting marked territorial differences in the industry, with a more considerable number of companies in the central provinces of Pichincha, Guayas, Manabí, and Azuay, generating a significant gap with respect to other areas in the territory, including the province of Cotopaxi. Therefore, the country's economic development is subject, to a large extent, to the degree of development and synergy of the local provincial productive systems.

Figure 2. Provincial productive dynamics resulting from the triangulation of the techniques applied in the research (Cotopaxi)



Source: Compiled by the authors.

The results of the economic specialization analysis for the province of Cotopaxi highlight the presence of regional diversification in each canton. However, the study of the location coefficient indicates a high level of specialization in certain productive activities found in a group of cantons, including agriculture, livestock, forestry, and fishing; electricity and water supply; public administration; and education. These are traditional activities that have minimal impact on the province's productivity. Furthermore, the prioritization of Cotopaxi's economic sectors refers to only two key sectors: animal husbandry and the production of timber and wood products, which again shows a limited, traditionalist productive dynamism in the province. It should also be noted that only the animal husbandry sector fulfills the prioritization given to the change in the country's productive matrix (National Ministry for Planning and Development, 2012).

Based on the above considerations, lines of improvement need to be implemented to increase the dynamism of the local productive system of the province, according to the recognition of the specific characteristics of the territory. In this case, Cotopaxi's Land Management Plan should aim to promote public policies for productive development, the formation of industrial clusters to promote competitiveness in the territory, the productivity of local companies, and the implementation of technological changes and innovation. Similarly, strategies should be developed to encourage the creation of productive chains and maintain existing ones (cocoa, sugarcane, milk, and blackberry). The capacity for territorial structuring also needs to be

strengthened based on institutional alliances, accessibility projects for quality infrastructure and equipment, and the creation of marketing networks, among other actions. Finally, another measure to consider is the promotion of human resources training, taking advantage of the substantial demographic potential and turning it into an endogenous resource with significant effects on the territorial development of the province.

## 5. CONCLUSIONS

The search for endogenous local development in the territories, from the point of view of Andean-Latin American development fundamentally based on *Sumak kawsay*, is linked to the creation of new forms of productive organization, such as local productive systems. These systems are established as flexible specialization mechanisms that promote endogenous and sustainable economic, social and environmental activities in the territory. In this respect, local productive systems can be defined as territorially located productive agglomerations that interrelate and cooperate with other participants in the territory.

This research provides a new approach to the concept of development, based mainly on the Andean vision of *Sumak kawsay*, defined as a process and a personal and collective way of life and a permanent work in progress, characterized by the deployment and synergic interaction of the capacities and potentialities of a given territory, oriented towards a quality of life freely chosen by the inhabitants of the region which includes the economic, social, endogenous territorial and environmental spheres and which allows and promotes personal wellbeing in society, equality, equal opportunities, cultural diversity and a harmonious relationship with nature.

The results obtained based on the triangulation of regional analysis techniques (cluster analysis, specialization and location coefficients, and the Rasmussen method) determine a difference in internal territorial economic behavior and the productive system of the province of Cotopaxi among its cantons, showing a well-defined territorial center-periphery model. The cluster analysis identified two territorial clusters: one, formed by the Latacunga canton (center) with the most sizable number of registered establishments, and the other, created by the rest of the provincial cantons (peripheries). An analysis of the micro-territories in the province, through the application of the specialization coefficient, establishes the existence of regional diversification in each canton, while the study of the location coefficients highlights mainly agricultural, livestock, forestry, and fishing activities, electricity and water supply; public administration; and education, with a high degree of specialization on a provincial level. The prioritization of key sectors includes animal husbandry and the production of timber and wood products. In this respect, the validation of these last two techniques (location coefficient and the Rasmussen method) indicates increased participation in production in each canton, concerning agriculture, livestock, forestry, and fishing activities, in line with the prioritization of the key animal breeding sector on a provincial level.

The study of the local productive system in Cotopaxi revealed the presence of endogenous potential in the territory, highlighting the availability of exploitable natural resources, the prioritization of productive chains, the possibility of creating industrial clusters, the presence of strategic sectors and drivers of the economy, among other aspects which, when put to good use, would contribute to improving productivity and competitiveness in the province. In this regard, these characteristic features of the province's local productive system would support the proposal of lines of improvement aimed at promoting public policies for productive development, consolidating the formation of productive chains, stimulating the formation of industrial clusters, strengthening the capacity for territorial structuring and encouraging the formation of human capital, among others.

## BIBLIOGRAPHY

Acosta, A. (2006). *Brief economic history of Ecuador*. National Publishing Corporation.

