https://repository.uaeh.edu.mx/revistas/index.php/jas/issue/archive

Journal of Administrative Science

Biannual Publication, Vol. 6, No. 12 (2025) 10-18

ISSN: 2683-2119

Concentration factors of manufacturing companies in the State of Guanajuato: A cluster analysis

Factores de concentración de las empresas manufactureras en el estado de Guanajuato: Un análisis de cluster

Clara A. Rodríguez-Sánchez [a], Alejandra López-Salazar[b], Jesús E. Rocha-Ibarra[c]

Abstract:

The geolocation of enterprises is an alternative for the regional development of small economies (Alegría et al., 1995). This research aims to group the cities of the State of Guanajuato into clusters based on the agglomeration factors that manufacturing companies have in common and to generate a business profile in this context. The research will be non-experimental, analyzing variables of the manufacturing sector such as Companies, Employment, Gross Value Added Census GCVA, transport costs, innovation, wages, daily hours worked, investment in gross fixed capital formation, economies of scale, Total Gross Production TGP, schooling and population by cities. The analysis technique is the hierarchical cluster using the Ward method to determine the essential factors in the business agglomeration based on the Euclidean distance, structuring a dendrogram with the resulting clusters. The results identify the agglomeration of cities in three clusters. The first cluster includes 28 cities whose business profile stands out for the economies of scale and the low level of schooling to which they have access. The second cluster includes 11 cities that have a medium-high educational level in common and whose companies are interested in accessing innovation. The third cluster includes seven cities in which manufacturing company salaries are not competitive. In conclusion, it is necessary to manage the factors used by manufacturing companies in Guanajuato to promote a decent development environment because family income from salaries improves people's well-being, quality of life, and regional economic growth.

Keywords:

Manufacturing companies, Cluster, Guanajuato, Ward's hierarchical method

Resumen:

La geolocalización de empresas es una alternativa para el desarrollo regional de las pequeñas economías (Alegría et al., 1995). El objetivo de esta investigación es agrupar las ciudades del estado de Guanajuato en clusters a partir de los factores de aglomeración que tienen en común las empresas manufactureras, y generar un perfil empresarial en este contexto. La investigación será no experimental, analizando variables del sector manufacturero como Empresas, Empleo, Valor Añadido Bruto Censo GCVA, costes de transporte, innovación, salarios, horas diarias trabajadas, inversión en formación bruta de capital fijo, economías de escala, Producción Bruta Total TGP, escolarización y población por ciudades. La técnica de análisis es el clúster jerárquico utilizando el método de Ward para determinar los factores importantes en la aglomeración empresarial a partir de la distancia euclidiana, estructurando un dendrograma con los clusters resultantes. Los resultados identifican la aglomeración de ciudades en tres clústeres. El primer clúster incluye 28 ciudades cuyo perfil empresarial destaca por las economías de escala y el bajo nivel de escolarización al que tienen acceso. El segundo clúster incluye 11 ciudades que tienen en común un nivel educativo medio-alto y cuyas empresas están interesadas en acceder a la innovación. El tercer clúster incluye 7 ciudades en las que los salarios de las empresas manufactureras no son competitivos. En conclusión, es necesario gestionar los factores que utilizan las empresas manufactureras en Guanajuato para promover un entorno de desarrollo digno, porque el ingreso familiar proveniente de los salarios contribuye a mejorar el bienestar, la calidad de vida de las personas y el crecimiento económico regional.

Palabras Clave:

Empresas manufactureras, Clúster, Guanajuato, Método jerárquico de Ward

[a] Corresponding author, Master´s student University of Guanajuato, https://orcid.org/0000-0002-0330-382X , Email: ca.rodriguez.sanchez@ugto.mx

[b] Research profesor, University of Guanajuato, https://orcid.org/0000-0003-3927-9603 , Email: lopez.alejandra@ugto.mx

[c] Research profesor, Universiy of Guanajuato, https://orcid.org/0000-0002-0838-3902 , Email: je.rocha@ugto.mx

Received: 07/08/2024, Accepted: 11/09/2024, Published: 05/01/2025

DOI: https://doi.org/10.29057/jas.v6i12.13495

Introduction

Companies in the manufacturing sector have common elements and factors that allow the states of the republic to compete as a group of companies with the rest of the country and the world. According to Alegría et al. (1995), the distribution of economic activity in the territory is uneven. In this way, the authors explain that the geolocation of companies concentrated in clusters can be considered as an alternative for the regional development of small economies.

