

En esta obra podrá encontrar una imagen de los diversos aspectos de la innovación en México y otros países, relacionados con la influencia social y económica.

Aspectos de Innovación. Zona México y el Caribe, es una contribución por parte de los autores de cada capítulo para generar evidencias de las acciones y resultados logrados en el tiempo, ubicar los avances de lo realizado exitosamente o no y avanzar junto con las instancias de gobierno, facilitando la evaluación y el análisis de los resultados.

Los contenidos se han clasificado en: Innovación en Tecnología de la Información y Desarrollo Tecnológico; Innovación Social; Vinculación, Educación Superior y Redes; Economía del Conocimiento y Polos de Ciencia y Tecnología.

Los temas permiten crear un contraste y reflexión respecto a ésta y otras obras que indiquen lo realizado anteriormente para la operación de las políticas que permitan acrecentar la ciencia, tecnología e innovación.

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Aspectos de INNOVACIÓN Zona México y el Caribe

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ASPECTOS DE INNOVACIÓN ZONA MÉXICO Y EL CARIBE



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**ASPECTOS
DE INNOVACIÓN
ZONA MÉXICO Y EL CARIBE**

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NURTURING STARTUPS IN MEXICO: AN ASSESSMENT OF THE ENTREPRENEURIAL ECOSYSTEM IN A DEVELOPING ECONOMY

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KEY WORDS

Entrepreneurship ecosystems, startups.

ABSTRACT

Entrepreneurship in technology-based industries in Mexico is largely unexplored in the literature. The lack of sufficient information makes it harder for policy makers and industry leaders to support the growth of entrepreneurship ecosystems around the country. This study uses official data on infrastructure, human capital, finance, and market access indicators to

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identify relationship that serve to describe the entrepreneurship ecosystem for startups in Mexico. The results indicate that financial resources are strongly related to new startup development across the country, and that resources are disproportionately allocated across three main economic centers.

INTRODUCTION

Entrepreneurship theory and practice have been important parts of the literature on business development for many years (Dorin & Alexandru, 2014). Most recently, entrepreneurship ecosystems have been associated with creating technology-based firms that are characterized by rapid growth and high rates of failure (Isenberg, 2016). Isenberg (2014) argued that the causes and effects of entrepreneurship ecosystems are often misunderstood, and he noted that popular misconceptions should be scrutinized. Isenberg (2010) recommended, among other things, that government officials interested in developing their entrepreneurship ecosystems should not try to replicate the Silicon Valley approach, and that they should develop their strategies based on the local context. His suggestions were echoed by Montero, Pennano, and Ortigueira-Sánchez (2017) when they argued that there are different levels of innovation that researchers and businesses should understand before they can address them.

Vera-Castillo (2015) argued that Isenberg's ideas on entrepreneurship ecosystems could be adjusted to fit the Latin American context to effectively link education, entrepreneurship, and innovation. In Colombia, Arciniegas and Bedoya

(2011) analyzed the relatively recent government policies and initiatives designed to strengthen the entrepreneurship ecosystem. These researchers identified concrete actions that have taken place that support entrepreneurs and business incubation, but they claimed that some of these initiatives lack organization and are not adequately articulated. Also in Colombia, Sepúlveda Rivillas y Gutiérrez Walter (2016) studied the entrepreneurship ecosystem, and concluded that success for entrepreneurs is contingent on several factors that include the overall economic environment, the entrepreneurship ecosystem, the type of enterprise, among others. One recommendation for future research that emerged from their study was that success factors be studied in different geographic regions.

The study of entrepreneurship ecosystems is scarce in Mexico; however, Sánchez Tovar, García Fernández, and Mendoza Flores (2015) conducted research to assess the capacity for innovation and entrepreneurship development of five geographical regions in the country. Their work serves to document differences in infrastructure and investment designed to promote entrepreneurship and innovation across Mexico. The present study was developed to attempt to build on the recognition that different parts of the country experience different conditions in terms of entrepreneurship development. The aim of the study was to assess whether differences in capacity yielded differences in results or outcomes in terms of new business development.

