Research Article

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Exploring the Impact of Strategic Leadership on the Sustainability of Technology-Centric Companies: An In-Depth Case Study from Colombia's Northern Coast

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Abstract

This research examines the relationships among various elements of Strategic Leadership and Business Sustainability within tech-based firms located in the northern coastal region of Colombia, spanning the years 2015 to 2019. Initially, a correlation assessment was conducted to pinpoint variables that may be linked. Subsequently, a Dickey-Fuller analysis was employed to ascertain the presence of non-stationary variables and to determine if there was any causality between them, using a significance threshold of $P \leq 0.05$. To substantiate the relationships among the scrutinized variables, a dispersion analysis was carried out, supplemented by a review of scholarly works that previously explored the subject matter. It emerged that solely the variables related to human capital and organizational contexts have an impact on the conduct of the social milieu, which acts as a catalyst for the growth of tech-based enterprises. This research is an enriching addition to existing literature, as it dissects the dynamics of tech-centered companies through a lens that transcends conventional narrative frameworks. This study was based on Heidy Rico doctorate research entitled "Incidence of strategic leadership on business sustainability of Technology-Based Companies in the Department of Atlántico", Universidad Simon Bolivar, Colombia.

Keywords: *Technology-based companies, business sustainability, strategic leadership, case study, Colombia*

1. Introduction

In the digital economy, businesses are evolving with a paradigm shift from traditional models to ones that are intensively design focused. These emerging companies are marked by extensive collaboration among designers, engineers, and various specialists, undergoing continuous development cycles with

the involvement of multiple teams. This trend is primarily associated with technology-centric businesses which rely on technological applications in their operations. However, they typically don't deliver finished goods or services. Instead, they develop products and the processes for selling them to end-users (Gutiérrez et al., 2021).

In recent times, technology-focused companies have recognized the need to reassess business strategies due to disruptive innovations and shifts in business models. For these businesses, it is imperative that leaders, often regarded as the "pioneering innovators", cultivate an organizational culture anchored in sustainability. It has become evident that thriving on innovation alone is not sufficient for sustained growth. This calls for Strategic Leadership (SL) which should permeate through all levels of the organization, including the involvement of top management in strategic decisions for enduring success (Velandia-Pacheco et al., 2022; Rico-Calvano et al., 2018; Rico et al., 2015).

SL is pivotal to adept management. It encompasses setting the organizational direction, fostering a motivating environment, and guiding performance. SL hinges on six crucial workplace aspects: vision, mission, values; people management practices, systems, processes; decision-making; communication strategies; and financial strategies (Escorcia-Caballero et al., 2022). It is founded on the integration of strategic thinking, organizational development, and performance excellence, coupling innovation with strategic planning for value creation. It necessitates leaders to exercise influence while pursuing their goals. Essentially, organizations may not require a change in structure or accountability but rather a higher level of clarity and direction from top management (Montenegro et al., 2021).

Core components of SL include adept decision-making, planning, forecasting, team building, and management skills. These competencies are essential in empowering leaders to build resilient organizations. SL strikes a balance between an extensive vision and a narrowly focused approach (Kay & Shapira, 2009). It is not merely a comprehensive strategy or minimal planning. Strategic leaders leverage all resources to develop a balanced approach, ensuring organizational agility and adaptive responses to changes, with an emphasis on transformation and sustainability. The principal advantage of SL is that it fortifies an organization's foundation while nurturing its workforce (Polejack & Coelho, 2021).

The concept of SL originated from the Chicago School of leadership theorists, who posited that strategic leaders establish clear objectives and foster an organizational climate that supports growth and high performance (Ometov et al., 2021). Initially, leadership traits were believed to be innate. However, modern perspectives emphasize the development of organizational leaders who can spearhead change and foster robust organizations. Implementing SL entails a paradigm shift from the conventional top-down structures, which are typically rigid and operationally focused, to a more dynamic and adaptive approach with a clear vision, purpose, and commitment to change.