The research idea is based on the business environment in the State of Guanajuato, which is characterized by manufacturing activities as a source of employment for the population. The State's industrial tradition is based on manufacturing production, which brings many questions and areas of opportunity that can be managed through business studies.

The objective of this research is to group the cities of the State of Guanajuato into clusters based on the agglomeration factors that manufacturing companies have in common and to generate a business profile in this context.

The structure of this work consists of a literature review, materials and methods, results, discussion, and conclusions.

Literature Review

1. Cluster Building and Business Development

According to Corrales (2007), Pinto et al. (2023), and Bouchra & Hassan (2023), a cluster is defined as a dense grouping of companies in a geographical territory that belongs specifically to a sector and is linked by similar characteristics.

Mungaray (2017) and Xu et al. (2023) explain that company interaction generates networks with multiple benefits. These connections can be appreciated through actions based on dialogue and, paradoxically, on competition. In this sense, the promotion and creation of competitive factors are fundamental in the industrial organization circumscribed in a region through clusters.

Porter (1980) and Yoyo et al. (2023) explain that domestic firms are subordinated to the environment in which they develop and compete, whose economic conditions they need to manage to survive.

2. Determinant factors of business concentration

Barajas (2019) points out that characteristics of first nature, that is, factors related to physical geography, usually explain the concentration of business activities in clusters: provision of natural resources, proximity to ports and borders, and others.

In this sense, according to Hernandez (2019), economies of scale are the capacity developed by a company to massify its production volume, which translates into lower operating costs. In this line of thought, Krugman (1992) explains that, due to economies of scale, there is an incentive to concentrate massive volume production in a single region due to transportation costs, holding all else constant, it is more profitable to produce in a conglomerate that offers a large market, workforce and suppliers than to move the product over long distances.

In this context, Ascani (2012) mentions transportation costs as a crucial factor influencing concentration strategies, as companies will search to locate where they have greater access to their target market.

According to Krugman (1992) and O'Leary et al. (2023), market size facilitates economies of scale. Although conceptualized as a centripetal force, it can also act as a centrifugal force since a large market size can inflict high congestion costs and discourage geographic concentration. The simplest way to integrate this variable into the geographic concentration analysis is through the selected city's population data.

In other studies, Perroux (1998), Mendi (2023), and Del Olmo-García et al. (2023) explain that industry development is associated with the technological level and the possibility of technology transfer, which is given by the interconnection of actors that generate knowledge and circulate between institutions and companies.

3. Guanajuato state and manufacturing sector

The case of Guanajuato is relevant because it reflects the different trends that characterize Mexico's industrial development. Moreno & López (2020) point out that the incorporation of a modern and more dynamic industrial sector, on the one hand, and the preservation of traditional sectors, on the other, have contributed to the creation of Guanajuato's industrial image, in addition to the remnants of the parastatal industry in the petrochemical sector. However, over 30 years, the State's per capita Gross Domestic Product GDP has represented almost three-quarters of the national per capita GDP.

The population in Guanajuato, according to SCINCE data (2020), was counted as 6,166,934 inhabitants, of which 48.6% are men and 51.4% women, the age ranges that concentrate more population are between 15 to 19 years with 552, 092 inhabitants. In this sense, the Economically Active Population (EAP) of the entity was counted until the last census as 2. 9 million people, its employed labor force represented 2.81 million people, of which 40.9% are women and 59.6% men, with an average monthly salary of 4,430.00 pesos, and an unemployment rate of 3.18%.
Guanajuato has also stood out in international sales of manufacturing industry products with a total of 19,829 million dollars in 2023, of which 3,819 million dollars was for parts and accessories for automotive vehicles, 627 million dollars for sales of footwear with rubber, plastic, natural or regenerated leather soles, and 594 million dollars for sales of products such as wire and electrical cables (Ministry of Economy, 2023).

According to Sistema Automatizado de Información Censal SAIC data (2019) (a), the economic sectors that have concentrated many companies in the State are retail trade, with 107,516 companies, other services except government activities, with 31,140 companies, and manufacturing industry, with 31,508 companies. Of these, 16,286 received some type of financing.

In this region, the manufacturing industry had the highest internet purchases, with a total of 91,385 million pesos and $78,881 million pesos from internet sales (SAIC, 2019 (b)).

Sánchez Juarez & Moreno Brid (2016) mention the need to build a strengthened endogenous industry, dependent on local resources, that promotes work in cities, which adds to social well-being through the conditions that manufacturing companies offer to the population.