The problem addressed in this study was the one identified by Arciniegas and Bedoya (2011): although the govern-

ment may be investing in efforts to promote entrepreneurship, these efforts are often not properly articulated or aligned with expected outcomes. Arciniegas and Bedoya's (2011) study took place in Colombia, but an assumption has been made on the part of the authors in the present study that their conclusion applies to the Mexican context. Furthermore, it is expected that the findings in this study be transferable to other countries. By partially addressing this problem, policy makers, educators, and entrepreneurs may find appropriate insights to better inform their decisions regarding entrepreneurship promotion, and the development of entrepreneurship ecosystems.

LITERATURE REVIEW

ENTREPRENEURSHIP ECOSYSTEMS

Ecosystem is a concept brought from biology to explain entrepreneurship systems, and it explains the interrelated nature and dynamics of living organisms in order for a system to function properly (Ramírez Castañeda, Londoño Vanegas, Osorio Flórez, & Cárdenas Aguirre, 2015). The nature of the environmental forces and systems is to change over time, and this can be explained by evolution, perhaps one of the most revolutionary concepts of science. It was proposed by Darwin (2009) in the mid-nineteenth century and implies in very general terms the gradual change from one state to another for purposes of adaptation, which served to explain the natural selection process of species. In the evolutionary process the traits or characteristics are inherited by the organisms with random

variations, and the ones that are better adapted to the environment are the ones that are most likely to be selected. That is, the organisms –the species in Darwin's study subjects– refine the mechanisms of adaptation to their ecosystem over time.

Another theory that explains the changing nature of systems can be found in complex systems, defined by Mitchell (2009) as a system in which the large networks of uncontrolled components and simple operating rules enact complex behavior, sophisticated information processing, and adaptation through learning or evolution. A significant body of knowledge around economics has been drawn from these two concepts –evolution and complexity–, a good reference can be found in the book *Evolution and Complexity: Toward a New Synthesis for Economics* (Wilson & Kirman, 2016). Both approaches study the processes that transform the economy and the elements that integrate it –among which entrepreneurship is key– analyzing the interactions of various agents.

Following these arguments, evolutionary and complexity economics begin with the premise –contrary to the Neoclassical approaches– that the economy is characterized by constant processes imbalance, so that agents must adapt and create novel solutions learning from the new conditions, information becoming a central element of the decision-making process (Heinrich, 2017). Heterogeneity, therefore, becomes an engine of economic development because it allows new solutions to the market, implying constant changes in the quantity of firms, new technologies and the emergence of new industries. The

randomness in the evolutionary context therefore implies that economic development is an open and uncertain process and the best organizations eventually will thrive over time (Heinrich, 2017).

Buenstorf (2007) made a relationship between the concept of evolutionary economics and entrepreneurship. The relationship rests on the idea that the evolutionary economy based on the Austrian economics tradition considers subjective factors inherent to individuals –like subjective knowledge, satisfactions and learning– as important elements in the decision making process. It also gives a central role to the process, where it does not leave only the market coordination of economic agents, but refers to the capacity of economic agents to induce dynamic changes and innovations. These elements have a clear relationship with the postulates of Schumpeter (1951) regarding the characteristics of the entrepreneurs and their role as the engine of the economy.

Under this approach, both the environmental factors and the entrepreneurial process, economic agents are crucial in shaping and reshaping the system as a whole. Grebel *et al.* (2001) reinforced this argument by referring to the evolution of the allocation of the economic agents (resources, skills and competences) and the environment factors as a feedback evolutionary loop in which economic agents both influence and are influenced by material and human resources. Therefore, it may be worth considering that the impact of the development path of the agents has an intrinsic relationship with the capacities that are generated, and that are able to translate into

relevant supply for the present business context at any given time. It is thus that the integration to the system and the evolution opens the way for economic agents to push on the supply side to markets for new products or services, which Montero *et al.* (2017) noted may take place under different degrees of innovativeness.

