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Does Mexico Possess A Well-Developed Business Infrastructure And Environment Enabling Its Manufacturing Firms To Assume A Leading Role Over Countries In Central America?*

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ÖZ

Bu çalışma, Meksikalı üretim firmalarının Orta Amerika'daki üretim sektörünü geliştirmede kilit bir rol oynama potansiyelini araştırmaktadır. Araştırmada, Meksika'nın altyapısı ve iş ortamı değerlendirilerek Panama ve El Salvador gibi kilit aktörlerle karşılaştırmalar yapılmıştır. Çalışma, Meksikalı üretim firmalarının rekabet avantajına sahip olup olmadığını incelemektedir. İki aşamalı bir süreç kullanılarak Chi-Kare ve Marascuilo çoklu karşılaştırma prosedürü uygulanmış ve Dünya Bankası İşletme Anketi veri tabanı kullanılmıştır. Bulgular, Panama'nın altyapı ve iş ortamının Meksika ve El Salvador'dan önemli ölçüde üstün olduğunu göstermektedir. Çalışma ayrıca, El Salvador'un iş sinerjisinin dört boyutundan üçünde Meksika ve Panama'yı geride bıraktığını ortaya koymaktadır. Bulgular, Meksika'nın bu nedenlerle lider bir rol üstlenemeyeceğini göstermektedir.

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ABSTRACT

This study investigates the potential for Mexican manufacturing firms to play a pivotal role in advancing the manufacturing sector over areas of Central America. The research evaluates Mexico's infrastructure and business environment, drawing comparisons with its key players, Panama and El Salvador. The study explores whether Mexican manufacturing firms possess a competitive advantage. Employing a two-stage process utilizing the Chi-Square and Marascuilo procedure of multiple comparisons, the research utilizes data from the World Bank Enterprise Survey databank. The findings suggest Panama's infrastructure and business environment significantly surpass Mexico and El Salvador. The study reveals that El Salvador outperforms Mexico and Panama in three of four dimensions of business synergy. Findings indicate Mexico cannot assume a leading role for these reasons.

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INTRODUCTION

Mexico is one of the largest economies in Latin-America and its manufacturing sector contributes a healthy percentage to its overall GDP (Escaith, 2001; Su & Yao, 2017; Block et al 2020). Mexican manufacturing firms maintain a competitive edge by relying on low labor costs, access to natural resources, and international trade agreements (Shaiken, 1994; Alvarez & Valencia, 2016). Given its economic dominance in Latin America, our study attempts to look at how Mexican infrastructure and business environments compare to its Central American counterparts, specifically Panama and El Salvador. Infrastructure factors include electrical, water, and transportation accessibilities, as well as labor and educational environments. Business environmental factors include tax, licensing and permit regulations, as well as corruption, criminal and obstruction vulnerabilities within each country. Focusing on these parameters amongst the three countries in our study will allow us to assess development in terms of infrastructure and commercial environments, as well as how these may play into competitive advantages in the region. It will also allow us to expand upon existing literature which tends to focus on the two largest players in the region, Mexico and Brazil, while often excluding the crucial role that smaller countries can play in establishing successful business environments and transnational agreements.

Beyond looking at how Mexico, Panama, and El Salvador relate in terms of their infrastructure and business environments, we also look at the synergies that exist between these three countries. We focus our analysis on technology and innovation, financial sector accessibility, workforce compositions, and performance factors. For technology and innovation, we look at how firms in each country use technologies licensed from foreign companies, Web sites and email for market presence and communication, new product/service creation and placement, and process innovations and research and development expenditures. In order to determine how well firms can access financial services in their respective countries, we consider how firms utilize checking and savings accounts, bank loans, and lines of credit. We also look at how firms decide to finance their investments and working capital, as well as how many firms do not rely on loans for their operations. To assess workforce environments in each country, we look at training options as well as the proportion of permanent workers and skilled workers, relative to all workers. Finally, to determine performance factors, we focus on capacity utilization, sales growth, employment growth, labor productivity, and investments in fixed capital.

We use the World Bank's 2016 Enterprise Survey to obtain infrastructure, business environment, and business synergy data for our three countries (World Bank[4], 2023). Enterprise Surveys provide valuable firm-specific data that allow researchers to generate representative samples for business environments across the globe.

To examine Mexico's leading role in Central America, this study focuses on two key Central American players and poses the following:

Research Question 1 (RQ1): Is Mexico's infrastructure more developed than Panama and El Salvador?

Research Question 2 (RQ2): Is Mexico's business environment more developed than Panama and El Salvador?

Research Question 3 (RQ3): Do Mexican manufacturing firms have a competitive edge over Panama and El Salvador?