In another of his studies, Sanchez Juárez (2024) assures that Mexico is experiencing a process of deindustrialization that hits the manufacturing sector. On the other hand, this process is a driver of taking advantage of the regional conditions that the states of the republic offer to compete and generate business advantages.

Gómez-Zaldivar (2023) explains that the municipal governments in Guanajuato have joined the efforts to strengthen the manufacturing industry, public policies participate as an ally to promote decent conditions and economic development, which is why some of the actions carried out in Celaya and León, two of the most essential municipalities in terms of manufacturing, are related to the spatialization and diversification of their activities.

Materials and methods

The strategy for this research is non-experimental because the variables (economies of scale, transportation costs, wages, linkages, market size, innovation, human capital, population by municipality, and so forth.) have already occurred and cannot be manipulated. In addition, it is cross-sectional and descriptive since it seeks to examine the level or status of one or more variables in a population at a single point in time, in addition to allowing comparative descriptions to be made between groups or subgroups.

The statistical sample for this research corresponds to the characteristics of non-probabilistic sampling, understanding that non-probabilistic samples are selected according to criteria based on the researcher's reasons and the research problem. This sample corresponds to the 46 cities in the State of Guanajuato. In this order of ideas, the agglomeration of companies through clusters and their study through this approach is open, as López Castro (2016) refers, since the criteria depend on the researcher to integrate the number of companies and sectors that constitute the cluster. Table 1 shows the operationalization of the variables to be analyzed in the 46 cities of the State of Guanajuato.

Table 1. Operationalization of the variables of analysis

Variable	Definition	Source
Companies in the manufacturing sector 31-33	Number of companies that are primarily engaged in one type of industrial activity.	Sistema Automatizado de Información Censal SAIC (2019) (C).
Employment in the manufacturing sector 31-33	Includes all persons who worked during the reference period (2018), whether or not contractually dependent on the business entity, subject to its direction and control.	Sistema Automatizado de Información Censal SAIC (2019) (d).
Wages in the manufacturing sector 31-33	Normal and extraordinary payments and contributions, in cash and in kind, before any deductions, to remunerate the work of the company's employees. Total salary is the result of dividing remunerations/employ	Sistema Automatizado de Información Censal SAIC (2019) (e).

	ed personnel by the number of employees.	
Market Size	Population of the selected city	Sistema de Consulta de Información Censal SCINCE (2020) (b).
Total Gross Production of the sector 31-33	It is the value of all goods and services produced or marketed by companies as a result of their activities, including the value of manufactured products, income from the provision of services, and the rental of machinery and equipment.	Sistema Automatizado de Información Censal SAIC (2019) (f).
Manufacturing Gross Census Value Added, sector 31-33.	Arithmetically, the Gross Censal Value Added (GCVA) results from subtracting Intermediate Consumption from Total Gross Production.	Sistema Automatizado de Información Censal SAIC (2019) (g).
Economies of scale	It results from the quotient of employment and the number of companies.	Banco de Información Económica (2019), Ascani (2012), Barajas (2019)
Transportation Costs	Interaction of the road distance from the selected municipality to the nearest border crossing point and the evolution of the cost of diesel.	Comisión Reguladora de Energía, (2019), Finanzas Publicas INEGI (2019).
Human capital	Percentage of population 15 years of age and older with high school level completion	Sistema de Consulta de Información Censal SCINCE (2020) (c).
Investment in Gross Fixed Capital Formation	This is the value of fixed assets purchased by the company (domestic or imported, new or used), less the value of fixed asset sales made.	Sistema de Información Censal SAIC (2019) (h).
Innovation	It is obtained through the following calculation: ((X / (P/1,000,000)) X=Patents requested per state; P=Population of the municipality per million inhabitants.	Instituto Mexicano de la Propiedad Industrial (2019), Consejo Nacional de Población CONAPO (2019) (a).
Daily working hours	Average hours worked in 2018 by paid personnel include regular and overtime hours spent on activities.	Sistema de Información Censal SAIC (2019) (i).

Source: own elaboration

Ward's method for cluster analysis

The method chosen to determine the number of clusters and to analyze the characteristics of each of them is Ward's method, which allows an analysis of groupings according to similar characteristics that, in turn, make them an independent group, calling them clusters according to a series of variables. The method used to identify these characteristics and their similarities by groups or clusters is Ward's hierarchical method, which minimizes variances (distances) and generates clusters with more remarkable similarities (Flores & Medina, 2018; Gere, 2023).