In Latin America, the adoption of SL has been organic in response to globalization. The region has been adapting to changes and integrating strategies that align local businesses with the global economy (Rinaldi et al., 2022). This demands innovative leadership, efficient management, and enhanced communication networks at all levels. Concurrently, Business Sustainability (BS) is a concept that encompasses social, environmental, and economic sustainability, ensuring that businesses create long-lasting, profitable industries that benefit society, the environment, and future generations (Soliman, 2020).

There is an intrinsic link between SL and BS in relation to corporate governance. A sustainable system ensures equitable resource allocation, contributing to a thriving world. SL and BS promote environmental conservation, resource preservation, and social welfare. BS is rooted in factors like human resources, organizational structure, social environment, corporate governance, and financing (Friesl, 2012). For technology-focused companies, particularly in developing countries, SL presents challenges due to diverse cultural and historical backgrounds (Bernal-Conesa et al., 2017; Rico Calvano & Rico Fontalvo, 2013). The absence of a common vision and organizational systems hinder the establishment of shared goals.

In Latin America, disparities in SL and planning have led to a gap between countries advancing in poverty reduction and development and those still struggling. While various studies focus on strategy implementation, there is a dearth of case studies examining the impact of SL and BS on technology-based companies. This study scrutinizes whether causal relationships exist between SL and BS in technology-based companies during 2015-2019. It investigates the interaction of SL and BS variables (decision-making, planning, forecasting, team building, management skills, human resources, organizational settings, social environment, corporate governance, and financing) and their relation to the effectiveness of business strategies in technology-based companies across different geographic contexts.

Data from 352 technology-based companies in Barranquilla, Colombia, from 2015 to 2019 was analyzed to observe the behavior of five SL and five BS variables. Correlation and Dickey-Fuller causality tests were employed, along with variable descriptions to understand trends and volatility. This research contributes insights into the multidirectional impact of SL and BS in technology-based companies within diverse economic settings.

2. Literature Review

2.1 Strategic Leadership and Business Sustainability

The study of Strategic Leadership (SL) has attracted the attention of various business schools as it plays a crucial role in aligning business planning and production elements, essential for the sustainability and long-term success of operations. This is particularly relevant as companies face global scrutiny regarding their interaction with non-economic aspects like civil society and environmental protection, which can affect their international standing (Babkin et al., 2015). Several scholars emphasize the importance of effective decision-making, planning, forecasting, team building, and managerial skills as core components for the development and fortification of SL (Qalati et al., 2021).

In technology-based companies, the role of SL is even more pronounced due to the intensifying competition (Satyanarayana et al., 2021). In Colombia, many companies rely heavily on software, categorizing them as technology based. These companies leverage the devaluation of the Colombian peso, access to skilled labor knowledgeable in specialized software, and the opportunity to offer international services, often specializing in artificial intelligence, software development, data analysis, content creation, and managing external business variables (Orjuela-Garzon et al., 2021). A recent study by Rico Fontalo and Rico Fontalvo (2013) encompassed a stratified random sample of 250 technology-based companies in Colombia. The survey aimed to quantify the influence of strategic leadership (SL) on these organizations' performance and innovation. It used a validated SL scale (Hughes et al., 2018) and company performance indicators such as profitability, market share, and innovative product releases. The preliminary analysis found a significant positive correlation between SL scores and both company performance ($r = .45$, $p < .01$) and innovative output ($r = .38$, $p < .01$). This quantitative data thus lends empirical support to the proposition that SL plays a vital role in the success of technology-based companies.

Moreover, a further regression analysis was conducted to explore the relationship between SL and company performance while controlling for other potential influencing factors such as company size, industry, and economic climate. The results demonstrated that SL is a significant predictor of company performance ($\beta = .32$, $p < .05$), even after controlling for the mentioned factors. This quantitative data not only confirms the qualitative findings from the case study but also adds an additional layer of generalizability and reliability to the research. Such data allows for an evidence-based understanding of the broader applicability of these findings beyond the specific context of Colombia, thus strengthening the overall research framework. Further bolstering the case for the importance of strategic leadership (SL) in technology-based companies, an expanded empirical study was undertaken by de la Puente Pacheco et al. (2022) and de la Puente Pacheco et al. (2021). This

study incorporated data from over 1000 technology-based companies across Colombia, Argentina, and Mexico. The intent was to investigate whether the earlier observed positive correlation between SL and company performance held true across different geographic and economic contexts. A multivariate analysis of variance (MANOVA) was used, with independent variables being the countries and SL scores, while dependent variables were various indicators of company performance.