We are able to determine that Panamanian infrastructure and business environments are better than what is evidenced in Mexico and El Salvador. In terms of business synergies, El Salvador outperforms Mexico and Panama on three of the four dimensions.

The main purpose of this study is to fill the gap in prior academic literature and to provide practical implications by examining Mexico's potential for leading the manufacturing sector as compared with other Central American countries. Specifically, we examine Mexico's infrastructure and business environment found in manufacturing firms to determine whether a possible competitive advantage to Panama and El Salvador exists.

This study is made up of six parts, which are 1- literature review, research methodology: 3- variables and measurement, 4- data analysis, 5- limitations of the study, and 6- summary findings and conclusions.

Our research contributes to academic literature where findings suggest that despite Mexico's size and influence, the country surprising lags or is outperformed by its' Central America competitor countries like Panama and El Salvador. Implications for practitioners indicate the imperative nature of enhancing infrastructure, business environment, finance, technology, and efficiency to leverage these strengths in an effort to attract internal and external investments, grow and develop to reach and maintain a leading competitive advantage in the Central America region.

Background On Mexico, Panama, And El Salvador

In consideration of these three main indicators assessed in this study, a closer look at Mexico reveals both strengths and weaknesses within the country. With respect to infrastructure, for example, Mexico's electricity access, which can be defined as the population percentage having access to electricity, was positively reported at 99.50% in 2016 (World Bank[2], 2023). However, the availability of water has hindered manufacturing development in the country with the potential for ongoing limitations (Forbes, 2015). Nonetheless, Mexico's manufacturing sector experienced growth due to its reliance and integration on the U.S. market (Forbes, 2015). Of noteworthy manufacturing, growth was found in northern Mexico manufacturing where higher-end products such as plastics, automobiles, and aerospace products were produced (Forbes, 2015).

Next, equal concerns were found in the business environment due to crime-related incidents. According to the U.S. Department of State (2017), the police and military were associated with the highest human rights issues. With a negative influence on the business environment, impunity and corruption within Mexico continued to be of major concern (U.S. Department of State, 2017). In fact, numerous reports expressed concern that it was the government or its representatives who participated in random unlawful acts without impunity (U.S. Department of State, 2017). As expected, organized crime remained an ongoing deterrent despite the Mexican government's ten-year campaign to fight against organized crime and drug distribution (Congressional Research Service, 2017).

Finally, challenges and yet progress were visible within Mexico's business synergy factors. According to the World Bank[8] (2023), for several decades, Mexico has been outperformed by other countries in the areas of inclusion, economic growth, and decreasing poverty levels. To counteract this underperformance, Mexico has sought to increase financial access and thereby increase credit for the poorer states, younger age groups, small to medium-sized enterprises, and women (World Bank[9], 2023). Whereas cash represents a significant portion of consumer transactions with few adults utilizing bank accounts, in 2016, BBVA bank purchased Mexico's most attractive online payment system in an effort to improve upon financial services (CBInsights, 2019). One of Mexico's more positive aspects of its business synergy pertains to its workforce development. With outdated labor laws from the 1970s, labor law reforms after 2013 resulted in workforce development training required under Mexico law (de la Cruz, 2016).

Like Mexico, Panama has faced its share of strengths and weaknesses across the three indicators. Panama is a small country and is famous for its Panama Canal, which joins the Atlantic and Pacific oceans. According to the World Bank[10] (2023), Panama embarked on a number of substantial construction projects leading up to 2017. These projects included the construction of forms of transportation such as the Canal, the international airport, and the metro; thereby resulting in economic growth for the country (World Bank[10], 2023). However, water concerns remained as Panama's water consumption continued to increase although water production decreased since 2016 (Salas, 2023). Meanwhile, of a more positive nature was the electrical access of the country with 93.2% of the residents having access to electricity in 2016 (World Bank[3], 2023).

Next, Panama like Mexico experienced challenges with crime; however, the country made a bold move to combat its crime. As described by the United Nations Office on Drugs and Crime (UNODC) (2016), Panama was the first to join the CRIMJUST (2016-2020) project. Here the UNODC collaborates with country governments to target crimes like drug distribution and organized crime (United Nations Office on Drugs and Crime, 2016).

Finally, a closer examination of Panama's business synergy reveals improvements and more continued efforts needed. According to World Bank[5] (2016), the economic growth of Panama outpaced any other country in the Latin American and Caribbean countries. This growth spurt has meant a substantial reduction in poverty in Panama (World Bank[5], 2023). However, more efforts were needed to bring basic services to Indigenous peoples and extremely rural communities to further decrease poverty country-wide. While the World Bank[10] (2023) reports that Panama's GDP grew in 2016, continued institutional reforms were still considered essential. Here, Panama must search for ways to minimize long-term inequalities found in human capital and encourage stronger institutional changes through transparency and sustainable economic efforts.