Ward's method uses the distance between objects that satisfies the objective of joining the two objects that increase the intraclass inertia the least at each step of the agglomeration process. Let A and B be two non-empty and disjoint objects, and let pA, pB, and gA, and gB be their weights and centroids, respectively. The Ward distance between the two groups, as a function of the canonical Euclidean distance d, is given by:

$$W(A, B) = (pA\ pB / pA + pB)\ d\ 2\ (gA - gB) \quad (1)$$

For this case study, the 46 cities of the State of Guanajuato were considered, therefore the distance of the district is given by:

$$W = (px\ py / px + py)\ d2 \quad (2)$$

Where

W= Ward's method value,

Px= Each of the selected variables that determine the geographic concentration of the manufacturing companies,

Py= Each of the cities in the sample, D= Euclidean distance

In the SPSS statistical program, this distance is obtained by selecting the Euclidean distance using the Ward method. The interpretation of the groups' results is represented by the graph "Dendrogram ."This type of graph provides a convenient way to identify clusters.

These clusters will be grouped according to the importance or euclidean distance between cities and the importance of the variables that determine the concentration of their manufacturing companies.

The database variables were standardized using the natural logarithm function derived from the diversity in each variable's scale.

Results

When analyzing the variables from the Euclidean distances by Ward's method for creating clusters, three main clusters are formed. In Table 2, we show the report with the description of each cluster by variable of analysis of the State of Guanajuato where the description of the means of the Euclidean distances in each cluster are concentrated, the number of cities that make up each cluster and their standard deviation, as mentioned by Alegría (1995) and Hirose et al (2023), the minimum euclidean distance will indicate the variable with the greatest weight for each cluster.

It should be noted that the value of each variable depends on its nature. A high value in the mean is not indicative of a favorable scenario for the general environment of Guanajuato. For example, a high level in the mean of transportation costs does not indicate an advantage; on the contrary, it will be sought that transportation costs are minimized to obtain economic benefits for the companies.

Table 2 shows that the variable of importance in the concentration of manufacturing companies in Guanajuato are: for cluster 1 employment, since in the State were generated in 2018, 499,649 jobs in the manufacturing industry, while for cluster 2, the predominant variable of concentration was the schooling of human capital that although it shows a minimum value of 2.106 (with 7. 9 years of schooling) this symbolizes advantages for the companies since by hiring low-skilled labor they will be able to offer low wages, this data is verified with the trend of cluster 3 which is the cluster with the lowest wages, and which is corresponding with the years of schooling of 7.8 in the population of its municipalities (2.051).

In this order of ideas, the main factor driving company concentration is the attractive wages (7.76) for the workforce in cluster 2, where the fifth largest city in Mexico, León Guanajuato, is located and is one of the capital cities of manufacturing in the State.

Table 2. Cluster description by analysis variable

Analysis variables	Descriptions	Cluster 1	Cluster 2	Cluster 3
Companies	Mean	5.486	6.857	3.681
	N	28	11	7
	Standard deviation	1.052	1.111	0.393
Employment	Mean	7.365	10.05	4.627
	N	28	11	7
	Standard deviation	1.204	1.078	0.555
Wages	Mean	4.405	7.760	0.871
	N	28	11	7
	Standard deviation	1.485	1.354	0.444
Market size	Mean	11.25	11.10	9.977
	N	28	11	7
	Standard deviation	1.252	0.942	1.037
TGP	Mean	6.540	6.200	6.240
	N	28	11	7
	Standard deviation	0.779	0.974	0.911
Manufacturing GCVA	Mean	5.511	9.426	1.848
	N	28	11	7
	Standard deviation	1.595	1.302	0.795
Economies of scale	Mean	1.879	3.199	0.944
	N	28	11	7
	Standard deviation	0.710	0.676	2.052
Transportation cost	Mean	6.594	10.71	2.791
	N	28	11	7
	Standard deviation	1.694	1.418	0.689
Human capital	Mean	2.099	2.106	2.051
	N	28	11	7
	Standard deviation	0.104	0.087	0.076
Investment gross fixed	Mean	4.995	6.501	17.11

capital formation				
	N	28	11	7
	Standard deviation	5.322	1.657	1.794
Innovation	Mean	4.892	2.820	16.80
	N	28	11	7
	Standard deviation	4.519	1.294	1.513
Daily working hours	Mean	2.242	2.220	2.225
	N	28	11	7
	Standard deviation	0.119	0.075	0.126

Source: own elaboration

Figure 1 shows the formation of three clusters among the municipalities of the State of Guanajuato based on the selected variables that determine the concentration of manufacturing businesses. In this case, it is observed that when delimiting the first level of the cluster in the Euclidean distance between 5 and 10, three clusters are obtained integrated by the following municipalities observed in the graph.

