



From Territorial Value to Innovation: Anchoring Environments for the Milagro Canton

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ABSTRACT

Regional value can be transformed into innovation, technology transfer, and development through anchoring environments in the Milagro canton. This article examines how the productive structure, infrastructure, governance, and regional resources articulate these processes using a structural equation model (SEM) estimated with WLSMV. Seven latent constructs were modeled: natural and environmental resources; economic and productive resources; demographics and the labor market; economic and social infrastructure; sociocultural resources; organizational and institutional aspects; and the dependent latent construct of innovation, technology transfer, and development. The model confirms that territorial innovation depends primarily on productive networks and interactions, physical and digital infrastructure, institutional governance, and human capital. Natural endowments make a complementary contribution, while sociocultural resources exert an indirect influence by strengthening social capital, trust, and institutional coordination. Public policy implications for strengthening clusters, reducing logistical gaps, and consolidating local governance are discussed.

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1. Introduction

In knowledge-based economies, the learning and combination of knowledge that contribute to territorial development are prevalent and constitute a competitive advantage (Samillan, 2026; Sirichai Nakudom, 2026). Absorption capacity demonstrates how organizations and territorial systems innovate when they possess prior knowledge that enables them to recognize, match, and apply external knowledge (Sirichai Nakudom, 2026).

Cohen and Levinthal (1990) note that the accumulation of knowledge and prior experience serve as levers for transforming information into results. The Milagro canton has a large territory encompassing agro-industrial activities, services, and connectivity; absorption depends as much on assets as on interactions and rules that reduce barriers and coordination costs (Morejón and Vergara, 2022).

The Milagro canton is an intermediate and peripheral territory seeking to develop territorial innovation strategies to overcome structural imbalances, revitalize the economy, and increase social resilience (Morejón and Vergara, 2022). Achermann (2013) and Florian (2022) show that innovation does not occur uniformly across all territories, nor does it depend on technological factors; rather, it is rooted in a series of specific territorial conditions.

This research examines the complex relationships between six dimensions of territorial resources and performance in innovation, technology transfer, and development in the Milagro canton. Using a structural equation model based on covariances and ordinal variables, the article seeks to provide rigorous empirical evidence on how anchoring environments enable the transformation of territorial value into dynamics of inclusive development.

1.1. State of the Art

The territorial vision is linked to the strategies established by the regional government, among which are the Regional Innovation Systems (RIS), which analyze the relational density among firms, universities, intermediaries, and public administrations (De Iudicibus et al., 2025). RIS describe ecosystems where interactive learning and knowledge externalities become endogenous to the territory and explain why places with similar resources may differ in innovative performance, with the quality of the links being the key differentiator (Cario et al., 2023; Cooke, 2001).

It is emphasized that territories must have partnerships between universities, businesses, and government within their systems, as this enables the experimentation, transfer, and scaling of solutions (Bravo Placeres et al., 2026). For the regional system to open up to innovation, intermediary spaces—such as innovation parks—and economic incentives are required to facilitate the influx of external knowledge (Etzkowitz and Leydesdorff, 2000).

An innovation environment is achieved when a region has employment opportunities, physical and digital infrastructure, markets, and knowledge networks capable of attracting innovative activities and retaining the capabilities of local residents over time (Jeannerat and Crevoisier, 2022). The multiplier effects of this system include public procurement based on local criteria and innovation districts that can focus on agro-innovation or the energy transition (Goddard et al., 2014).

A key reference point is the place-based paradigm that fosters smart specialization, as it is based on the idea that regional strategies should originate from entrepreneurs, universities, and government agencies and rely on multilevel governance for public-private coordination (Rauhut and da Costa, 2021; Solly, 2016).

In the case study of the Milagro canton—which is considered a mid-sized city—assets such as its strategic logistical location, a productive network of SMEs, and agro-industrial bases should be leveraged (Morejón and Vergara, 2022). Likewise, digital connectivity gaps should be closed, ensuring that research conducted by universities and technical colleges can foster technology transfer and attract investment (McCann and Ortega-Argilés, 2018).

1.2. Variables and Conceptual Model

Natural and environmental resources include factors such as geographic location, climate, and soil quality, which are key determinants of the productive structure and the types of economic activities found in a given territory (Tao et al., 2022). Fan et al. (2023) have demonstrated that natural resources, when managed sustainably and integrated into innovation strategies, can become assets for territorial development (Yangfen and Yansui, 2011).

Economic and productive resources include the productive organization, business networks, and inter-firm cooperation (Héraud, 2021). These factors help drive innovation dynamics from the business sector (Jeannerat and Crevoisier, 2022). Cantú and Bernardi (2019) demonstrate that territorial production clusters and local business networks are effective mechanisms for increasing regions' innovation capacity (Héraud, 2021).

Demographics and the labor market—including population dynamics, unemployment, and underemployment—directly affect the availability of human capital and the sustainability of local development (Macas-Acosta et al., 2024). An environment with high unemployment can limit local innovation capabilities, although it can also encourage the emergence of entrepreneurial initiatives when support networks are in place (Baron, 2016; Torre, 2021).