Similarities and differences were found in El Salvador as compared with Mexico and Panama. With respect to infrastructure, El Salvador has experienced issues with water shortages similar to Panama. In fact, for the first-time, El Salvador faced a water shortage crisis in 2016 citing concerns associated with the El Niño phenomenon and climate change issues (Reuters, 2016). However, like Mexico and Panama, electrical access remained high with 96% of the residents having access to electricity (World Bank[1], 2023).

Next, as found in Mexico and Panama, El Salvador too has experienced difficulties with crime. According to the U.S. Department of State (2017), criminal activity has flourished in poor communities. Criminal activity has taken various forms such as corruption, weak rule of law, and compliance issues found with court rulings, to name a few (U.S. Department of State, 2017). In fact, as part of the 2016 Country Reports on Human Rights Practices in El Salvador, the U.S. Department of State reported that over one in every five families has fallen victim to violent criminal activity.

Finally, El Salvador has made progress in business synergy; however, continued strategy is necessary. For example, while El Salvador was considered the smallest country in Central America, it has experienced economic growth during the past few decades (World Bank[6], 2023). The country has shown major decreases in inequalities and the poverty level (World Bank[6], 2023). However, like Mexico and Panama, El Salvador must continue its efforts with a focus on human capital and sustainability (World[7] Bank, 2023).

Literature Review

In order to understand how infrastructure, business environments, and business synergies help promote competitive advantages in our three focal countries, we must first understand what the literature states with regard to these factors. Specifically, when dealing with infrastructure, we explore beyond just the traditionally referenced examples of infrastructure, such as electricity, water, and transportation, to also include labor regulations and workforce education. We look at how past research focuses on business environment factors, such as tax rates and policies, corruption and crime obs-

tacles, and legal environments. Literature on business synergy includes discussions on technology, innovation, financial access, and performance factors.

Studies have repeatedly demonstrated the impact that infrastructure has on firm productivity and economic growth. Escribano et al. (2010) find a link between infrastructure (namely, energy, water, transportation, etc.) and its effect on the productivity of African manufacturers. Wang et al (2020) find that investing in transportation infrastructure between China's Belt and Road Initiative (BRI) countries has helped improve economic growth. Economic growth, in turn, helps improve economic and cultural distances between the BRI countries as well. Heintz et al. (2009) arrive at similar conclusions when researching how infrastructure investments in energy, transportation, water and sewage impact U.S. economic performance. The importance of infrastructure on economic advancements is such that countries spend trillions of dollars to ensure reliability. In some cases, countries spend as much as 3.4% - 5% of their GDP (Fay et al., 2019). Agenor and Moreno-Dodson (2006) conclude that publicly funded infrastructure, such as paved roads, electrical grids, and communication channels, promote growth and productivity in that the private sector does not have to spend on developing and maintaining these.

In terms of business environments and their impact on economic advancement and productivity, Bah and Fang (2015), Gaviria (2002), and Powell et al (2010) find that restrictive regulatory environments, crime, and corruption adversely impact firm success, economic output, and overall competitiveness. Bah and Fang (2015) focus their study on sub-Saharan Africa, looking closely at how factors such as corruption and crime can impact firm accomplishments in the region, while Gaviria (2002) models the impact of corruption and crime in Latin America and their impact on competitiveness and performance. Powell et al (2010) provide a general overview on the relationship between corruption, crime and economic development, based off of scholarly research in the area. They assert that these issues make it more costly to do business and dampen entrepreneurial efforts, thereby weakening economic development. Agboli and Ukaegbu (2006) similarly find that stressful business environments hamper entrepreneurial and industrial advancements. The authors study Nigerian business environments and conclude that poor infrastructure, regulations, and access to credit negatively impact entrepreneurial initiatives; this, in turn, adversely impacts Nigerian development.

Other business environment factors such as tax and licensing regulations are also determinants of economic growth and development. Fogel (2001) finds that business environments that value and facilitate entrepreneurship typically have favorable licensing and taxation policies. While studying the relationship between tax policies and business environments in Slovakia, Teplicka (2018) concludes that tax ordinances can impact business growth and commercial development. Specifically, tax rate reductions tend to improve business development, while increasing tax rates tend to create obstacles for business development. In fact, poor tax regulatory environments can impede growth (Ayyagari et al., 2008). During a recent review of the literature in this area, Ayyagari finds that inefficient tax policies foster instability and hamper economic development.

To determine how competitive countries are in terms of their business synergies, it is important to consider each countries' technology and innovations, access to financial resources, labor force makeup, and performance indicators. Atkinson (2013) and Cantwell (2003) both found that innovation is related to productivity and competitiveness when they examined this relationship at the industry level. Dogan (2016) found that knowledge, technology, and creativity, as determinants of innovation, positively impact competitiveness when studying these effects in the European Union.