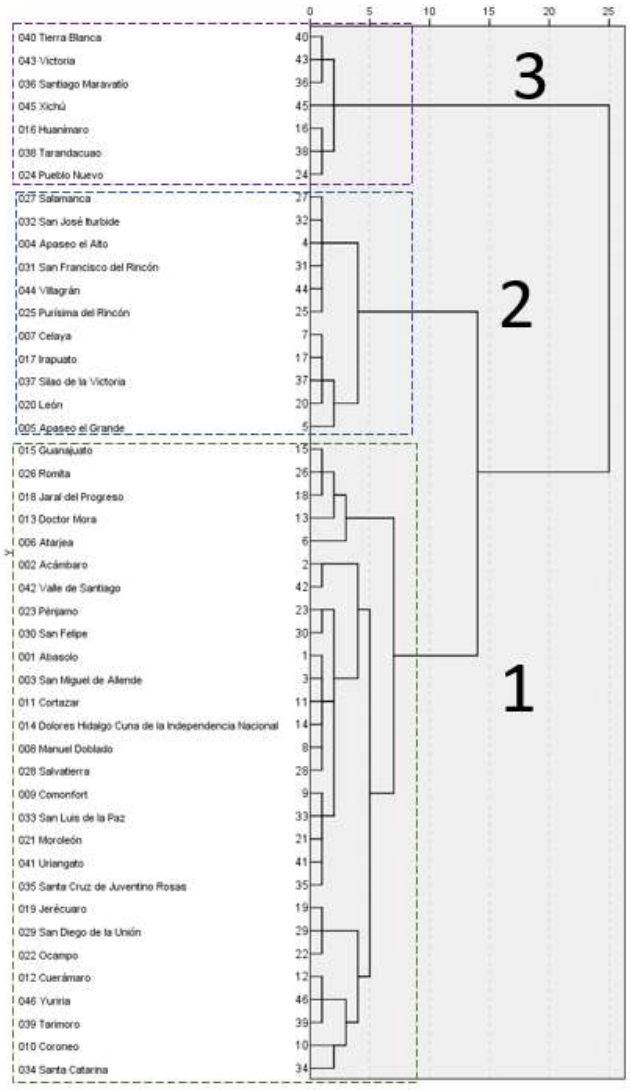
In the cluster delimited by green lines, number 1, 28 municipalities were agglomerated: Guanajuato, Romita, Jaral del Progreso, Doctor Mora, Atarjea, Acambaro, Valle de Santiago, Pénjamo, San Felipe, Abasolo, San Miguel de Allende, Cortazar, Dolores Hidalgo, Salvatierra, Comonfort, San Luis de la Paz, Moroleón, Uriangato, Santa Cruz de Juventino Rosas, Jerécuaro, San Diego de la Unión, Ocampo, Cuerámaro, Yuriría, Tarimoro, Coroneo, Santa Catarina, All of them are municipalities that have in common that their manufacturing companies are interested in accessing a large labor market and taking advantage of the maximum daily hours worked in a total workday of 9.4 hours per day.

Blue lines delimit cluster 2 and include 11 cities: Salamanca, San José de Iturbide, Apaseo el Alto, San Francisco del Rincón, Villagrán, Purísima del Rincón, Celaya, Irapuato, Silao de la Victoria, León y Apaseo el Grande, cities that have in common the concentration of manufacturing companies by factors such as employment, which is large and at the same time generates economies of scale.

Cluster 3 is the smallest, it is delimited by purple lines and includes 7 municipalities such as: Tierra Blanca, Victoria, Santiago Maravatío, Xichú, Huanímaro, Tarandacuao y Pueblo Nuevo, que son pequeñas ciudades en desarrollo, con privaciones sociales y atraso económico,

El nivel de innovación en este cluster presenta un nivel muy bajo según los cálculos realizados, existen pocas patentes registradas sobre su población

Figure 1. Dendrogram of manufacturing company concentration clusters in Guanajuato



Source: own elaboration

Table 3 shows the agglomeration profile of manufacturing companies in the State of Guanajuato, as represented by the three clusters formed in Ward's analysis.

In this context, it is important to delimit the business profile so that manufacturing companies interested in locating in the State of Guanajuato can make the right decisions about the municipality in which to settle according to their economic, social, and productive needs, such as large factories that work economies of scale, their interest in innovation, transportation costs, among others.