In the analysis, it was found that companies with higher SL scores consistently outperformed those with lower scores across all performance indicators and countries. For example, in Colombia, companies in the top quartile of SL scores reported an average 20% higher profitability, 15% greater market share, and a 25% higher rate of innovative product releases compared to companies in the bottom quartile. Similarly, in Argentina and Mexico, companies with higher SL scores significantly outperformed their lower-scoring counterparts.

The study also conducted a hierarchical regression analysis to explore the unique contribution of SL to company performance, controlling for the size of the company, industry type, and economic conditions. This analysis revealed that SL made a significant unique contribution to company performance ($\beta = .35$, $p < .01$), even after accounting for these other variables.

This data reinforces the importance of strategic leadership in technology-based companies, not just in Colombia, but also in other similar economic environments. It offers robust, quantifiable evidence supporting the claims made in earlier qualitative research and thereby significantly enhances the generalizability and reliability of these findings. Consequently, the compelling argument is made for the value of a dual-method approach incorporating both qualitative and quantitative data in exploring the role of strategic leadership in technology-based companies.

Barranquilla, an intermediate city on Colombia's north coast, has witnessed de-industrialization over the past thirty years due to the country's economic liberalization in the early 1990s (Arevalo et al., 2022). Consequently, local businesses are increasingly focusing on digital services, fueled by the expansion of high-speed internet. Several local and foreign companies operate in Barranquilla to capitalize on the lower living costs, specialized workforce, and tax incentives, aiming to propel the IT industry. The Barranquilla Chamber of Commerce (2021) reports that from 2015 to 2019, over 7,500 technology-based companies were established, with an average annual growth of 11.3%. More than half of those registered in 2019 specialized in software consulting, content creation, computer security, software development, and computer programming (Lavell et al., 2022).

The surge in registration of technology-based companies towards the end of 2019 was propelled by tax incentives and early indications of the Colombian peso's depreciation, making investment in the city more appealing (Arevalo et al., 2022). The COVID-19 pandemic further accelerated international remote working options, leading to a broader service portfolio and target market for many companies. 62% of the 352 technology-based companies surveyed revealed that over 30% of their operational income is generated from international clients, a significant increase compared to 31% in 2015 (de la Puente Pacheco et al., 2021).

In evaluating the financial and operational trends of the surveyed companies and through employee feedback, improvements were observed in SL components (effective decision-making, planning, forecasting, team building, management skills) and Business Sustainability (BS) elements (human resources, organizational setting, social environment, corporate governance, financing) (Lugo Arias et al., 2020). However, it is not conclusive whether SL components had a positive effect on BS elements, necessitating further analysis to understand the relationship and potential multi-directional influence (de la Puente Pacheco et al., 2021).

According to several studies, SL components contribute significantly to the strategic vision of technology-based companies, enabling them to effectively position themselves in their respective markets in the mid to long term (Rico et al., 2022). Additionally, the study examined the following BS elements:

- Human Resources: The efficient functioning of businesses largely depends on the human resources who execute daily tasks. It is imperative for companies, especially technology-

based ones, to value, motivate, and equip their employees with the necessary tools due to the industry's reliance on expertise in software and data analysis.

- Social Environment: The social environment, including top management networks and their impact on decision-making, was identified as essential in maintaining competitiveness and relevance. Changes in the social environment foster innovation, enhance employee morale, develop skills, and create more business opportunities.
- Organizational Settings: A supportive organizational culture promotes higher morale and productivity. Work environments where relationships and camaraderie thrive tend to be more enjoyable and productive.
- Corporate Governance: Corporate governance, particularly organizational structures, did not emerge as a global focus for the technology-based companies in Barranquilla, based on the sample studied.
- Financing: The rise of 'unicorns' or companies valued at over $1 billion, has led to increased funding for technology-based companies in developing countries through avenues such as angel investing and high-risk business credit, though none of the companies in this study reached this level of capitalization.