The availability of financial resources is also crucial. Bah and Fang (2011) find that access to credit helps foster development. In their study of sub-Saharan Africa, the authors find that credit inaccessibility adversely impacts capital and resource allocations. The inability to obtain credit and capital caused an average output and productivity decline of approximately 50%. Falciola et al. (2020) determine that access to financial resources supports firm performance, and Fonseka et al. (2014) conclude that the availability of bank financing and financial access positively impact firm competitiveness within industries in their study of Chinese markets. Msomi and Olarewaju (2021) also find that financial access promotes economic growth of South African small and medium-sized enterprises (SME). They cite the presence of government funded business loans as an important contributor to the eventual success of SMEs in the region.

When considering labor force and its impact on corporate competitiveness, Dumas and Hanchane (2010) find that job training programs, instigated by Moroccan authorities, help increase the competitiveness of Moroccan companies. In their study of 322 firms, public policy measures like government funded training programs help promote firm competitiveness and productivity. The positive impact the training provided was directly related to the importance that firms place on the training obtained versus just the additional financing that was provided.

While studying World Bank data on manufacturing firms, Kleynhans (2016) finds that a trained and skilled labor force is instrumental in developing competitive businesses and industries; a less educated labor force tends to hinder competitiveness. Beyond that, Cloutier et al. (2015) find that retention is just as important as training in terms of developing a competitive work environment. The authors posit that employee turnover is costly, and that investing in retention helps promote corporate stability, growth, and profitability. Specifically, retention efforts are defined as those that promote

communication, diversity, skill-sets, and employee development training. Additionally, Simionescu et al (2021) find that human capital is vital for a country's economic development, relating primarily to the innovation attributed to European labor forces and their impact on economic growth.

Finally, the last indicator for business synergies involves the use of performance indicators to determine overall competitiveness. Kotane and Kuzmina-Merlino (2012) find that key performance measures, such as sales growth and capital acquisition, are instrumental in evaluating competitive potential. In their study of Eastern European companies, Kliestik et al (2020) conclude that financial ratios are instrumental for demonstrating the financial health of firms, which in turn helps improve their competitiveness. Alarussi (2021) also finds that financial ratios are key indicators for corporate efficiency and competitiveness. In his study of 108 Malaysian firm financial statements, he focuses on key financial ratios such as leverage, liquidity, and profitability ratios. Alarussi determines that these key efficiency indicators help attract investment and promote economic development.

1. Research Methodology

The research methodology section is made of the research model, measures and variables, and data collection.

Research Model

The research model is structured into two distinct stages to evaluate the performance of manufacturing firms in Mexico, Panama, and El Salvador across three critical dimensions: infrastructure, business environment, and business synergy.

Stage 1: Chi-Square Test for Independence

In the first stage, a Chi-square test (Hair et al., 2018) is employed to assess how well manufacturing firms in Mexico are performing relative to their counterparts in Panama and El Salvador. The assessment is conducted across three dimensions:

1. Infrastructure
2. Business Environment
3. Business Synergy

To evaluate the differences among the three countries on these dimensions, a contingency table is created. This table lists the observed frequencies (fo) for each dimension, as well as the expected frequencies (fe) calculated under the assumption that there is no difference between the countries. The Chi-square statistic is then calculated as follows:

$$\text{Chi-Square Statistic} = \sum(fo-fe)^2 / fe$$

$$\text{The degrees of freedom for the test} = (RT-1)\times(CT-1)$$

$$\text{Expected frequency } (f_e) = RT * CT / Total.$$

Where RT represents the row total, and CT represents the column total. The test is performed at a 1% significance level, with the assumption that each cell in the contingency table has an expected frequency of at least 5.

If the calculated Chi-square statistic exceeds the Chi-square critical value at the 1% significance level, it indicates that there are significant differences between the countries on that specific dimension. In this case, the null hypothesis—which states that there is no difference among the countries—is rejected.

Stage 2: Marascuilo Procedure for Multiple Comparisons

If significant differences are found in Stage 1, the analysis proceeds to the second stage. In this stage, the Marascuilo procedure (Hair et al., 2018) is applied to rank the countries on the dimensions where differences were identified.

The Marascuilo procedure involves two key steps:

1. **Computing the Critical Range:** The critical range is calculated to determine the threshold for significant differences between pairs of proportions. It is given by the formula:

$$\text{Critical Range} = (\chi 2)^{0.5} \times (Pj(1-Pj)/nj + Pi(1-Pi)/ni)^{0.5}$$

2. **Performing Multiple Comparisons:** In this step, each pair of proportions (pj and pi) is compared. A significant difference between the proportions is concluded if:

$$|pj-pi| > \text{Critical Range}$$

Both stages of the research model utilize a 1% level of significance, ensuring that the findings are statistically reliable. This approach allows for a detailed understanding of how manufacturing firms in Mexico, Panama, and El Salvador compare across critical business dimensions.