Table 3. Agglomeration profile of manufacturing companies in the State of Guanajuato

Cluster	Concentration profile
1	This cluster is constituted of manufacturing companies that value obtaining profits based on the average cost of production, which is reduced as the volume of production increases; they are usually located in large plants and tend to be spatially concentrated. In addition, the companies in this cluster are characterized by having access to a population with a low level of schooling, a basic level, and working hours of more than 8 hours a day. In addition, these economic units are particularly interested in the salaries of their personnel because they represent an important component of their sector's total costs.
2	The companies that constitute Cluster 2 value the population's education level, which is essential for high school education. Companies interested in the technological aspect will be found because they are located in an area where industrial property registrations stand out. In this sense, the manufacturing companies agglomerated in this cluster should have a large production capacity to stimulate their economies of scale and obtain incentives from this; they are companies that take advantage of their working days exceeding 8 hours per day. In addition, the geographical location of these companies will allow them to experience advantages in transportation costs.
3	The manufacturing companies of the third cluster in Guanajuato have the particularity that their salaries are not very competitive, but this turns out to be an advantage for these companies that operate in a social environment where the educational level is not prioritized, being the lowest of the three clusters, at a basic level, and being of common interest the generation of economic benefits based on their economies of scale and the daily working day that exceeds 8 hours.
	It is evident that the nature of these manufacturing business activities lacks a strict specialization of their workers. These types of companies do not need to be highly innovative, but they do require a particular efficiency that allows them to solve their costs.

Source: own elaboration

Discussion

When exploring the concentration characteristics of manufacturing companies in the State of Guanajuato, it is observed that the general profile of the State depends on an environment where economies of scale, production volume, and the establishment of large plants for the achievement of efficiency prevail in the business environment, as well as the educational level of the population in the municipalities, which on average amounts to 8 years of educational instruction, is of importance for the economic units. These are companies that work, on average, 9.4 hours a day.

In this context, it is evident that there is a correspondence with Krugman's (1992) contributions on economies of scale and market size since Guanajuato is characterized by its cost advantage in production. However, it is worth mentioning that this entity has other factors that make its companies concentrate; one of them, as mentioned by Ascani (2012), is transportation costs, which, by having an internal custom, positions Guanajuato as an attractive state for the establishment of national and foreign capital companies whose market is external and can benefit from the advantages offered in transportation costs.

In this order of ideas, the cluster identified with the greatest lag in the analyzed variables is number three, which integrates cities such as Tierra Blanca and Xichú. These localities present high levels of social lag, small population groups, and low educational levels. On the other hand, as Perroux (1998) points out, innovation is a driving force for companies and this category is absent in this cluster, so the manufacturing companies in the municipalities of this cluster cannot aspire to it if they concentrate on these localities; However, the cost advantage they develop due to low competitive wages is an incentive for them to locate there.

In this context, the results are consistent with the research carried out by Sanchez Juárez & Moreno Brid (2016) and Sánchez Juárez (2024). The manufacturing industry constantly struggles to generate economic advantages, which causes other types of structural and social problems that, far from increasing regional development, simply turn

the territory into a mega factory from which it obtains resources and advantages; it is necessary to convert Guanajuato into a specialized region that also stands out for the generation of innovation and application of endogenous technology.

In this order of ideas, the proposals of Gómez-Zaldíbar (2023) are efficient for the problem identified in this research. Specializing municipalities is one of the solutions, and with this, an environment of value can be created since a specialized industry will depend on a group of qualified workers with particular technical and professional skills, which at the same time will represent the demand for a higher educational level, and therefore better employment opportunities, as well as the creation of projects that involve a process of innovation and industrial property records.

Conclusion

In conclusion, exploring the factors of business concentration in the cities of the State of Guanajuato has multiple advantages, among them, it generates a profile of the manufacturing companies located in each locality and can be used by stakeholders such as investors or entrepreneurs who, based on their organizational objectives, can take advantage of the factors of concentration in each territory.

In this sequence of ideas, the clusters that stand out in the innovation and development variable are also characterized by the inclusion of localities that generate investment in their gross fixed capital formation, that stand out for their years of schooling and the registration of their industrial property, which is also an invitation to the public sector to create conditions in the State so that the innovation and development variable is strengthened.

The public sector needs to create conditions in the state so that innovation and development can be strengthened and the clusters of municipalities that concentrate on manufacturing companies can progressively cease to depend on the traditional agglomeration variables and experience an integral, modern, and evolving development.

