

Socioeconomic Reality of the Rural Population of the Milagro Canton

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Abstract

In this research we applied the multivariate techniques of Factor Analysis or principal components and Cluster Analysis to a wide spectrum of relative indicators, with the purpose of extracting a reduced number of variables that reflect the different latent aspects of the socioeconomic reality of the rural localities of the Milagro canton. This will make it possible to analyze the existence of significant socioeconomic differences among the milagreños precincts and their subsequent classification into relatively homogeneous groups that can serve as a basis for the development of solutions that will benefit the localities.

Keywords: *population, socioeconomic indicators, rural development, factor analysis, cluster analysis.*

INTRODUCTION

Ecuador is a developing country, the social and economic consequences of Covid-19 restrictions have created serious social and economic concerns, especially in the homes of the most vulnerable families. The Covid-19 pandemic had socio-economic repercussions in 2020 that were reflected in an abrupt drop in real GDP of 7.8%. The impacts of the global economic crisis derived from confinement are multiple, among which education, employment, health, the digital divide and lack of opportunities stand out, were some of the parts that most affected the rural sector. (Castillo Toledo, Rodríguez Enriquez, Holguin Cedeño, & Díaz Bedoya, 2022)(Ortega Santos, Márquez Sánchez, Sorhegui Ortega, & Vergara Romero, 2021)

An in-depth analysis of the socioeconomic reality of a population makes it possible to establish the characteristics and lines of intervention suitable to its requirements without going into generalities provided by the standardization of a total population. Martínez

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Hernández tells us that to improve the development and growth of a population, education and national policy play a very important role in this field, however, Herrera, Gutiérrez and Flores, ratify that education can contribute to positive socioeconomic development and can be decisive to get out of poverty. Other authors, such as Paño Yáñez, talk about the circular economy that is expanding its social impact towards becoming a movement, as well as its transformative potential, contributing decisively to open-source solutions to social, environmental and resource problems. Fundamentally, the promotion of internal solidarity and solidarity with society that favours a commitment to local development, equal opportunities, social cohesion, the generation of stable and quality employment and sustainability are important factors for the growth of a sector.(2011) (2022)(2021) (Martínez Martín, Guilló Rodríguez, Santero Sánchez, & Castro Núñez, 2010)

The dimension of food associated with social interaction, whether with family or friends are also some of the problems they face, for Mina, socioeconomic stratification as a targeting instrument is necessary, since it identifies households that lack the ability to pay and cannot access public services on their own, in this way it is also ratified by Romero in his research. There are also variables such as territorial unity or historical periods, which are important factors in the constant socioeconomic differences between cantons in terms of political division, in Ecuador, for efficient economic planning, in all its magnitude, whether national, regional or local, that affects the improvement of the quality of life of its inhabitants. Up-to-date information on its population and localities is required, basically socio-economic information that accounts for the living conditions of the population and the basic infrastructure available.(Schnettler, 2014) (2004)(2016)(Sánchez , Lardé, Chauvet , & Jaimurzina, 2017)

Within the components of a territory (physical, biotic, socio-cultural and economic), the socio-cultural and economic aspects are what build and energize it. The present research uses factor analysis or known as principal components and the Cluster analysis handling a wide spectrum of indicators related to the physical, demographic, economic and social environments in the rural parishes of Milagro (Chobo, Mariscal Sucre and Roberto Astudillo), to obtain a reduced number of variables that reflect the different latent aspects of the socioeconomic reality of rural localities. If we appeal to examples of research, we have those of Pardo Campo & Del Campo (Verduga, 2011) (2007), Rodríguez (2010), Bridle (2012) and Arias (2019), which used the same statistical methods that we are implementing in our research. On the other hand, Rodríguez Muñoz tells us that socioeconomic studies not only manage to show a perception of the economic and social reality with respect to certain social indicators, but also show the need for a change in policy regarding the economy and society that maintains the benefit to the great majority. (2017)

METHODOLOGY

In a first stage, and after knowing the corresponding 36 selected indicators, we apply the technique of factor analysis or main component in order to identify, if possible, those indicators that are expressing the same latent (or unmeasured) aspect of the socioeconomic reality of the Milan enclosures and, simultaneously, to be able to explain this reality through a small number of indicators that adequately summarize the information contained in the initial indicators. The results obtained will be used to identify groups of precincts with similar socioeconomic characteristics through a Cluster Analysis.