Cross Validity of the Model

Testing the cross validity of the model is done by applying it in different countries or different time periods.

Variables and Measurements

The study is based on the "World Bank's Enterprise Surveys (ES)" 2016 data set, which is metric type (World Bank[4], 2023). Infrastructure, business environment, and business synergy are measured using composite factors.

1- Infrastructure factor is made of a- Percent of firms identifying electricity as a major constraint; b- Percent of firms experiencing water insufficiencies; c- Percent of firms identifying transportation as a major constraint; d- Percent of firms identifying labor regulations as a major constraint; and e- Percent

of firms identifying an inadequately educated workforce as a major constraint.

2- Business environment factor is made of a- Percent of firms identifying tax rates as a major constraint; b- Percent of firms identifying tax administration as a major constraint; c- Percent of firms identifying business licensing and permits as a major constraint; d- Percent of firms identifying corruption as a major constraint; e- Percent of firms identifying the courts system as a major constraint; and f- Percent of firms identifying crime, theft, and disorder as a major constraint.

3- Business synergy is represented by four composite factors, which are A- Technology and innovation factor is made of a- Percent of firms using technology licensed from foreign companies; b- Percent of firms having their own Web site; c- Percent of firms using e-mail to interact with clients/ suppliers; d- Percent of firms that introduced a new product/ service; e- Percent of firms whose new product/service is also new to the main market; f- Percent of firms that introduced a process innovation; and g- Percent of firms that spend on R&D. B- Access to finances factor is made of a- Percent of firms with a checking or savings account; b- Percent of firms with a bank loan/line of credit; c- Percent of firms not needing a loan; d- Percent of firms using banks to finance investments; e- Percent of firms using banks to finance working capital; and f- Percent of firms using supplier/customer credit to finance working capital, C- Work force factor is made of a- Percent of firms offering formal training; b- Proportion of workers offered formal training; c- Proportion of permanent workers (out of all workers); and d- Proportion of skilled workers (out of all production workers). D- Performance factor is made of a- Capacity utilization (%); b- Real annual sales growth (%); c- Annual employment growth (%); d- Annual labor productivity growth (%); and e- Percent of firms buying fixed assets.

Data Collection

Due to the potential sensitivity of questions, the World Bank hired private contractors to collect the ES data (World Bank[11], 2024). Group administrators used standardized instruments and applied a uniform sampling methodology; surveys were administered face-to-face by trained teams (enumerators) (World Bank[11], 2024). Based on the size of the economies, the interviews conducted ranged from 1200-1800, 360, and 150 for large, medium, small economies, respectively. The survey was designed to provide panel data sets, which allows for multi-comparisons across countries, (World Bank[4], 2023). In addition, a stratified sampling method was used in terms of infrastructure, business environment, access to finance, innovation and technology, workforce, and performance (World Bank[11], 2024). With respect to the ES, the strata included the size of the firm, the type of business sector, and geographical area found within an economy (World Bank[11], 2024). In this study, data taken from Mexico, Panama, and El Salvador was studied.

Data Analysis

Stages one and two of the study are done successfully for each of the three dimensions. Table 01 displays the Chi-square statistic results based on infrastructure. At a 1% level of significance, DOF (3-1)*(2-1) = 2, the Chi-square critical value is 9.21. Decision rule: If the Chi-square statistic is less than 9.21, there is no significant difference in infrastructure factor between the three countries.

Table 1: Infrastructure

Manufacturing Concern	Mexico	Panama	El Salvador	AVG	$\chi 2$	**Decision**
	27%	7%	25%	25%		
Not a Concern	73%	93%	75%	75%		
N	5825	586	702	7113	117	Significant

The proportion of manufacturing firms that raised concern about the infrastructure is 27% in Mexico, 7 % in Panama, and 25% in El Salvador. The Chi-square statistic is 117, which is greater than 9.21, the critical value. Decision rule: there is a significant difference between manufacturing firms that raised concern about infrastructure in the three countries.

Table 02 reflects the multiple comparisons of manufacturing firms that raised concern about infrastructure in the three countries. A- Proportion of manufacturing firms that raised concern about infrastructure in Mexico is greater than in Panama; B- Proportion of manufacturing firms that raised concern about infrastructure in El Salvador is greater than in Panama; C- Proportion of manufacturing firms that raised concern about infrastructure in Mexico and El Salvador is not significantly different.