SUCCESS FACTORS OF ENTREPRENEURIAL ECOSYSTEMS

Suresh (2012) conducted a qualitative study, including cases and in-depth interviews, and concluded that ecosystem factors have a strong influence in the development of entrepreneurs and the success of their startups. This finding can be taken to suggest that network support from organizations and other entrepreneurs, financial support from institutions and market support from customers and distributors, are critical for the development of more effective entrepreneurship projects, and these elements allow for the construction of entrepreneurship ecosystems. Spigel (2017) argued through case study analyses of entrepreneurial ecosystems in Waterloo, Ontario and Calgary, Alberta, in Canada, that partnerships between universities, investors and entrepreneurial organizations are unlikely to succeed if they do not converge their activities with a social and cultural agenda that enhances the entrepreneurial mindset. The author concluded that the value of an entrepreneurship ecosystem is not in the growth rate of entrepreneurs within a region, but in the connection between organizations that allows entrepreneurs to succeed.

Soto-Rodriguez (2015) analyzed secondary data and public information from the government of Puerto Rico to gain insights on the entrepreneurship ecosystem, policies, and strategies of the area. The author noted that ecosystems must not be created exclusively by the government. Other actors like investors, educational institutions, and relevant members of the ecosystem should be allowed to participate to develop stronger relationships. Furthermore, formal and informal institutions have to work together to create a more productive network for entrepreneurs. In alignment, Pitelis (2012) conducted extensive research using secondary data and stated that ecosystems have to be co-created by the synergy of firms within a cluster. The author also affirmed that organizations by themselves found more difficulties in attracting entrepreneurs in comparison to those who create partnerships that allow the construction of entrepreneurial ecosystems. Srivastava (2017), using sample surveys, interviews and focus group discussions involving several organizations in Pune and NCR Delhi, concluded that a healthy entrepreneurship ecosystem can be achieved if there are enough organizations like accelerators, angel investors and guidance, as well as international collaboration that allow the exchange of technology, human capital and ideas. Srivastava's (2017) work highlighted the need for educational institutions and chambers of commerce to push the entrepreneurs in a positive spirit.

Ensign and Farlow (2016), through the analysis of twelve serial entrepreneurs in Waterloo, confirmed the assumption that entrepreneurship ecosystems are key for the success of en-

trepreneurs, and also provide emotional support since they are a powerful source of satisfaction and affirmation for what entrepreneurs do. They also discovered that entrepreneurs seek out supportive ecosystems in terms of funding and exchange of ideas. However, Zupic, Cater and Pustovrh (2017), who conducted 32 interviews with individuals from entrepreneurship ecosystems, concluded that there were five critical barriers in the development of an entrepreneurship ecosystem: finance, human capital, growth ambition, growth management knowledge, and product market fit. The presence of every single element in the ecosystem allows the entrepreneur to have a more successful development.

LATIN AMERICA AND ENTREPRENEURSHIP

Vogel (2013) noted that the components of an entrepreneurship ecosystem can be categorized into three main factors. First, factors that are not in the level of action of the entrepreneur that can be defined as externalities, and that refer to infrastructure, government and regulations, markets, innovation and geographic location. Second, the factors to the specific level of the entrepreneur, defined as the context of the environment that includes the financing, the entrepreneurial education, the culture, networks, support to the entrepreneurs. Finally, the entrepreneurial actors as the individual components of the system. Auletta and Rivera (2011) reviewed the initiatives designed to support entrepreneurship ecosystems in some of the most important economies in Latin America. They noted that these types of initiatives tended to have a regional focus,

and that success depended on the support of the public and private sectors.

Even though it is clear that nurturing entrepreneurship ecosystems has contributed to iconic regions like Silicon Valley into becoming an economic and innovation epicenter, for most Latin American regions the environmental conditions to become the “next Silicon Valley” are still far away from its near future. UNDP (2004) addressed this issue by stating that domestic private initiative and entrepreneurship, particularly within the small and medium enterprise segment and the informal sector, have enormous potential, but they are largely trapped in disabling business environments. The main question that arises is the possibility of public policy into the creation of new business ecosystems. According to UNDP (2013), underdeveloped places like some nations in Africa have had successful experiences in this matter. One of the key factors related to building local support institutions that facilitate the creation of inclusive businesses that would reduce the cost for established enterprises when venturing into new markets. Financing is mentioned in all studies as one of the key elements that entrepreneurs struggle to access. According to the OECD (2015), bank lending for this specific segment has deleveraged since the 2008 financial crisis, forcing governments to implement loan guarantees programs to enable some level of access to some forms of credits like loans, complementary to tax exemption programs. Nevertheless, mechanisms widely discussed in the literature like angel and venture funding, public funding or even newer models like crowdfunding are absent for most of

the entrepreneurs whether they have high value products and services or traditional profile companies.