Description of the data

In this work we make use of the official statistics prepared by the project entitled "Socioeconomic reality of the rural population of the Milagro canton" financed by the

Agrarian University of Ecuador, in it we can find data related to the physical, demographic, economic and social environments of any territorial area of the Milagro canton.

Table 1: Socioeconomic indicators

Indicators	Code
• Families on site	X5, X12, X22
• Trash Pickup Services	
• How to Dispose of Trash	
• Establishment of basic education	X6, X20, X21
• The educational establishment resides	
• Time to get to schools	
• Where it works	X17, X18, X19
• Monthly Income from Occupation	
• Total Monthly Household Income	
• Drinking water	X11, X29, X38
• Agricultural viability	
• Access routes to the site	
• Harvest Reception or Storage Center	X33, X35
• Consulting room	
• Private Health Insurance	X15, X34, X36
• Public Health Center	
• On-site restaurants	
• Older Adults in Homes	X3, X4, X37
• Minors in homes	
• Farmer's Insurance	
• Private Health Insurance	X13, X14, X24,
• Means of transport	X26
• Predominant material of the dwelling	
• Internet Service	
• Electrical energy	X10, X30
• Rural electrification	
• Men's level of education	X27, X28
• Women's level of education	
• Unemployed women	X7, X8
• Unemployed men	
• Is the head of the household currently working?	X16, X23, X31
• Type of housing	
• Receive financial aid from the government	
• Establishments with economic activity	X9, X25, X32
• Immigrant Household Member	
• Population center	

Authors' own elaboration: 2023

RESULTS

Results of Factor Analysis or Principal Components

This multivariate statistical technique of information synthesis, which has as its central idea of reducing dimensionality and forming a small number of subsets of a dataset in which there are a large number of interrelated variables. Therefore, as indicated before in the description of the socioeconomic indicators of the rural population of the canton of Milagro, we base it on the joint behavior of the 36 indicators already described, a previous step for the application of factor analysis or principal components. (Pillaca Montes, 2018)

In this case, the results obtained from the latent indicators of the socio-economic reality of rural parishes are as follows:

The data entry into the software is considered observations, corresponding to the number of cases observed, which is 793, thus forming a total of 13 components, of 36 previously standardized indicators, having a treatment of values lost by the listwise elimination, a method mostly used, since it assumes that the missing data follow a pattern that disappeared completely randomly. In order to proceed to work only with the observations available in all the indicators, in short, that the information is complete. Table 2 shows the percentage of variance, the eigenvalue (eigenvalues) and the cumulative percentage associated with the 13 principal components found.

Table 2: Cumulative percentage of variance associated with the 13 components

Number of Components	Eigenvalue	Variance %	Cumulative %
Component 1	2,904	8,066	8,066
Component 2	2,474	6,872	14,938
Component 3	2,436	6,767	21,704
Component 4	1,954	5,429	27,133
Component 5	1,78	4,943	32,077
Component 6	1,724	4,788	36,864
Component 7	1,617	4,492	41,356
Component 8	1,583	4,397	45,753
Component 9	1,491	4,142	49,896
Component 10	1,346	3,738	53,634
Component 11	1,345	3,735	57,37
Component 12	1,286	3,572	60,942
Component 13	1,179	3,275	64,217

Authors' own elaboration: 2023

The thirteen components retained by the software, according to the criterion based on selecting those corresponding to eigenvalue (eigenvalues) greater than unity, explain 64.21% of the total variability, a more than acceptable percentage, taking into account the relative studies of the Social Sciences where it indicates that the lower the percentage we are losing, the more information we are losing. as the admissibility limit must be less than 60%.

After looking at the weight of each component, we need to check what indicators are in each component to determine the name based on the resulting relationship. The objective

of the interpretation of the factorial matrix or component scoring coefficient matrix is to identify each of the latent dimensions extracted from the project database. Therefore, for each factor or component, the initial indicators that have the highest correlations with the factor (close to +1 or -1) are chosen.

There are several ways to interpret a indicator reduction chart. Perhaps the most correct and comprehensible is to say that this type of analysis is a particular case of principal component factor analysis (PCA), and differs basically in the following respect: whereas a PCA tries to summarize the number of variables or indicators involved in an analysis by constructing new, more synthetic composite indicators (or factors). The extraction method used was the Varimax rotation method with Kaiser normalization, in Table 3 you can see a conformation of 13 components, out of a total of 36 indicators. In this case, as the variables were named with the letter X and a corresponding number.