Albuquerque, F., Dini, M. and Pérez, R. (2008). Learning guide on productive integration and territorial economic development. In *Learning Guide on Productivity Integration and Economic Development*. Inter-American Development Bank  
<http://elearning.cepal.org/moodle/file.php/1/documentos/modulo3/dinialbuquerque/modulo1.pdf>

\_\_\_\_\_ (2016). The territorial economic development approach and policy. Lessons for the change of productive model. In J. Noguera (ed.). *The territorial and sustainable vision of local development: A multidisciplinary perspective* (pp. 47-66). Universitat de València-Servei de Publicacions.

Alderete, M. and Bacic, M. (2016). Is there a better local development in clustered municipalities in the case of São Paulo state in Brazil? *Development and Society*, 2016(77).<https://doi.org/10.13043/dys.77.2>

Alfaro, E., Larrea, A., Valarezo, G., Vallejo, M. and Viera, M. (2007). *Cotopaxi: social space and political change*. IEE.

Andreotti, A. and Enzo, M. (2016). Local welfare systems in Europe and the economic crisis. *European Urban and Regional Studies*, 23(3).  
<https://doi.org/10.1177/0969776414557191>.

Aydalot, P. (1986). *Milieux innovateurs en Europe*. Editorial GREMI. <https://www.worldcat.org/es/title/461728055>

Barzotto, M., Coro, G. and Volpe, M. (2017). Global value chains and the role of MNEs in local productive systems. *Routledge Studies in Global Competition*.

Becattini, G. (1979). From the "industrial sector" to the "industrial district". *Revista Económica de Catalunya*. [https://www.academia.edu/386067/Theor%C3%ADa\\_of\\_the\\_Industrial\\_District\\_G\\_Becattini](https://www.academia.edu/386067/Theor%C3%ADa_of_the_Industrial_District_G_Becattini)

Bellandi, M. and Santini, E. (2019). Territorial servitization and new local productive configurations: the case of the textile industrial district of Prato. *Regional Studies*, 53(3).<https://doi.org/10.1080/00343404.2018.1474193>

Bértola, L. (2015). Development Patterns and Welfare States in Latin America. In A. Bárcena and A. Prado (eds.). *Neo-structuralism and heterodox currents in Latin America and the Caribbean at the beginning of the 21st Century XXI CENTURY* (pp. 261-296). ECLAC.

Bielschovsky, R. (2009). Sixty years of ECLAC: structuralism and neo-structuralism. *CEPALReview*, 206.<https://repositorio.cepal.org/handle/1/1362/11278>

Boiser, S. (1980). *Regional analysis techniques with limited information*. ECLAC. Castillo, J. (2017). *The inequality trap and agricultural health in Latin America: the case of Nicaragua* [Doctoral Thesis, University of Cadiz]. <https://dialnet.unirioja.es/servlet/tesis?codigo=122198>

Central Bank of Ecuador (BCE) (2019). *Cantonal Accounts 2019*. <https://contenido.bce.fin.ec/documentos/Estadisticas/SectorReal/CuentasCantoniales/Indice.htm>