The 2011 High-Impact Entrepreneurship Global Report (Morris, 2012) conducted by the Center of High-Impact Entrepreneurship and the Global Entrepreneurship Monitor funded by Ernst & Young refers to the unique characteristics of entrepreneurship in Latin America. One of the specificities is the lack of international focused entrepreneurs on the region. Only 13% have at least $\frac{1}{4}$ clients located internationally. This situation may be partially explained by the fact that some Latin American countries have very few large cities, which may suggest a limited number of firms that are developed enough to expand their markets. However, Isenberg and Onyemah (2017) acknowledged that mega cities tend to be more dynamic in terms of entrepreneurial endeavors, but that the role of mid-sized markets should not be underestimated. Other factors that affect the development of entrepreneurial endeavors may be present as well. For example, the research presented by Corona-Treviño (2016) in Mexico has helped to explain the situation of the entrepreneurial environment in said country. Through the analysis of the organizations involved in the entrepreneurship ecosystem, Corona-Treviño (2016) identified barriers for entrepreneurs, which are the lack of technology and innovation.

The need to increase productivity in different parts of the world, including under developed countries and cities is paramount. However, this statement may be a stretch in the discussion given that it is not clear whether entrepreneurship ecosys-

tems actually promote increased economic drive in Latin America. Isenberg (2016) noted that information on the relationship between startup development and job creation, for instance, deserved a closer look because researchers often rely on data that may be misrepresenting the actual impact on entrepreneurs who chose to create their own startups. The present study will serve to address some of the questions about the entrepreneurship ecosystem in Mexico, but it is hoped that the findings may be transferable to other contexts, particularly in Latin America. The study is largely exploratory given the scarcity of studies on entrepreneurship ecosystems in Latin America, and in Mexico specifically. However, areas for further research will be identified in the concluding section.

METHODS

This study was developed using quantitative data. The dependent variable was the number of new start-ups by state in Mexico and the independent variables were efforts made in finance, human capital, infrastructure, and access to markets. These independent variables were selected in agreement with the contributions to the literature on ecosystem facilitators and inhibitors provided by Zupic, Cater and Pustovrh (2017). The data was accessed through a publicly available database, The National Statistic Directory of Economical Units, which is hosted by the National Institute of Statistics and Geography (INEGI, using the acronym in Spanish).

Procedures. INEGI is the official census data organization in Mexico. Its purpose is to collect, analyze and disseminate

nate information regarding social and economic topics, including business. The type of businesses or units in the database are catalogued with a specific industry or category name. For purposes of this study, the units selected were found under the categories *scientific research and development services in the natural and accurate sciences, engineering and life sciences, provided by the private sector, and computer science design services and related services*. Once the categories were selected through the INEGI portal, the authors downloaded the database in MS Excel format and arranged that data for analysis.

Data Analysis. The first step in the analysis was to collect descriptive statistics and create a visual representation by plotting the data into maps (see Figure 1-4 in the Appendix). Second, the dependent and independent variables were analyzed using regression analyses to determine the level of association between them (Tufféry, 2011). The process was facilitated through the use of the Statistical Package for the Social Sciences (SPSS). To further examine the relationships between the variables, scatter plot charts were developed to visually identify residuals that may influence the overall trend of the relationships.

RESULTS

After the data analysis phase was completed, regression analyses revealed statistically significant low to moderate relationships between the dependent and independent variables (see Table 1). However, the scatter plot showed that three outliers were influencing the trend line. As seen in Figure 1 - 4, the

Federal District, and the states of Jalisco and Nuevo Leon were not consistent with the rest of the sample.

Table 1. Relationship between Technology-Based Firms and Entrepreneurship Ecosystem Support in all 32 locations in the sample.

Dimensions	N	R ²	P
Infrastructure	32	.52	<.001
Human Capital	32	.23	<.001
Finance	32	.38	<.001
Access to Markets	32	.13	<.05

Note: developed by the authors.

In order to account for the influence of the three outliers in the sample, r squared coefficients were calculated again, but without these three data points. Table 2 illustrates statistically significant results for the relationship between new startups and financial and access to market variables.