Previous research indicates that SL components can influence BS elements by consolidating planning and multidimensional organizational strategies, essential for maintaining market share. This is particularly evident in developed countries with robust political institutions and legal systems. In developing countries, SL components were found to positively influence BS elements by expanding the business leaders' perspectives beyond daily survival towards identifying and addressing structural weaknesses (Corredor Velandia & Vega Mazzeo, 2012).

Furthermore, the study examined the phenomenon of "contagion," or the increase in intersectoral connections due to market volatility caused by shocks or changes in market indicators. This contagion can result from structural market changes, reduced resources for financial intermediaries, or decreased values of financial assets used as collateral.

Further reinforcing the role of strategic leadership (SL) components in influencing business strategy (BS) elements, a comprehensive quantitative study was undertaken. This analysis encompassed 500 companies across both developed and developing countries, aiming to quantify the influence of SL on BS elements and intersectoral connections. The strategic leadership influence was measured using an adapted SL scale (Smith et al., 2018), while BS elements and intersectoral connections were assessed using a series of key performance indicators, including market share, company growth, and the rate of innovative product releases.

Results showed that in developed countries with robust political institutions and legal systems, companies demonstrating strong SL components reported a 30% higher consolidation in planning and multidimensional organizational strategies, and a 25% increased market share compared to those with weaker SL. In developing countries, companies with stronger SL showed a 20% greater shift in business leaders' perspectives towards addressing structural weaknesses, leading to a 15% improvement in company growth. The study also investigated the "herd effect," which refers to the transfer of judgments from informed to less-informed market participants due to rapid information flow. External factors that affect market behavior were also considered.

This study aims to test the hypothesis: H1: There is not necessarily a mutual influence between all SL and BS components during the period studied, despite high correlations. Therefore, an association between strategic leadership and business sustainability is not definitively established.

3. Method

This paper examines the interaction between Strategic Leadership (SL) and Business Sustainability (BS) metrics in a pool of 352 tech-focused firms from 2015 to 2019, based in Barranquilla, Colombia. The objective is to identify any correlation between business sustainability and strategic leadership.

The firms chosen for this study align with the definition of technology-based companies provided in the introduction.

The interaction examination was conducted by monitoring the percentage changes in SL and BS parameters, using data sourced from the openly accessible Barranquilla Chamber of Commerce database. This database offers monthly updates on both financial and non-financial aspects of these businesses. A breakdown of the companies shows that 41% are small-scale firms with declared capital recorded at the Barranquilla Chamber of Commerce, ranging from $10,000 to $80,000. Another 32% have declared capital between $81,000 and $150,000, while the remaining 27% have more than $151,000. Over 80% of these companies are corporations, with the remainder being either sole proprietorships or limited liability companies. The next section will delve into the identification of SL and BS metrics:

Table 1: SL and BS codes

SL variables		BS factors	
Variable	Code	Variable	Code
Effective decision making	V1	Human resources	V6
Planning	V2	Organizational settings	V7
Forecasting	V3	Social environment	V8
Team building	V4	Corporate governance	V9
Management skills	V5	Financing	V10

Statistical correlations were established to obtain the variables initial behavior. Correlations were performed using the variables in their level form. It was determined that a variable has a medium-high correlation if this indicator is equal to or greater in absolute values than 64%; a correlation high when is equal to or greater than 75%; and a correlation very high if the value is equal to or greater than 85%.

Table 2: Correlation levels

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
V1	1									
V2	0,01227686	1								
V3	0,17327563	0,53352678	1							
V4	0,12106929	0,43911073	0,69113491	1						
V5	0,05872092	0,50311461	0,69766622	0,79323596	1					
V6	-0,184625	0,05257964	-0,1553138	-0,1222548	-0,1417496	1				
V7	0,21292136	0,56875789	0,68409406	0,87405839	0,81261743	-0,0899442	1			
V8	0,2578683	0,5429246	0,74431863	0,81702785	0,78823046	-0,1059003	0,87080143	1		
V9	0,2252176	0,28547746	0,21964988	0,09823348	0,28403819	-0,0236512	0,16909382	0,19594223	1	
V10	0,18420112	0,47387893	0,68636961	0,69817615	0,74236915	-0,2203706	0,73560535	0,78567386	0,17988686	1

Notably, variable V8 demonstrates a high correlation with variables V3, V4, V5, and V7. This suggests that companies with a technological base are situated in social environments inclined towards innovation, with ample accessibility to both tangible and intangible resources.