On the other hand, the research carried out in this paper shows the educational level in each municipality and how it is an essential factor in the concentration of companies. However, it is also observed that the clusters that have a low educational level in their population as a prominent variable, at the same time experience the importance of another related variable, wages, which, according to the Consejo Nacional de Población CONAPO (2022) (b), family income, specifically from wages, contributes to the increase in well-being and quality of life, family income, therefore, if we want to promote a dignified development environment, it is necessary to look at the factors that manufacturing companies in Guanajuato use to generate their competitive advantages at the expense of the social deficiencies experienced in the cities where they are located.

The limitations identified in this research are related to the variables' disaggregation level. For subsequent studies, it is suggested to analyze the branch and sub-branch level of the subsector 31-33.

The lines of research on this topic, the factors of business concentration in the State of Guanajuato, are broad and continuous, making the analysis timely, including social, demographic, and economic variables.

The information generated in this study is timely for entrepreneurs, educational institutions, universities, research centers, and politicians who are interested in managing their training programs, sales, cost savings, innovation programs, and academic plans to generate new conditions in the manufacturing business environment that bring the State a competitive position in business terms and stimulate social conditions.

References

[1] y [45] Alegría, T., Carrillo, J. and Alonso, J. (1995). Productive restructuring and territorial change in northern Mexico: consolidation of a second industrialization axis. Paper presented at the International Seminar "Territorial Impacts of Restructuring Processes", Santiago de Chile, Institute of Urban Studies, July 12-14.

[2] Corrales, C. (2007). The importance of the cluster in current regional development. Northern border, 19(37), 173-201.

[3] Pinto, M. R., Salume, P. K., Barbosa, M. W., & de Sousa, P. R. (2023). The path to digital maturity: A cluster analysis of the retail industry in an emerging economy. Technology in Society, 72, 102191. https://doi.org/10.1016/j.techsoc.2022.102191

[4] Bouchra, N. H., & Hassan, R. S. (2023). Application of Porter's diamond model: A case study of tourism cluster in UAE. In Industry Clusters and Innovation in the Arab World (pp. 129-156). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80262-871-520231007

[5] Mungaray, A., Machain, G., & Medina, E. (2001). Especialización industrial y desencadenamientos regionales en Nayarit. Región y sociedad, 13(22), 49-71.

[6] Xu, R., Wu, J., Gu, J., & Raza-Ullah, T. (2023). How inter-firm cooperation and conflicts in industrial clusters influence new product development performance? The role of firm innovation capability. Industrial Marketing Management, 111, 229-241. https://doi.org/10.1016/j.indmarman.2023.04.009

[7] Porter, M. (1991): The competitive advantage of nations, Plaza and Janés Editores, Barcelona.

[8] Yoyo, T., Hanitha, V., & Hendra, H. (2023). Developing The Competitiveness Model of The Palm Oil-Based Fatty Acid and Fatty Alcohol Industry in Indonesia Using Porter's Diamond Cluster

Competitiveness Model. Primanomics: Jurnal Ekonomi & Bisnis, 21(1), 13-23. https://doi.org/10.31253/pe.v21i1.1537

[9] y [35] Barajas, M.R. (2019). Los cambios en el proceso de relocalización industrial de la industria Bovin, P. (Ed.), Las fronteras del istmo: Fronteras y sociedades entre el sur de México y América Central. Centro de estudios mexicanos y centroamericanos. Doi https//doi.org/10.4000/books.cemca.659

[10] Hernández, I. (2019). Liberalización Comercial y Localización Industrial en México. Departamento de Economía. Universidad de Barcelona.

[11], [13] y [47] Krugman, P (1992). Geography and Trade. Publisher Antoni Bosch, Barcelona, Spain

[12], [34] y [48] Ascani, A., Crescenzi, R., and Lammarino, S. (2021). New economic geography and economic integration: a review. WP Search, 1(02), 1-24. Doi https://doi.org/10.1111/pirs.12275

[14] O'Leary, D., Doran, J., & Power, B. (2023). Urbanisation, concentration and diversification as determinants of firm births and deaths. Regional Studies, Regional Science, 10(1), 506-528. https://doi.org/10.1080/21681376.2023.2204143

[15] y [49] Perroux, F. (1962). La Comunidad Económica Europea. Investigación Económica, 22(87), 709-727.

[16] Mendi, P. (2023). Concentration of innovation investments along the business cycle. Journal of the Knowledge Economy, 1-18. https://doi.org/10.1007/s13132-023-01267-z

[17] Del Olmo-García, F., Domínguez-Fabián, I., Crecente-Romero, F. J., & del Val-Núñez, M. T. (2023). Determinant factors for the development of rural entrepreneurship. Technological Forecasting and Social Change, 191, 122487. https://doi.org/10.1016/j.techfore.2023.122487

[18] Moreno Codina, T., López Flores, N., & de la Barrera Medina, M. S. (2020). Análisis de los instrumentos de gestión pública para administrar y gestionar los parques industriales.