Table 2. Relationship between Technology-Based Firms and Entrepreneurship Ecosystem Support without data from the Federal District, and the states of Jalisco and Nuevo Leon.

Dimensions	N	R ²	P
Infrastructure	29	.003	>.05
Human Capital	29	.001	>.05
Finance	29	.40	<.001
Access to Markets	29	.14	<.05

Note: developed by the authors.

DISCUSSION AND CONCLUSION

The disproportionate size and resources and size of the Federal District, Jalisco and Nuevo Leon creates the impression infrastructure, human capital, finance, and access to markets associate with technology-based firms development. Upon closer examination, only the relationship between the financial and access to markets hold. Although the associations between factors and effectiveness differ in strength, it seems clear that the contributions by Suresh (2012) and Srivastava (2017) hold some merit in the entrepreneurship ecosystem in Mexico. This means the ability of entrepreneurs to develop organizations will be enhanced by the existence of other organizations that can help them secure financial resources, and access to consumers and intermediaries. Recently, academics have been working to close the gap on the development of entrepreneurship ecosystems designed to support technology-based firms in Latin American countries (Montoya Pineda, 2015). Admittedly, there continues to be a wide gap on the topic, but hopefully the present study represents a step forward in narrowing the gap. Especially since the findings were reached using data on ecosystem dimensions and results in Mexico; rather than basing conclusions on efforts made in developed countries where startups encounter very different realities. However, there are still several issues to consider in helping to address some of the gaps in the literature on the subject.

Concretely, this study supports the claim that technology-based entrepreneurs need access to capital develop their companies. It also supports the claim that resources in Mexico tend

to be disproportionately allocated among the main economic centers of the country. With this information, investors and policy makers can seek to facilitate financial resources to entrepreneurs with good business plans and expertise, especially in midsize markets around the country. However, this study was only an exploration into the entrepreneurship ecosystem in Mexico. More research is needed in terms of systems at the municipality and state level. Furthermore, given the findings of this study, it is important to conduct primary research to better understand the motivations behind venture capitalists, and financial institution representatives to allow for guided strategy development for technology-based entrepreneurs to have more access to capital.

APPENDIX

ArcGIS software was used to generate maps through five levels of magnitude both on the independent and dependent variable. So the map can be read as follows:


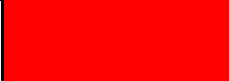








Level of Independent Factors	Color	Number of Startups	Color
Low		22-54	
Medium Low		55-120	
Medium		121-203	
Medium High		204-364	
High		365-1124	

Figure 1. Infrastructure and New-Startups in Mexico.