Table 3: Component Score Coefficient Matrix

	COMPONENTS												
	1	2	3	4	5	6	7	8	9	10	11	12	13
X3	-0,04	0,00	-0,08	-0,06	-0,01	0,01	0,47	-0,08	-0,07	0,39	0,13	0,00	0,07
X4	0,01	-0,13	0,01	-0,02	0,03	0,04	-0,28	0,11	0,08	-0,03	0,10	-0,20	0,09
X5	-0,28	0,09	-0,02	0,04	0,10	0,09	0,07	0,00	0,04	-0,11	-0,09	-0,05	0,00
X6	-0,03	0,35	0,08	0,07	-0,02	-0,01	0,02	0,05	-0,02	-0,07	-0,09	-0,04	0,07
X7	0,01	0,04	-0,07	0,10	-0,05	0,04	-0,07	0,07	-0,07	-0,06	0,04	-0,05	0,03
X8	0,04	-0,04	0,07	-0,01	0,05	0,01	0,16	0,02	0,08	-0,02	0,60	-0,02	-0,07
X9	0,11	0,10	0,05	0,09	0,11	-0,03	-0,05	0,06	-0,16	-0,09	-0,05	-0,03	-0,41
x10	-0,05	0,01	0,02	-0,04	0,02	-0,01	-0,01	0,05	0,51	0,09	0,12	0,02	-0,09
X11	-0,09	0,05	0,03	-0,44	0,00	0,00	0,03	0,07	0,00	0,02	0,06	-0,04	0,06
X12	0,30	-0,02	-0,02	0,07	-0,02	0,01	0,00	-0,08	0,11	0,02	0,05	0,04	0,22
x13	-0,10	-0,01	0,07	-0,13	0,02	0,07	-0,11	0,29	-0,01	0,01	-0,05	0,02	-0,35
X14	0,01	0,01	0,05	-0,01	-0,02	-0,04	0,03	0,04	0,03	0,01	0,03	-0,06	0,05
x15	0,00	-0,06	-0,02	0,03	-0,08	0,05	-0,04	-0,09	0,00	-0,01	-0,07	-0,04	-0,05
X16	-0,06	0,09	-0,20	0,09	-0,07	0,07	0,17	0,11	-0,08	0,19	0,12	-0,37	-0,09
x17	-0,05	-0,04	-0,28	-0,01	-0,02	0,05	-0,13	-0,09	0,01	0,11	0,05	0,24	-0,06
x18	-0,03	0,01	0,36	-0,03	0,01	0,06	-0,06	0,02	0,03	0,04	0,00	0,05	0,01
x19	0,03	-0,01	0,37	0,00	0,01	0,03	-0,14	0,00	0,03	0,07	0,07	0,11	0,01
X20	-0,04	0,36	-0,05	0,04	-0,04	-0,04	-0,02	-0,05	0,01	0,04	0,06	0,02	0,02
X21	-0,09	0,32	-0,02	-0,09	0,03	-0,02	0,02	0,04	0,01	0,06	0,04	-0,01	-0,01
X22	0,28	0,05	-0,04	0,14	-0,03	-0,01	0,01	-0,04	0,07	-0,01	0,05	0,04	0,16
X23	0,10	-0,16	-0,03	-0,17	-0,01	0,05	0,08	0,17	-0,19	0,16	0,04	0,27	0,16
X24	0,11	-0,09	-0,01	0,07	-0,06	0,05	0,09	0,16	0,08	-0,02	-0,13	0,11	-0,04
x25	0,05	0,05	0,12	-0,07	0,04	0,00	-0,08	0,23	-0,15	0,00	-0,09	-0,01	0,58
X26	-0,06	0,07	-0,08	0,04	0,09	-0,04	-0,07	0,37	-0,03	0,03	0,15	0,08	0,07
X27	0,01	-0,05	0,03	-0,06	0,00	0,03	0,03	0,08	0,14	0,62	0,02	-0,06	-0,02