- \_\_\_\_\_ (2022). *Provincial Accounts 2020*. <https://contenido.bce.fin.ec/documentos/Estadisticas/SectorReal/CuentasProvinciales/Indice.htm>
- Cividades, J. (2001). *Territory as an economic variable: the concept of local productive system*. Department of Applied Economic Analysis, University of Alicante, 14. <https://geohumana.files.wordpress.com/2011/09/territorio1.pdf>
- Coe, N. and Yeung, H. (2019). Global productive networks: Mapping recent conceptual developments. *Journal of Economic Geography*, 19(4). <https://doi.org/10.1093/jeg/lbz018>
- Cooke, P. (2002). *Knowledge Economies*. Routledge. <https://www.routledge.com/Knowledge-Economies-Clusters-Learning-and-Cooperative-Advantage/Cooke/p/book/9780415757164>
- De la Fuente, S. (2011). Cluster analysis (vol. 1, Issue 1). Autonomous University of Madrid. <http://www.fuenterrebollo.com/Economicas/ECONOMETRIA/SEGMENTACION/CONGLOMERADOS/conglomerados.pdf>
- Decentralized Autonomous Government (GAD) of Cotopaxi (2021). *Cotopaxi Land Use and Development Plan 2021-2025*.
- Economic Commission for Latin America and the Caribbean (ECLAC) (2016). *Economic Survey of Latin America and the Caribbean*. ECLAC.
- Flores-Cevallos, K. (2018). *The input-output matrix and the identification of key economic sectors for the province of Tungurahua* [Thesis, Universidad Técnica de Ambato]. <https://repositorio.uta.edu.ec/handle/123456789/27682>.
- Flores-Ruiz, D. (2010). Territorial competitiveness and local productive systems. In M. Barroso and D. Flores (eds.). *Local Development Theory and Strategies* (pp. 131-166). Universidad Internacional de Andalucía Ediciones. [https://dspace.unia.es/bitstream/handle/10334/3817/2010\\_desarrollolocal.pdf](https://dspace.unia.es/bitstream/handle/10334/3817/2010_desarrollolocal.pdf)
- Flores-Tapia, C. (2019). *Proposal to improve productivity and territorial competitiveness in the context of the change in Ecuador's productive matrix applied to the province of Tungurahua* [Doctoral Thesis, University of Cadiz].
- Flores-Tapia, C., Pérez-González, M., Maza-Ávila, F. and Flores-Cevallos, K. (2022). A conceptual perspective of development from Latin American alternative theories and territorial actors. In F. Maza, A. Salas and M. D. C. Pérez (eds.). *Problems and challenges of development in Latin America* (pp. 41-59). Editorial Universitaria.
- Gallardo (2016). *Hierarchical cluster analysis methods*. University of Granada.
- Gallego, L. and Mira, S. (2004). Misfortunes of a poor man in the economic world: orthodox economics and its limits in the analysis of poverty and Amartya Sen's proposal. *Lecturas de Economía*, 60. <https://doi.org/10.17533/udea.le.n60a4891>
- García, L. and Castellanos, G. (2007). Local productive systems as an alternative for the development of the municipality of La Ceiba (Trujillo State, Venezuela): a prospective approach. *Agrifood*, 12(25). [http://ve.scielo.org/scielo.php?script=sci\\_arttext&pid=S1316-03542007000200009](http://ve.scielo.org/scielo.php?script=sci_arttext&pid=S1316-03542007000200009)
- Garofoli, G. (1986). Local development models. *Franco Angeli*. 2. <http://www.rivistameridiana.it/files/Garofoli,-Lo-sviluppo-locale.pdf>
- Gayoomi, M., Abooei, M., Vahdatzad, M. and Ebrahimi, A. (2020). Designing a model for creation of export consortiain business cluster. *International Journal of Engineering Transactions C: Aspects*, 33(3). <https://doi.org/10.5829/ije.2020.33.03c.10>
- Giner, J., Santa María, M. and Fuster, A. (2006). Local productive systems in the Valencian Community: analysis for their identification and territorial localization. *Journal of the University of Alicante*. [https://rua.ua.es/dspace/bitstream/10045/2765/1/Eco\\_Reg\\_2006.pdf](https://rua.ua.es/dspace/bitstream/10045/2765/1/Eco_Reg_2006.pdf)
- Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*. <https://www.jstor.org/stable/2780199>
- Gudynas, E. (2011). Good living: germinating alternatives to development. *Latin America in Movement*. <https://doi.org/http://www.rebellion.org/plancolombia/gallego180203.pdf>
- Gudynas, E. and Acosta, A. (2011). The renewal of the critique of development and good living as an alternative. *Utopia and Latin American Praxis*, 16(53) <https://www.redalyc.org/pdf/279/27919220007.pdf>
- Gutiérrez, A., González, F., Torres, J. A. and Gallardo (1994). *Multivariate data analysis techniques*. University of Granada.
- Gutiérrez, M., Romo, J. and Quintana, A. (2018). Base point specialization index and specialization coefficient: comparative and statistical analysis. *Milestones in Economic and Administrative Sciences*, 69(24). <https://doi.org/10.19136/hitos.a24n69.2745>
- Hernández, L., Gallardo, R., Dios-Palomares, R., & Martínez, S. (2018). An application of network theory to territorial analysis: The case of yaqui valley networks (2006 and 2016). *Revista de la Facultad de Ciencias Agrarias*, 50(2). [https://bdigital.uncu.edu.ar/objetos\\_digitales/12005/cp-22-hermndez-hermndez.pdf](https://bdigital.uncu.edu.ar/objetos_digitales/12005/cp-22-hermndez-hermndez.pdf)
- Internal Revenue Service (2019). *Database of the Single Registry of Contractors*. <https://www.sri.gob.ec/web/guest/RUC>
- Iráizoz, B. (2006). Is the method decisive in identifying the key sectors of an economy? An application to the case of the input-output tables of Navarra. *Estadística Española*, 48(163). <https://docplayer.es/39630171-Es-determinante-el-metodo-en-la-identificacion-de-lossectores-clave-de-una-economia-una-aplicacion-al-caso-de-las-tablas-inputoutput-de-navarra-1.html>
- Jeréz, L. (2013). *Implications of the Code of Territorial Organization, Selfnomy and Decentralization on local economic development. Caso Cotopaxi* [Degree thesis, Pontificia Universidad Católica del Ecuador]. <http://repositorio.puce.edu.ec/bitstream/handle/22000/6874/7.36.001457.pdf?sequence=4&isAllowed=y>
- Koch, M. (2017). *Roads to post-Fordism labor markets and social structures in Europe*. Routledge.
- Kuryliak, V., Lishchynskyy, I., Lyzun, M. and Komar, N. (2017). Benchmarking of local productive systems in Eastern Europe and Ukraine. *Management and Governance*, 17. <http://dspace.wunu.edu.ua/bitstream/316497/23101/1/%d0%9b%d1%96%d1%89%d0%b8%d0%bd%d1%81%d1%8c%d0%ba%d0%b8%d0%b9%20%d0%86.%20%d0%9e.%20M%26G.17.pdf>
- Lira, L. and Quiroga, B. (2009). Regional analysis techniques. *Latin American and Caribbean Institute for Economic and Social Planning (ILPES)* (ILPES), 59. <https://repositorio.cepal.org/handle/11362/5500>