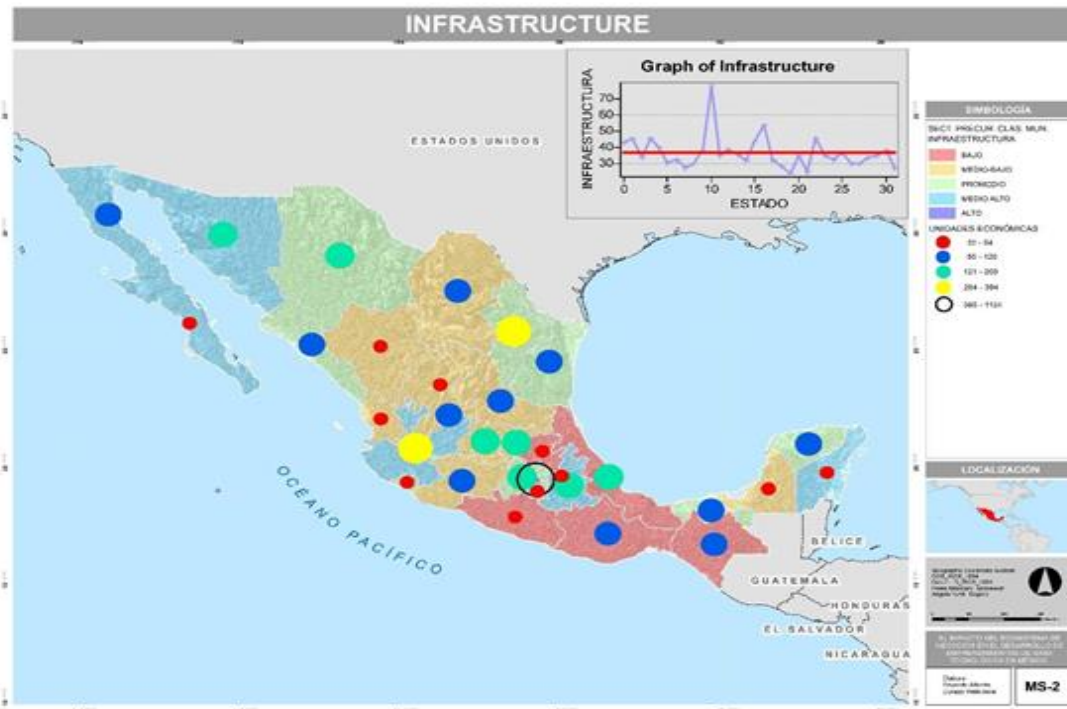


Figure 2. Human Capital and New-Startups in Mexico.

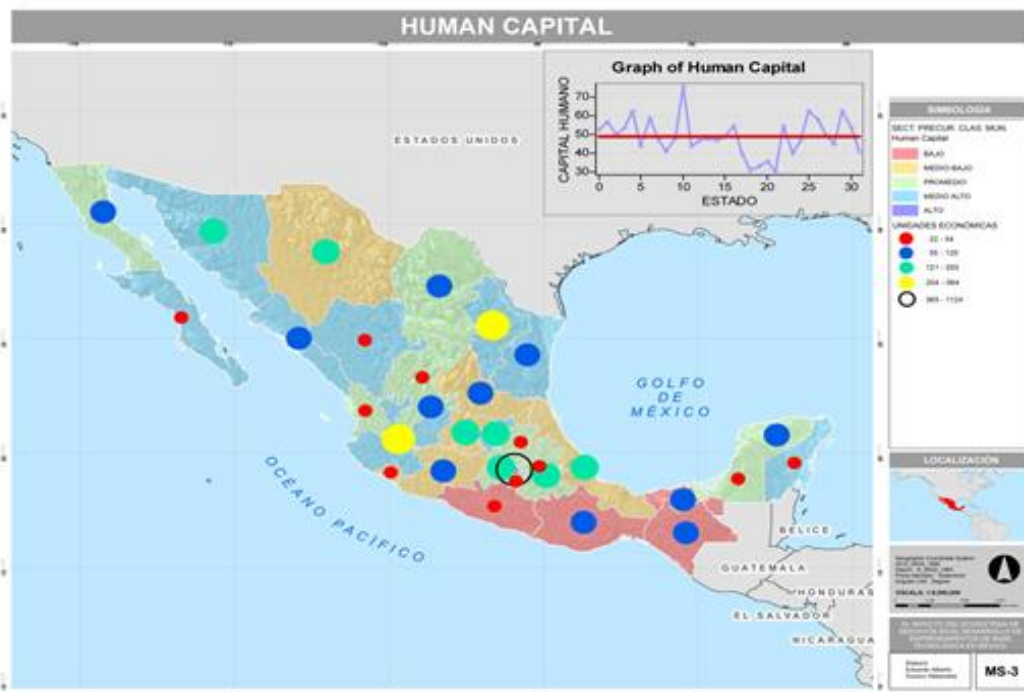


Figure 3. Financial Capital and New-Startups in Mexico.