x28	0,01	0,05	-0,02	0,06	0,06	-0,02	-0,07	-0,06	-0,07	0,48	-0,06	0,04	0,09
X29	0,08	0,00	0,02	0,43	-0,01	0,04	0,01	0,08	-0,05	0,03	0,08	0,00	-0,04
X30	0,04	-0,04	0,04	-0,02	-0,02	0,00	-0,03	-0,04	0,51	-0,01	-0,08	0,01	0,01
X31	0,02	-0,04	0,03	-0,09	0,01	0,04	0,00	-0,02	-0,03	0,03	0,06	-0,05	0,06
X32	0,24	0,01	0,07	0,11	-0,01	0,03	-0,03	0,07	-0,11	-0,02	-0,02	-0,04	-0,26
X33	-0,08	0,04	-0,01	0,02	0,51	-0,06	-0,03	-0,02	-0,02	0,01	0,08	0,11	0,00
x34	0,00	-0,03	0,08	-0,05	-0,05	0,44	0,04	0,11	0,00	0,05	0,14	-0,05	0,00
x35	0,02	-0,07	0,08	-0,09	0,46	-0,07	-0,01	0,01	0,01	0,10	-0,03	-0,13	-0,06
X36	-0,04	0,06	-0,10	0,48	0,24	0,28	-0,03	-0,19	0,01	-0,06	-0,05	0,09	0,10
x37	-0,03	0,03	-0,03	0,54	-0,01	-0,02	0,50	0,13	0,08	-0,09	0,06	-0,18	-0,07
x38	-0,21	0,25	-0,08	0,03	-0,06	-0,09	0,00	0,03	-0,01	0,13	0,23	0,18	0,06

Authors' own elaboration: 2023

For the compression of each component, the coefficients or load have been placed in colored boxes, specifying the indicators that have the greatest significance in the respective components, explaining to themselves the terms of the socioeconomic indicators of the enclosures.

Component one has a strong association with 3 of the 36 indicators studied, which explain 8.06% of the total variability. This component was called "HOUSEHOLD WASTE MANAGEMENT", thus reflecting the treatment of organic waste from the premises. It must be taken into account that most of the load coefficients are positive, they are associated with the fact that the facilities lack the garbage collection service, the simple reason that many facilities do not have adequate streets to receive this service, although this service is charged and that many families do not receive it choose to burn the waste by polluting the air little by little.

In component two, it has an association with 3 of the 36 indicators studied, which explain 6.87% of the total variability. Thus naming the component as "EDUCATIONAL ACTIVITY", because the indicators found here have to do with the educational environment in the campuses such as: basic education establishment, residence of the educational establishment and time to reach the educational establishments, these three indicators denote the lack of interest in education, for the simple reason that many of the establishments are not in operation and for which many families send their children to the center of the city to study.

With respect to component three, it has an association with 3 of the 36 indicators studied, which explain 6.76% of the total variability. Thus naming the component as "ECONOMIC ACTIVITY", so its indicators found are: where they work, monthly income from the occupation and total monthly household income, most of the families in the precincts earn below the basic salary, thus implying that they cannot even cover the expense of the basic basket.

Component four, called "PROVISION OF SERVICES AND TERRESTRIAL INFRASTRUCTURE", has an association with 3 of the 36 indicators studied, which explain 5.42% of the total variability. In this component, very important indicators were found that denote how the enclosures have been developed, the lack of drinking water, a vital resource for human beings, is not perceived by the families, the access roads that make it impossible for producers to sell their product, sometimes making it impossible to reach the health centers on time, and finally the agricultural viability that many families are no longer dedicated to food production when there is a lot of land fertile to be able to cultivate.

Component six, called "HEALTH AND WELL-BEING", has an association with 3 of the 36 indicators of the study, which explain 4.78% of the total variability. In this component, these two indicators are highlighted, private health insurance and public health center, since this service is lacking in the facilities, for each parish there is only one public health center, leaving aside the lack of care and medicines, sometimes the facilities are assisted by medical brigades but not all the facilities enjoy that opportunity. For the reason of access to it, many families choose to go to the city center or visit other cantons to be assisted or operated on in emergencies.

"DEMOGRAPHIC DIMENSION" was the name given to component seven, which has an association with 3 of the 36 indicators studied, which explain 4.49% of the total variability. The indicators found in this component are older adults and minors in the households within these indicators it was possible to perceive a large population of these two ranges, half of the older adults surveyed do not have peasant insurance. This shows the difficulties they face at the advanced age they have.

Component nine, called "ELECTRICAL SERVICES", is associated with 2 of the 36 indicators studied, which explain 4.14% of the total variability. The indicators that defined the name of this component are the electrical service and rural electrification, these two services do not present any difficulty to the enclosures, what is missing for them is public lighting on the roads, since for emergencies they must leave very late, the roads are very dark causing accidents and robberies on the roads.