- Maillat, D. (1995). Territorial dynamics, innovative milieus and regional policy. *Entrepreneurship and Regional Development*, 7(2). <https://doi.org/10.1080/089858562950000010>
- Martin, R. and Trippel, M. (2017). The evolution of the ICT cluster in southern Sweden regional innovation systems, knowledge bases and policy actions. *Geografiska Annaler: Series B, Human Geography*, 99(3). <https://doi.org/10.1080/04353684.2017.1344559>
- Martinez-Marín, S., Puello-Pereira, N. and Ovallos-Gazabon, D. (2020). Cluster competitiveness modeling: An approach with systems dynamics. *Social Sciences*, 9(2). <https://doi.org/10.3390/socsci9020012>
- Martínez, G. and Corrales, S. (2017). Productive chains and clusters in the regional economy of Nuevo León. An analysis with input-output matrices. *New Epoch*, 46. <https://www.scielo.org.mx/pdf/etp/n46/2448-7481-etp-46-00041.pdf>
- Martínez, M., Avila, C., & Marques, N. (2019). Location and productive specialization: The case of the thirteen main cities in Colombia. *Revista Brasileira de Gestão e Desenvolvimento Regional*, 15(6). <https://doi.org/10.54399/rbgdr.v15i6.5196>
- Martinez, V. and Paris, S. (2017). *Amartya K. Sen and globalization*. Universitat Jaume I.
- Mofih, Y. (2017). The localized productive system: A literature review. *International Journal of Advanced Engineering, Management and Science*, 3(3). <https://doi.org/10.24001/ijaems.3.3.20>
- National Secretariat of Planning and Development (2012). Transformation of the Productive Matrix. *SENPLADES*. <https://portal.compraspublicas.gob.ec/sercop/wp-content/uploads/downloads/2014/06/Matriz-Productiva.pdf>
- \_\_\_\_\_ (2015). *Zonal Agenda Zone 3-Center 2013-2017*. 126. <http://www.planificacion.gob.ec/wp-content/uploads/downloads/2015/10/Agendazona-5.pdf>
- \_\_\_\_\_ (2020). Public Investment Ecuador. *SENPLADES*. <https://www.finanzas.gob.ec/wp-content/uploads/downloads/2020/09/INFORME-PGE-29-09-2020.pdf>
- Paunero, X., Sánchez, G. and Corona, L. (2007). Local productive systems in Mexico. *Economy Informa*. <http://www.economia.unam.mx/publicaciones/econinforma/pdfs/345/10Paunero.pdf>
- Peeters, L., Tiri, M. and Berwert, A. (2001). Identification of techno-economic clusters using input-output data: application to Flanders and Switzerland. In *Innovative cluster: drivers of national innovation systems* (pp. 251-272). OECD-Editions. [https://wissenschaftsrat.ch/images/stories/archiv/CEST\\_2001\\_Techno\\_economic\\_Clusters.pdf](https://wissenschaftsrat.ch/images/stories/archiv/CEST_2001_Techno_economic_Clusters.pdf)
- Pérez-González, M. and Castillo-Eslava, J. (2017). From colonization to decoloniality with endogenous collective consciousness: the case of Latin America. *Economic Panorama*, 25(4). <http://revistas.unicartagena.edu.co/index.php/panoramaeconomico/article/view/2090/1712>
- Pino, O. (2004). Analysis of productive chains for the regional economy, 1996 base. *Theoria*, 13. <http://www.ubiobio.cl/theoria/v/v13/6.pdf>
- Piore, M. and Sabel, C. (1984). *The second industrial divide*. Modern Library. Porter, M. (1998). Clusters and the new economics of competition. *Harvard Business Review*, 76(6). <https://hbr.org/1998/11/clusters-and-the-new-economics-of-competition>
- Ramírez, R. (2012). *Methods and techniques of regional analysis*. <http://www.economia.unam.mx/cedrus/descargas/ESTRUCTURAYDINAaMICA.pdf>