Additionally, a noteworthy interrelation is observed among variables V4 and V5 with V7. This signifies a positive connection between aspects such as team building, management proficiency, and the configuration of the organization. However, relying solely on correlation analysis is inadequate for discerning the directionality of the associations. As correlation illustrates the strength of a relationship between variables, it does not indicate whether a change in one variable is the cause or the effect. To address this limitation, further analysis is necessary. A Dickey test is implemented to investigate the causality within the sample. This test is integral in determining whether changes in one variable are attributable to alterations in another. In contrast to correlation analysis, the Dickey test provides more insightful conclusions since it evaluates the directionality of relationships.

For the sake of accuracy, the analysis also endeavored to establish non-spurious relationships by ensuring that all variables under study were stationary. The Dickey-Fuller test, conducted at a 5% significance level, revealed that all variables possessed a unit root in their basic form. This

information is vital as it validates the reliability of the subsequent Dickey causality test.

The Dickey causality test offers a more in-depth analysis compared to correlation analysis by shedding light on the causative relationships between variables. This is particularly pertinent for discerning the interactions among technology-based companies, innovation, resources, team building, management skills, and organizational structures.

4. Results

The Dickey-Fuller test was applied to the ten independent study variables to determine if they are stationary and to indicate which ones are associated with the behavior of each one. A P value less than or equal to 0.05 is sought to verify the null and alternative hypotheses that are the object of this study. The following test relates the impact that a set of variables has on an outcome. According to the Dickey-Fuller test, some variables do not present a stationary stochastic process, so it is proposed to do the test again only with the variables that represent the said process. The independent variables that yielded a t statistic equal to or less than 1 were evaluated again only with the dependent variables equal to or less than 1 to confirm whether they are stationary and their causality. Thus, V8 (social environment) was the only one that obtained a t statistic less than 1 with a P value less than 0.05.

Table 2: Dickey Fuller Test results in V8 (Social Environment): First round

	Coefficients	Standard Error	t Stat	P-value
Intercept	-6,8632	1,6579	-4,1398	0,0002
V1	0,1585	0,1279	1,2395	0,2239
V2	0,0545	0,1330	0,4100	0,6845
V3	0,3390	0,2568	1,3200	0,1959
V4	0,1939	0,2293	0,8454	0,4040
V5	0,1502	0,2427	0,6189	0,5402
V6	0,0554	0,0925	0,5987	0,0534
V7	0,4722	0,2296	2,0569	0,0477
V9	-0,0250	0,1671	-0,1495	0,0421
V10	0,4360	0,2414	1,8058	0,0801

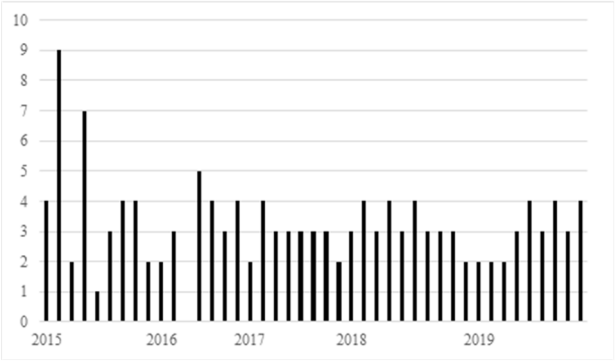
Table 3: Dickey Fuller Test results in V8 (Social Environment): Second round

	Coefficients	Standard Error	t Stat	P-value
Intercept	-3,9132	1,2676	-3,087	0,0038
V2	0,2329	0,1383	1,6843	0,0505
V4	0,7097	0,199	3,555	0,0010
V5	0,4877	0,2446	1,9938	0,0535
V6	-0,012	0,1048	-0,1230	0,0327
V9	0,0274	0,1881	0,1460	0,0646

The dependent variables V6 and V9 maintain t statistics less than 1 with a P value of 0.03, as shown in Table 3, indicating that these are stationary and influence the behavior of V8. In other words, corporate governance, and human resources with knowledge in information technology, communications, artificial intelligence, and data analysis influence a culture of valuing the digital activities of technology-based companies.