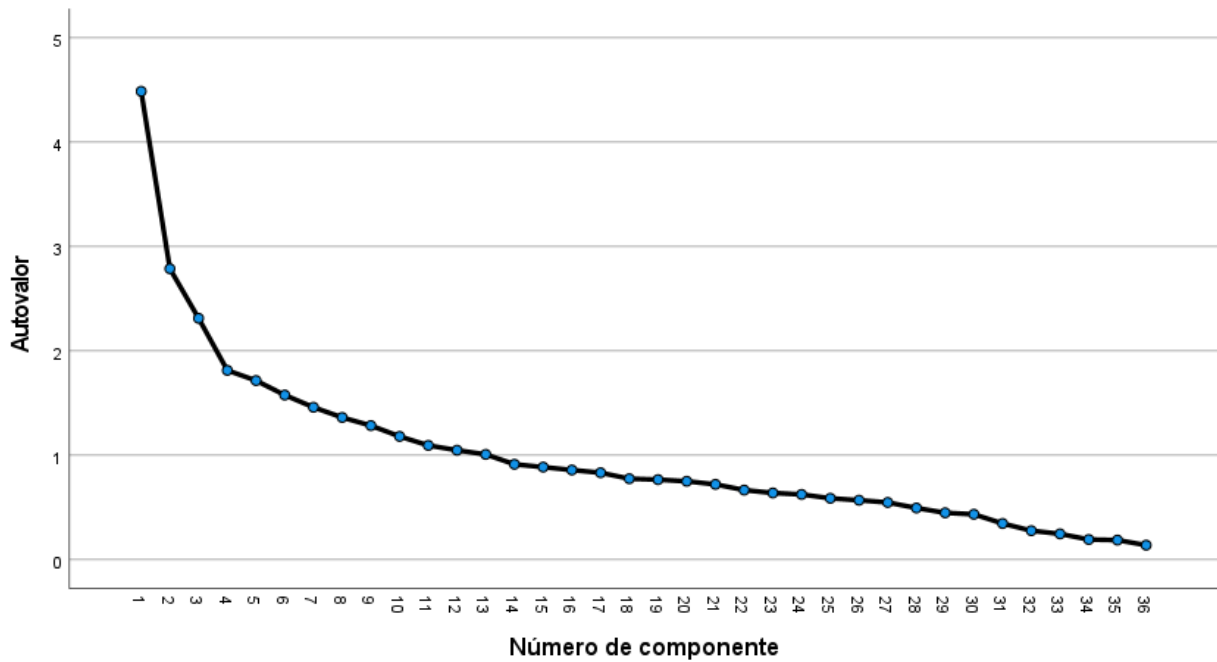
Component ten, in which 2 of the 36 indicators of the study are associated, and these explain 3.73% of the total variability. It was called "LEVEL OF TRAINING", since there are the indicators of instruction of men and women, in this case the greatest education they have in a general way is secondary education, also noting that people without studies are few, what could be perceived is that people only get to study secondary school with the maximum of study without venturing into higher education, many of them indicated that due to the lack of resource they do not aspire to study.

"LEVEL OF UNEMPLOYMENT" was the name given to component eleven, which has an association with 2 of the 36 indicators studied, which explain 3.73% of the total variability. As its name indicates, unemployment is unemployment between men and women, noting that, if there is a higher degree of unemployment in women, unlike men who manage to have more opportunity due to the issue of agricultural work that these activities require.

In the last component it was called "LOCAL DEVELOPMENT", in this component the indicators establishments with economic activity, immigrant household member and population center were found, the lack of job opportunities and the increase in the cost of economic establishments have caused people to migrate to other localities to improve the economic situation they face. Therefore, it has an association with 2 of the 36 indicators of the study and these explain 3.27% of the total variability.

Finally, components five, eight, and twelve were not called by a specific name for the reason that they only have a numerical relationship but no conceptual relationship. All of the above is shown in Figure 2, a graph of sedimentation of the enclosures where the 13 components can be seen.