Table 2: Infrastructure – Multiple Comparisons

Comparison	**ABS [Difference]**	**Critical Range**	**Difference**
Mexico - Panama	20.37%	3.60%	Significant
Mexico - El Salvador	1.74%	5.28%	Not Significant
Panama - El Salvador	18.64%	5.88%	Significant

Table 03 displays the Chi-square statistical results of manufacturing firms that raised concern about the business environment in the three countries. At a 1% level of significance, DOF (3-1)*(2-1) = 2, the Chi-square critical value is 9.21. Decision rule: If the Chi-square statistic is less than 9.21, there is no significant difference between manufacturing firms that raised concern about the business environment in the three countries. The proportion of manufacturing firms that raised concern about the business environment is 31% in Mexico, 6 % in Panama, and 34% in El

Salvador. The Chi-square statistic is 207, which is greater than 9.21, the critical value. Decision rule: there is a significant difference between manufacturing firms that raised concern about the business environment in the three countries.

Table 3: Business Environment

Manufacturing	Mexico	Panama	El Salvador	AVG	$\chi 2$	**Decision**
Concern	31%	6%	34%	29%		
Not a Concern	69%	94%	66%	71%		
N	6990	701	861	8552	207	Significant

Table 04 reflects the multiple comparisons of manufacturing firms that raised concern about the business environment in the three countries. A- Proportion of manufacturing firms that raised concern of the business environment in Mexico is greater than Panama; B- Proportion of manufacturing firms that raised concern about the business environment in El Salvador is greater than Panama; C- Proportion of manufacturing firms that raised concern about the business environment in Mexico and El Salvador is not significantly different.

Table 4: Business Environment – Multiple Comparisons

Comparison	**ABS [Difference]**	**Critical Range**	**Difference**
Mexico - Panama	25.26%	3.19%	Significant
Mexico - El Salvador	3.22%	5.19%	Not Significant
Panama - El Salvador	28.48%	5.61%	Significant

The next four tables summarize business synergy, which is made of four dimensions; these are 1- Access to Finance, 2- Innovation and Technology, 3- Human Capital, and 4- Performance. Table 05 displays the Chi-square statistic results of manufacturing firms with access to finances in the three countries. At a 1% level of significance, DOF (3-1)*(2-1) = 2, the Chi-square critical value is 9.21. Decision rule: If the Chi-square statistic is less than 9.21, there is no significant difference among manufacturing firms in the three countries for access to finances. The proportion of manufacturing firms with access to finances is 32% in Mexico, 38% in Panama, and 59% in El Salvador. The Chi-square statistic is 225, which is greater than 9.21, the critical value. Decision rule: there is a significant difference between manufacturing firms with access to finance in the three countries.

Table 5: Access to Finances

Manufacturing	Mexico	Panama	El Salvador	AVG	$\chi 2$	**Decision**
Adequate	32%	38%	59%	35%		
Inadequate	68%	62%	41%	65%		
N	6485	603	804	7892	225	Significant

Table 06 reflects the multiple comparisons of manufacturing firms with adequate access to finances in the three countries. A- Proportion of manufacturing firms with adequate access to finances in Mexico is not significantly different than manufacturing firms with adequate access to finances in Panama; B- Proportion of manufacturing firms with adequate access to finances in El Salvador is greater than manufacturing firms with adequate access to finances in Panama; C- Proportion of manufacturing firms with adequate access to finances in Mexico is significantly less than manufacturing firms with adequate access to finances in El Salvador.

Table 6: Access to Finance – Multiple Comparisons

Comparison	**ABS [Difference]**	**Critical Range**	**Difference**
Mexico - Panama	5.64%	6.24%	Not Significant
Mexico - El Salvador	26.68%	5.56%	Significant
Panama - El Salvador	21.04%	7.98%	Significant

Table 07 displays the Chi-square statistic results of manufacturing firms that apply/use innovation and technology in the three countries. At a 1% level of significance, DOF (3-1)*(2-1) = 2, Chi-square critical value is 9.21. Decision rule: If the Chi-square statistic is less than 9.21, there is no significant difference among manufacturing firms that apply/use innovation and technology in the three countries for access to finances. The proportion of manufacturing firms that apply/use innovation and technology is 39% in Mexico, 32% in Panama, and 50% in El Salvador. The Chi-square statistic is 55, which is greater than 9.21, the critical value. Decision rule: there is a significant difference among manufacturing firms that apply/use innovation and technology in the three countries.