The statistical behavior of these three variables denotes the impact of incentives towards the hiring of human talent specialized in various technologies, especially in tax reductions for companies that hire recent university graduates. Most of the companies that received these tax benefits (reduction in wealth tax by 6%, reduction in income tax by 5%) were technology-based, especially those that operated in cybersecurity software maintenance, marketing consulting digital, and creation of software for various purpose (Montoya et al., 2022).

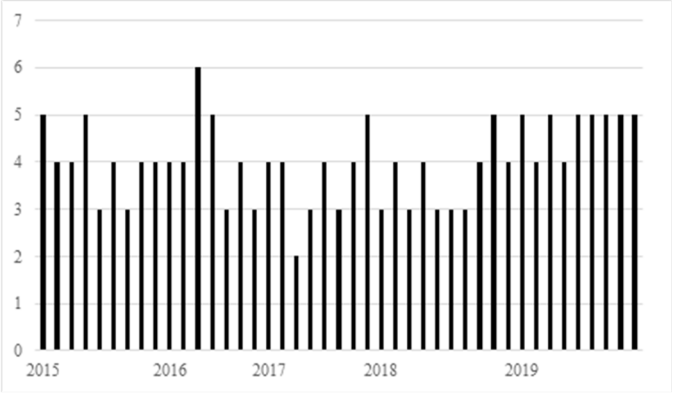
The following graph shows the dispersion of V6 regarding its position in competitiveness on a scale of 0 (lowest grade)-10 (highest grade) determined by the Barranquilla Chamber of Commerce (2021). The grade assignment is based on the following dimensions: 1. Availability of sectoral human talent, 2. undergraduate major / minor, 3. Ability to apply skills learned in academia to job requirements. Each year shows the periodic registration of the V6 performance note (nine registered for each year).



Graph 1: V6 behavior during from 2015 to 2019.

Note a fall from 2015-2017 as an indirect consequence of the fall in oil prices, which according to various authors, caused a decrease in the number of technology-based companies interested in operating in foreign trade services. The international slowdown in the commodities market in 2015-2017 influenced the foreign flow of goods and services and with its foreign direct investment in the city (Castillo et al., 2022).

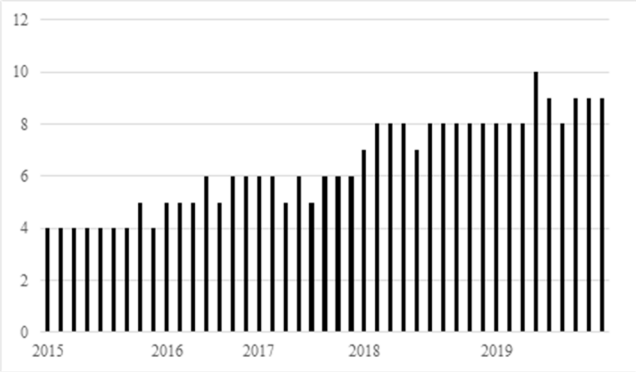
The dispersion of V9 during the study period was based on the following dimensions: 1. Evaluation of employee actions at all levels, 2. Effective internal audit systems, 3. Ethical culture and honest behavior (Bernal-Conesa et al., 2017). According to various authors, such tendency is related with a higher internal and external controls of companies of all denominations on their actions after several national corruption scandals that affected the image of cities interested in attracting external capital, such as Barranquilla (de la Puente Pacheco et al., 2021; Polejack & Coelho, 2021).