Figure 1: Enclosure sedimentation graph



Authors' own elaboration: 2023

Results of the Cluster Analysis

As indicated in the introduction, the next step in this study is the use of a hierarchical method of agglomeration, known as a cluster analysis, it is a statistical method of the development of business networks at the local and regional levels, based on cooperation and joint action to the socioeconomic indicators established from the beginning of the research for the precincts of the three rural parishes of the canton of Milagro. to form clusters of precincts that are homogeneous in terms of the socioeconomic characteristics summarizing these indicator variables and so that these characteristics differ as much as possible for precincts belonging to different groups. As for the reasons that may maintain the relevance of the use of a hierarchical method against the non-hierarchical one, we can argue that the hierarchical method is especially indicated when, as in the case, the data set is very large. (Corrales C, 2007)

Table 3: Description of the cluster groups formed

Group #1	Venues (Vuelta Piano 2, Vuelta Piano 1, Las Palma 1, Las Palmas 2, La Cristalina 2, Chaparral, América Pérez, Los Cachiotes, La Cristalina 1 and Alegría de Dios).
Group #2	Enclosures (Finca Sánchez, Los Palmares, Cerecita, Estero Verde, Los Aguacates, Piñoelal, Bananeros Unidos, Bellavista and Rancho el Sol).
Group #3	Venues (San Francisco de Guabi, Flor de Bosque, Venecia de Chimbo, La Carolina, Guabo, San Antonio, Maravilla 2, Beldaco, Venecia Central, Manga de Jején, San Francisco, Galapagos, Campamento, Legía 2 and La Libertad).
Group #4	Venues (El Paraíso, Santa Rosa de Chobo, La Unión, Linderos de Venecia and El Carrizal).
Group #5	Venues (Papayal, Las Guayjas, Cristo del Consuelo, Córdova, Paz y Bien, Legía 1, Rayito de Luz and Revesa).

Authors' own elaboration: 2023

This dendrogram (Figure 2) was created using a final partition of 5 clusters, which occurs at a similarity level of approximately 50. The first cluster (upper left end) is made up of ten enclosures, the second cluster, immediately next to the first, is composed of nine enclosures, the third group is composed of 15 enclosures, the fourth conglomerate is composed of five enclosures, and finally the last conglomerate at the lower left end, is composed of eight enclosures. If we were to cut the distance of the dendrogram higher, then there would be fewer final clusters, but their level of similarity would be lower. If we were to cut the distance of the dendrogram lower, then the level of similarity would be higher, but there would be more final clusters. In this case, an average distance was defined to better measure the groups formed within the dendrogram.

On the other hand, knowing that the shorter the distance the conglomerates are more homogeneous, it is convenient to stop the joining process when the horizontal lines are very long: in our result the process was stopped at distance 15, as shown in Figure 1 (parallel dashed lines); obtaining five clusters from a total of 47 precincts in the rural parishes of the canton.

To gain an in-depth understanding of the characteristics of each cluster group of the enclosures based on the indicators used in Table 1, provide more information on the indicators. On the other hand, the SPSS explore option can be very useful to get a basic overview of the resulting clusters, as summarized in Figure 2:

- The first cluster is characterized by grouping the smallest single-line campuses, which have few basic education establishments, few establishments with economic activity, scarce drinking water service, garbage collection services, long distance from educational establishments, long time to reach educational establishments, poor process for garbage disposal, type of housing, predominant material of the dwelling, population center, few reception or harvest storage centers, few clinics and restaurants on the premises.
- The second cluster includes slightly larger three-line facilities, with a lower proportion of electricity, drinking water, private health insurance, transportation, scarce opportunity to work for the head of the household, internet services, rural electrification, and peasant insurance.
- The third cluster includes campuses with a greater number of lines, with a greater number of older adults in households, families in the facility, lower monthly income from the labor occupation, total monthly household income, greater

members of the immigrant household, with a low level of education of men and women, scarce public health center and clinic.

- The fourth cluster includes facilities with a smaller number of lines, with greater agricultural viability, little economic aid from the government, few reception or storage centers for harvests, clinics and access roads to the site in poor condition.
- And finally, the fifth cluster includes facilities with a smaller number of lines, with a greater number of minors in homes, greater cases of unemployed women and men, with a medium development of accommodation area for visitors, with few opportunities in the labor system and few public health centers.

CONCLUSION

The 47 precincts that make up the Milagro canton of the rural parishes (Chobo, Mariscal Sucre and Roberto Astudillo) have been grouped into five clusters that, based on the average scores achieved in them by the factors, we have concluded that most of the precincts face extreme difficulties due to problems such as monthly family income, the lack of employment and, most importantly, access to basic services. Not to mention that the predominant economic activity in the study localities is traditional agriculture.

Finally, the results obtained show not only the socio-economic heterogeneity existing between precincts of the different rural parishes of the canton but also the fact that geographical proximity between precincts does not necessarily mean proximity in terms of socioeconomic level. It is also possible to support the idea that the actions of the public administrations of the parishes are not seen and for this strategic development actions must be designed through rural development groups and the preparation of sustainable development plans.

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