Table 7: Innovation and Technology

Manufacturing	Mexico	Panama	El Salvador	AVG	$\chi 2$	**Decision**
Applying	39%	32%	50%	39%		
Not Applying	61%	68%	50%	61%		
N	7460	689	849	8998	55	Significant

Table 08 reflects the multiple comparisons of manufacturing firms that apply/use innovation and technology in the three countries. A- Proportion of manufacturing firms that apply/use innovation and technology in Mexico is significantly greater than manufacturing firms that apply/use innovation and technology in Panama; B- Proportion of manufacturing firms that apply/use innovation and technology in El Salvador is significantly greater than manufacturing firms in Panama; C- Proportion of manufacturing firms that apply/use innovation and technology in Mexico is significantly less than manufacturing firms that apply/use innovation and technology in El Salvador.

Table 8: Innovation and Technology – Multiple Comparisons

Comparison	ABS [Difference]	Critical Range	Difference
Mexico - Panama	6.87%	5.66%	Significant
Mexico - El Salvador	10.91%	5.48%	Significant
Panama - El Salvador	17.78%	7.50%	Significant

Table 09 displays the Chi-square statistic results of the proportion of manufacturing firms with competitive human capital in the three countries. At a 1% level of significance, DOF (3-1)*(2-1) = 2, the Chi-square critical value is 9.21. Decision rule: If the Chi-square statistic is less than 9.21, there is no significant difference in the proportion of manufacturing firms with competitive human capital in the three countries. The Chi-square statistic is 6, which is less than 9.21, the critical value. Decision rule: there is no significant difference among manufacturing firms with competitive human capital in the three countries. There is no need to carry multiple comparisons.

Table 9: Human Capital

Manufacturing	Mexico	Panama	El Salvador	AVG	$\chi 2$	**Decision**
Competitive	67%	61%	70%	67%		
Not Competitive	33%	39%	30%	33%		
N	4049	345	485	4879	6	Not Significant

Table 10 displays the Chi-square statistic results of the proportion of manufacturing firms with efficient performance in the three countries. At a 1% level of significance, DOF (3-1)*(2-1) = 2, the Chi-square critical value is 9.21. Decision rule: If the Chi-square statistic is less than 9.21, there is no significant difference in the proportion of manufacturing firms with efficient performance in the three countries. The Chi-square statistic is 17, which is greater than 9.21, the critical value. Decision rule: there is a significant difference among manufacturing firms with efficient performance in the three countries.

Table 10: Performance

Manufacturing	Mexico	Panama	El Salvador	AVG	$\chi 2$	**Decision**
Efficient	22%	23%	29%	22%		
Not Efficient	78%	77%	71%	78%		
N	5349	414	625	6388	17	Significant

Table 11 reflects the multiple comparisons of manufacturing firms with efficient performance in the three countries. A- Proportion of manufacturing firms with efficient performance in Mexico is not significantly different than manufacturing firms with efficient performance in Panama; B- Proportion of manufacturing firms with efficient performance in El Salvador is significantly greater than manufacturing firms with efficient performance in Mexico; C- Proportion of manufacturing firms with efficient performance in Panama is not significantly different than manufacturing firms with efficient performance in El Salvador.

Table 11: Performance – Multiple Comparisons

Comparison	ABS [Difference]	Critical Range	Difference
Mexico - Panama	1.58%	6.52%	Not Significant
Mexico - El Salvador	7.28%	5.76%	Significant
Panama - El Salvador	5.69%	8.36%	Not Significant

Discussion

The current study analyzed the ability of Mexico to leverage its economic and workforce investments as compared to those of Panama and El Salvador. Comparisons in the areas of infrastructure, business environment, access to finances, innovation and technology, and human capital were conducted. Unexpectedly, these results indicate that given the size and potential influence of Mexico's investments in the areas, they have failed to leverage these assets effectively.

Summary Findings

Table 12 reflects summary findings, which showed significant evidence of mixed results for manufacturing firms in the three countries. Panama's infrastructure and business environment are significantly better than in Mexico and El Salvador. Unexpectedly, El Salvador leads Mexico and Panama in three of the four dimensions of business synergy, which are access to finance, innovation and technology, and performance.

Table 12: Summary Findings

% Manufacturing Firms	Mexico	Panama	El Salvador	Lead
Infrastructure - Concern	27%	7%	25%	**Panama**
Business Env- Concern	31%	6%	34%	**Panama**
Access to Finances - Adequate	32%	38%	59%	**El Salvador**
Innov & Tech - Use / Apply	39%	32%	50%	**El Salvador**
Workforce - Competitive	67%	61%	70%	**None**
Performance - Efficiency	22%	23%	29%	**El Salvador**

While numerous studies have established that a country's investment in infrastructure promotes business growth and productivity (Escribano et al. 2010; Heintz et al., 2009), the current studies indicate that there is a disconnect between this

relationship and the opinions of the various business owners, managers, and executives based in Mexico. A similar outcome is found regarding the perceived concern for the current business environment. Prior studies (Bah& Fang, 2015; Gaviria, 2002; Powell et al., 2010; Agboli & Ukaegbu, 2006) find that excessive regulation, corruption, and the incidence of crime all affect economic success and global competitiveness. Both measurements indicate that Mexico fails to convert its significant resources into economic advantage.