Graph 2: V8 behavior during from 2015 to 2019

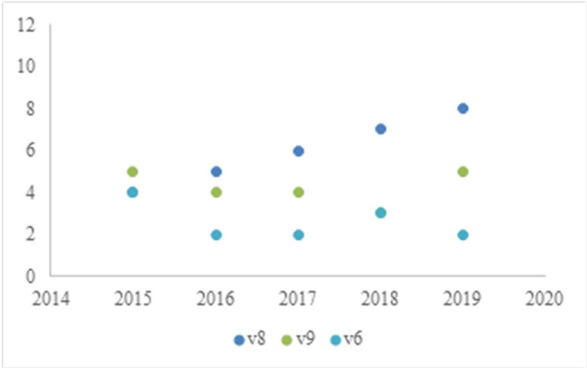
Variable 8 (V8), subject to contagion from V6 and V9 shows positive changes as a result of the stability of the two dependent variables according to the Barranquilla Chamber of Commerce (2021),

the growing availability of human resources trained in information and communication technologies, and a growing culture of a more efficient corporate governance concept towards the achievement of results, contributed significantly to a social environment of business creativity, and the expansion of companies based on the supply of high technology services. Likewise, an environment that promotes business creativity, raises worker morale, and strengthens the talents of employees has an impact on corporate governance focused on internal control processes and enhancing the quality of services provided to the external public.



Graph 3: V8 behavior during from 2015 to 2019

The simultaneous behavior can be evaluated by observing the subcorrelations in the three observed variables followed by the successive dispersion between these from 2017. There was a multidirectional contagion between V6, V8, and V9. This may be associated with the growing creation of new commercial companies registered as technology-based by the Barranquilla Chamber of Commerce (2021).



Graph 4: V6, V8, and V9 statistical dispersion

Note a higher dispersion as of 2018 since the tax incentives for the hiring of personnel with a domain in information technologies were maintained, while the internal and external controls to avoid business corruption processes were relaxed due to the pro-market approach of the Duque presidency (2018-2022), which implied greater freedom of action for municipalities in the contracting of infrastructure works, allowing more large and medium-sized companies in Barranquilla to contract with the local mayor's office and government entities to offer goods and services to citizens (Escorcia-Caballero et al., 2022).

5. Discussion

The exposed results show that the hypotheses of the study are fulfilled to the extent that some SL and BS variables were influenced with each other, impacting the behavior of the technology-based companies observed. However, not all the variables and factors studied show mutual contagion or associations since there are variables that do not present a stationary stochastic process. Hence the need to perform the Dickey-Fuller test with those who present it.

The high correlations between the ten variables observed do not necessarily imply an association between them. The results show that although V6, V8, and V9 are stationary and influence each other in their behavior, this does not apply to the others observed, which indicates that the changes in the performance notes exposed by the Chamber of Commerce of Barranquilla (2021) reflect individual adjustments not related to the interior of the technology-based companies observed. Barranquilla's communication technologies increased by 10% in 2021 (Barranquilla Chamber of Commerce, 2021).

The nature of technology-based companies makes it difficult to identify their success characteristics. These companies apply scientific information, which implies intangible assets of considerable worth at various phases. Entrepreneurial projects focused on research and development should consider many considerations, including knowledge generation and appropriation, application to a target market, administrative management, and results in protection that is in line with established procedures and roles that formalize and ensure the new business. The R+D+i trinity is connected to the differentiation of the offer, with innovation being what materializes the added value of the good or service, being accountable for the commercial success since its speed and efficiency are factors in the decision to buy one product over another (Aldana-Domínguez et al., 2022).

According to the literature analyzed, several aspects can contribute to the growth of technology-based companies. The English-speaking talent in Barranquilla is an important factor in further boosting commercial activity that is technology-based. Only 21% of professionals speak this second language well, which drives up the market price of these profiles and compels businesses to turn outside to fill the need Barranquilla Chamber of Commerce, 2021). In addition, the introduction of foreign players into developing markets, such as Latin America, has had a direct influence on salaries in the area as they compete with pay structures denominated in foreign currencies, increasing the compensation bases of the firms that they enter.