[19] Sistema para la Consulta de Información Censal SCINCE (a) (2020). Censo de Población y vivienda. https://gaia.inegi.org.mx/scince2020/

[20] Secretaría de Economía (2020). Población Económicamente Activa. https://www.gob.mx/se

[21] Sistema Automatizado de Información Censal SAIC (a) (2019). Número de empresas. https://www.inegi.org.mx/app/saic/

[22] Sistema Automatizado de Información Censal SAIC (b) (2019). Ventas por internet. https://www.inegi.org.mx/app/saic/

[23] y [50] Sánchez Juárez, Isaac Leobardo, & Moreno Brid, Juan Carlos. (2016). El Reto Del Crecimiento Económico En México: Industrias Manufactureras Y Política Industrial. Revista Finanzas y Política Económica, 8(2), 271-299. https://doi.org/10.14718/revfinanzpolitecon.2016.8.2.4

[24] y [51] Sanchez Juarez, I. L. (2024). Desindustrialización prematura e informalidad laboral en América Latina. Instituto de Ciencias Sociales y Administración.

[25] y [52] Gómez-Zaldívar, Fernando, & Gómez-Zaldívar, Manuel. (2023). Evolución manufacturera de Guanajuato: complejidad económica y estrategias industriales municipales. Problemas del desarrollo, 54(213), 73-102. Epub 07 de noviembre de 2023.https://doi.org/10.22201/iiec.20078951e.2023.213.69951

[26] López Castro, E. (2016). Aglomeraciones económicas del sector industria manufacturera en México y su vínculo al desarrollo humano.

[27] Sistema Automatizado de Información Censal SAIC (c) (2019). Empresas manufactureras. https://www.inegi.org.mx/app/saic/

[28] Sistema Automatizado de Información Censal SAIC (d) (2019). Empleo subsector 31-33. https://www.inegi.org.mx/app/saic/

[29] Sistema Automatizado de Información Censal SAIC (e) (2019). Remuneraciones. https://www.inegi.org.mx/app/saic/

[30] Sistema para la Consulta de Información Censal SCINCE (b) (2020). Censo de Población y vivienda por municipio. https://gaia.inegi.org.mx/scince2020/

[31] Sistema Automatizado de Información Censal SAIC (f) (2019). Producción Bruta Total. https://www.inegi.org.mx/app/saic/

[32] Sistema Automatizado de Información Censal SAIC (g) (2019). Valor Agregado Censal Bruto. https://www.inegi.org.mx/app/saic/

[33] Banco de Información Económica BIE (2019). Indicadores. https://inegi.org.mx/app/indicadores/?tm=0&t=10000215

[36] Comisión Reguladora de Energía (2019). Precio del diésel 2018. https://www.gob.mx/cre

[37] Instituto Nacional de Estadística y Geografía INEGI (2019). Finanzas públicas. https://www.inegi.org.mx/programas/finanzas/

[38] Sistema para la Consulta de Información Censal SCINCE (c) (2020). Educación. https://gaia.inegi.org.mx/scince2020/

[39] Sistema Automatizado de Información Censal SAIC (h) (2019). Inversión en Formación Bruta de Capital Fijo. https://www.inegi.org.mx/app/saic/

[40] Instituto Mexicano de Propiedad Industrial (2020). Patentes Guanajuato. https://www.gob.mx/impi

[41] Consejo Nacional de Población (2019) (a). Guanajuato https://www.gob.mx/conapo

[42] Sistema Automatizado de Información Censal SAIC (i) (2019). Horas diarias trabajadas. https://www.inegi.org.mx/app/saic/

[43] Flores-llhuicatzi, U., & Medina-Conde, A. (2018). Aceptación del concepto de Economía Social e identificación de grupos homogéneos en países de Latinoamérica y Europa. CienciaUAT, 12(2), 104-126.

[44] Gere, A. (2023). Recommendations for validating hierarchical clustering in consumer sensory projects. Current Research in Food Science, 6, 100522.

[46] Hirose, K., Miura, K., & Koie, A. (2023). Hierarchical clustered multiclass discriminant analysis via cross-validation. Computational Statistics & Data Analysis, 178, https://doi.org/10.1016/j.csda.2022.107613

[53] Consejo Nacional de Población (2019). Bienestar y calidad de vida https://www.gob.mx/conapo