- Ramos, J., Polo, J. and Arrieta, A. (2017). Input-output analysis and public information: an application to the Colombian Caribbean. *Cuadernos de Economía*, 36(70). <https://doi.org/10.15446/cuad.econ.v36n70.58796>
- Rendón, J. and Forero, J. (2014). Local productive systems; strategies for development. *Semestre Económico, Universidad de Medellín*, 17(35). <https://revistas.udem.edu.co/index.php/economico/article/view/933/938>
- Rodríguez, A., Galaso, P., Goinheix, S. and Martínez, C. (2017). Productive specializations and regional economic development in Uruguay. *iecon Institute of Economics*. <http://desarrolloterritorial.ei.udelar.edu.uy/tti/wp-content/uploads/2019/08/DT-07-2017.pdf>
- Samuelson, P., Nordhaus, W., Pavón, L. and Blanco, C. (2010). *Economics: with applications to Latin America*: 19. McGraw Hill.
- Schuschny, A. (2005). Topics on the Input-Output Model: theory and applications. *Statistical and Prospective Studies Series*, 37. [https://repositorio.cepal.org/bitstream/handle/11362/47371/S0501011\\_en.pdf](https://repositorio.cepal.org/bitstream/handle/11362/47371/S0501011_en.pdf)
- Semitiel, M. and Noguera, P. (2004). Regional productive systems from the perspective of network analysis. *NETWORKS*, 6. [http://revista-redes.rediris.es/pdf-vol6/vol6\\_3.pdf](http://revista-redes.rediris.es/pdf-vol6/vol6_3.pdf)
- Sen, A. (1988). The concept of development. In H. Chenery and T. Srinivasan (eds.). *Handbook of Development Economics*, vol. 1 (pp. 9-26). Elsevier.
- \_\_\_\_\_ (2009). Economic development and freedom. *Apun, XXVIII* (48). <https://www.redalyc.org/pdf/4795/479549576011.pdf>
- Stiglitz, J. (2012). *The price of inequality: 1 percent of the population has what 99 percent need*. Taurus.
- \_\_\_\_\_ (2016). *The great divide: what to do with unequal societies*. Penguin Random House.
- Stiglitz, J. and Rodríguez, C. (2007). *The malaise in globalization: Vol. 140/1*. Reading Point.
- Storper, M. and Scott, A. (1988). The geographical foundations and social regulation of flexible productive complexes. *The Power of Geography*.
- Valli, V. (2018). Return and crisis of the fordist model of development. In V. Valli. *The American Economy from Roosevelt to Trump* (pp. 31-43). Palgrave Macmillan Cham. <https://doi.org/10.1007/978-3-319-96953-4>
- Vázquez, A. (2001). Local economic development policy. In *Desarrollo, económico local y descentralización en América Latina: un análisis comparativo* (p. 317). CEPAL. <https://doi.org/10.5849/jof.15-015>
- \_\_\_\_\_ (2018). Constitution, endogenous development and dynamics of institutions. *World Economic Review*, 48. <http://www.conectadel.org/wp-content/uploads/2018/04/2018-AVB-CONSTITUCION-Y-DESARROLLO-ENDOGENO-REM-48.pdf>

- Veltmeyer, H. (2010). A synopsis of the development idea. *Migration and Development*, 8(14). <https://www.scielo.org.mx/pdf/myd/v8n14/v8n14a2.pdf>
- Vidal, A. and Pezoa, C. (2016). Identification of productive clusters: application of the to the Chilean economy. *Social Science Journal*, 18(3). <https://www.redalyc.org/articulo.oa?id=28024392007>
- Villardón, J. (2015). *Introduction to cluster analysis*. University of Salamanca.
- Wang, Y., Geschke, A., & Lenzen, M. (2017). Constructing a time series of nested multiregion input-output tables. *International Regional Science Review*, 40(5). <https://doi.org/10.1177/0160017615603596>