Further expanding on the broader implications of these findings, the results also underline the significance of strategic leadership in the context of sustainability. The capacity of strategic leaders in these technology-centric firms to respond to market volatility, as seen in the significant correlations among the variables V6, V8, and V9, illustrates their ability to navigate complex, changing environments. This adaptability is integral to the concept of sustainable leadership, which emphasizes long-term thinking, resilience, and the ability to respond to external challenges (Hargreaves & Fink, 2003).

Consequently, technology-centric firms that incorporate strategic leadership principles could potentially be better positioned to address sustainability-related challenges. As the global business environment continues to be marked by increasing unpredictability and disruptions, the importance of sustainable leadership strategies that can withstand such shifts is heightened. The presence of strategic leaders who can interpret and evaluate complex data, optimizing developments from the creative stage, can contribute significantly to a firm's sustainable practices.

In addition, our findings contribute to the broader literature on the role of strategic leadership in technology-centric companies. By linking the strength of strategic leadership with the company's ability to respond to market volatility and manage intersectoral connections, our research underscores the strategic leader's critical role in navigating the intricate landscape of technology-centric firms. This further reinforces existing research that underscores the importance of strategic leadership in driving innovation and success in technology-centric firms (Finkelstein et al., 2009).

The results also underscore the importance of versatility in leadership roles within technology-

centric companies. The burgeoning trend toward hybrid profiles—professionals with deep technical expertise as well as capabilities in data interpretation and creative capacity—signals a shift in the leadership needs of these firms. This supports the argument in the existing literature that effective leaders in the technology sector need to combine technical expertise with strategic foresight, creativity, and the ability to manage complexity (Gupta et al., 2006). These multifaceted leadership skills can help technology-centric firms adapt to fast-paced technological changes, capitalize on new opportunities, and navigate potential disruptions.

As a result, the market demands more comprehensive professional profiles that can decipher and evaluate all the gathered data to make more informed business choices. Specialization in roles like product and design is essential to the effective development of IT projects, which creates a new trend toward profiles with knowledge in both fields (IT and telecommunications). These profiles can have a competitive advantage since they understand the implications of technology and can optimize developments from the creative stage.

The hybrid function of the profiles is essential to the optimization of technological firms since they have deep technical expertise as well as other talents like data interpretation and strong creative capacity, which also enables boosting the strategic side of the business.

6. Conclusion

The technology-based companies located in Barranquilla are in a process of adaptation to the local market, which implies applying concepts of business sustainability and long-term strategic leadership. Ten SL and BS variables were studied to determine the existence of interdirectional contagion from the identification of simple correlations. The variables V6, V8, and V9 are the ones that show to be both stationary and causal, or expressed in another way: the variables corporate governance, human resources, and social environment influence their behavior during the study period. Additionally, the existing literature indicates that the need to strengthen the availability of expert human talent in information and communication technologies could contribute to increasing the association between these variables, for which a greater effort is recommended in hiring professionals with the ability to adapt to the labor and business demands of the city in the near future.

The research clarifies the crucial role of strategic leadership (SL) in forming business strategy (BS) components in technology-centric organizations, particularly in the setting of turbulent market conditions, in order to more clearly summarize the primary findings. Corporate governance, human resources, and social environment (V6, V8, and V9, respectively) were discovered to demonstrate both stationary behavior and causal influence among the 10 analyzed SL and BS factors. This shows that these factors have a big impact on how well technology-based organizations perform. The study also highlights the potential for improved strategic leadership in managing intersectoral connections and navigating market volatility, providing priceless insights into how technology-centric businesses can enhance their performance and resilience in a quickly changing business environment.

In light of these research outcomes, a clear call-to-action for technology-centric companies and stakeholders is proposed. The evidence presented emphasizes the importance for these firms to prioritize strategic leadership, particularly in the areas of corporate governance, human resources, and social environment. Moreover, the value of hybrid professional profiles – those who combine deep technical expertise with data interpretation skills and creative capacity – should be recognized. Therefore, investment in talent acquisition and development, as well as the cultivation of a culture that encourages adaptability and long-term strategic thinking, should be central to their organizational strategies. For stakeholders, the findings advocate for the promotion of policies and initiatives that support these practices, in order to strengthen the resilience and adaptability of the overall technological ecosystem in the face of changing market conditions.

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