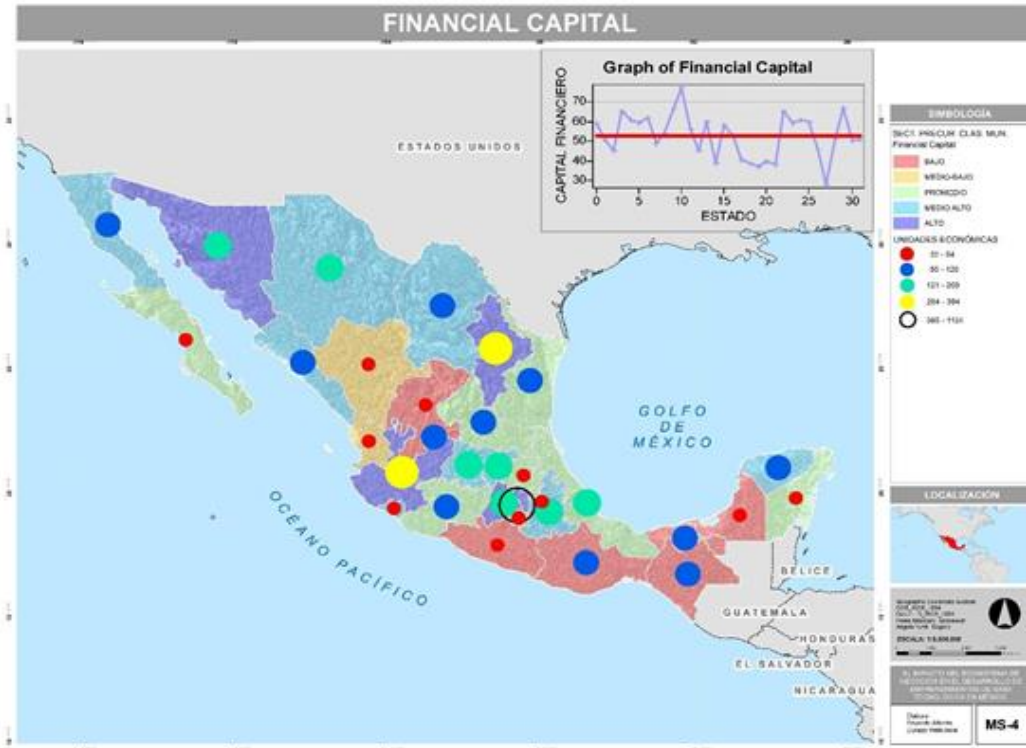
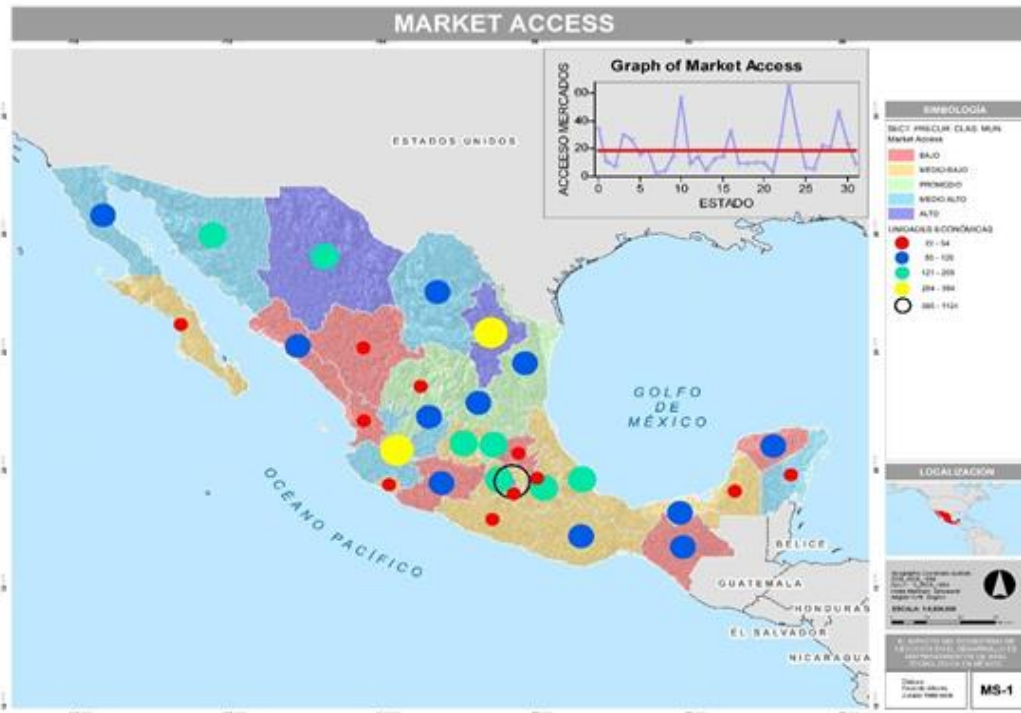


Figure 3 Financial Capital and New-Startups in Mexico.



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