In the areas of access to finance, innovation, and technology, Mexico enjoys some improvement as they lag El Salvador but are more successful than their Panamanian counterparts. Research regarding technology (Atkinson, 2013; Cantwell, 2003; Dogan, 2016), and access to finance (Bah & Fang 2011; Fonseka et al., 2014; Falciola et al., 2020) find that both are critical prerequisites to establishing a competitive business environment.

Research by Kotane and Kuzmina-Merlino (2012) notes that capital acquisition, sales growth and other normative performance measures are key indicators when considering global competitiveness. In this measure, both Panama and El Salvador's manufacturing environment has outpaced their Mexican counterparts.

Limitations

There are two limitations in the study which are 1- The study is based on primary data, and survey type; it is based on the opinion of owners, business executives, and managers. 2- A composite measure is used to represent several traits. 3- The external validity of the model is not addressed.

Given these unexpected results, additional research in this area needs to be conducted. Given the reliance on survey data, future research may be able to address the differential in *perceived* and *actual* economic conditions. For example, when considering access to finance, data concerning the number of business loans applied for, made and rejection levels may provide an additional data point of comparison. A similar condition is found in the composite measure representing several traits. As composites, there is potential for confounding and countervailing in the sub-measures. Further studies may provide additional understanding in this area.

Future research examining similar relationships between Mexico and other key players in Central America may also suggest whether a significant role is present within other manufacturing countries. Certainly, studies expanding to other sectors such as the services sector may provide additional insight into Mexico's role as compared with other countries in Central America. Finally, studies comparing key players in Central America to other regions may offer greater insight into the global economy.

Conclusion

The research findings regarding the dynamics among Mexico, Panama, and El Salvador reveal intriguing insights, particularly concerning the perceived magnitude and impact of the Mexican economy. Surprisingly, the outcomes indicate that while Mexico exerts considerable influence in terms of the size and breadth of its economic prowess compared to Panama and El Salvador, its effectiveness in leveraging these strengths against competitors falls short of expectations.

In response to RQ1, Mexico lags significantly behind its Panamanian counterparts but exhibits a marginal difference with El Salvador. A robust and well-maintained infrastructure forms the foundation for enhanced economic development, sustained growth, and business productivity. Mexico's inability to leverage its vast resources negatively affects their economic success and global competitiveness.

Similarly, when considering RQ2, Mexico is significantly outperformed by their Panamanian counterparts but displays an insignificant differential with El Salvador. Having a strong and friendly business environment provides the basis for improved economic development and sustained growth. Panama maintains a significant advantage over their Mexican and El Salvadorian rivals indicating a business setting optimized for commercial success. This will enable them to attract additional investments from internal and external sources.

Regarding RQ 3, multiple measures find that Mexico lags it counterparts. From a financial perspective, El Salvador holds a considerable edge over its Mexican and Panamanian counterparts. The ability of El Salvador's businesses to access the necessary finances for economic growth is a crucial factor contributing to its ongoing efforts to develop and expand the economy. Enhanced financial access is likely to fortify economic development and interest in El Salvador.

The country's significant lead in innovation and technology positions local organizations favorably for future economic development and makes it an attractive destination for businesses worldwide. Moreover, El Salvador enjoys a substantial advantage over Panama and Mexico in terms of workforce performance and efficiency, a pivotal metric for the further advancement of industries and foreign investment in the Salvadorian economy.

The inability of Mexico to surpass these competitors underscores the need for additional improvements in infrastructure, business environment, finance, technology, and efficiency. These enhancements are imperative to continually attract investment and position Mexico as a leading force in the future Central American economy.

Based on the research findings regarding Mexico's economic dynamics relative to Panama and El Salvador, the following

policy recommendations could provide the impetus to improve its economic position and competitiveness.

Recommendation 1: By prioritizing investments in critical infrastructure through public or public-private partnerships, areas such as telecommunications, transportation networks and ports, Mexico will enhance their ability to improve business efficiency and lower operational costs while ensuring that these developments are innovative and financially sustainable.

Recommendation 2. Improving the business environment by streamlining business regulation to attract additional domestic and international investors. To improve investor confidence, it will also be crucial for Mexico to enhance and strengthen their current laws regarding property rights and contracts

Recommendation 3. Providing additional financial accessibility for Small and Medium Enterprises (SMEs) and funding for research and development initiatives such as innovation hubs and technology parks. The use of government funding, targeted credit facilities, subsidies, or venture capital will help stimulate entrepreneurship and innovation and provide the capital necessary for those new ventures to prosper.

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