Economic and social infrastructure—including transportation, telecommunications, energy, water, and sanitation—is essential for the efficient functioning of a territorial innovation system (Miorner et al., 2025). A strong infrastructure facilitates the flow of knowledge, goods, and services, and enables connections between innovation actors and networks (Chetyrbuk and Holod, 2023; Stehnei et al., 2023).

Sociocultural resources—including formal and non-formal education, as well as tangible and intangible heritage—serve as drivers of territorial identity, social cohesion, and social innovation (Broekel et al., 2021). These elements are essential for building a culture of innovation rooted in the territory (Broekel et al., 2021; Veyssi re et al., 2022).

Organizational and institutional aspects include local governments, institutional planning, and private institutions that play a coordinating role within the territorial system (Sgroi, 2021). Multilevel governance and the ability to build territorial consensus are key conditions for constructing a shared vision of development and innovation (Luongo et al., 2023; Sgroi, 2021).

The dependent variable of the study includes elements such as technological innovation, research processes, technology transfer, and university-business linkages (Todella et al., 2024). These dimensions can be considered drivers of inclusive and sustainable territorial development, particularly in contexts where they are integrated into local innovation ecosystems (De Nicola et al., 2023; Todella et al., 2024).

Within this framework, sociocultural resources (η_{rsc}) provide the foundation for social capital, interpersonal and institutional trust, and shared identity (Chen et al., 2025; Nguyen Thi and Vu Dinh, 2025; O'Dwyer et al., 2023). These elements do not directly generate patents or technological innovations on their own, but rather act as a relational lubricant that enhances business networks and strengthens local institutions (O'Dwyer et al., 2023).

1.3. Rationale, Objectives, and Hypotheses

This research aims to analyze the relationships between territorial resources and innovation in the Milagro canton. These relationships are framed within various natural, socioeconomic, cultural, infrastructural, and organizational dimensions that foster an environment conducive to innovation, technology transfer, and territorial development (Allais et al., 2015; Omelyanenko and Omelyanenko, 2022).

The objective of this research is to analyze the influence of natural and environmental resources; economic and productive resources; demographic and labor resources; economic and social infrastructure; sociocultural factors; and organizational and institutional factors on the processes of innovation, technology transfer, and territorial development in the Milagro canton. The purpose is to identify conditions that enable a strategy for anchoring environments that promote a sustainable, inclusive, and knowledge-based development model. The following research hypotheses serve as the basis for revitalizing the model.

The following research hypotheses are formulated:

H1: Natural and environmental resources influence innovation, technology transfer, and development in the Milagro canton (Yangfen and Yansui, 2011).

H2: Economic and productive resources influence innovation, technology transfer, and development in the Milagro canton (Cantú and Bernardi, 2019; Héraud, 2021).

H3: Demographics and the labor market influence innovation, technology transfer, and development in the Milagro canton (Baron, 2016; Torre, 2021).

H4: Economic and social infrastructure influence innovation, technology transfer, and development in the Milagro canton (Chetyrbuk and Holod, 2023; Stehnei et al., 2023).

H5: Sociocultural resources influence innovation, technology transfer, and development in the Milagro canton (Broekel et al., 2021; Veyssièrre et al., 2022).

H6: Organizational and institutional factors influence innovation, technology transfer, and development in the Milagro canton (Luongo et al., 2023; Sgroi, 2021).

2. Methodology

A structured questionnaire was used with Likert-scale items ranging from 1 to 8 (1 = strongly disagree/very poor situation; 8 = strongly agree/optimal situation), organized into seven reflective constructs:

Natural and Environmental Resources (rna): geographic location (rna1), climate (rna2), soils (rna3).

Economic and Productive Resources (rep): productive organization (rep1), business networks (rep2), business associations (rep3), cooperation among businesses (rep4).

Demographics and Labor Market (dmt): demographics and population dynamics (dmt1), unemployment (dmt2), underemployment (dmt3).

Economic and Social Infrastructure (ies): transportation (ies1), telecommunications (ies2), energy (ies3), water (ies4), sanitation (ies5), housing (ies6), specialized business services (ies7), consulting services (ies8).

Sociocultural Resources (rsc): formal education (rsc1), non-formal education (rsc2), tangible heritage (rsc3), intangible heritage (rsc4).

Organizational and Institutional Aspects (aoi): municipal government (aoi1), local authority (aoi2), institutional planning (aoi3), private institutions (aoi4).

Innovation, Transfer, and Development (idt): product innovation (idt1), process innovation (idt2), technology transfer and adoption (idt3), university–business collaboration (idt4), regional technological development (idt5).

Let $\eta = (\eta_{rna}, \eta_{rep}, \eta_{dmt}, \eta_{ies}, \eta_{rsc}, \eta_{aoi}, \eta_{idt})^T$ be the latent vector and y the stacked vector of observed indicators. For each latent block j with indicators $i = 1, \dots, k_j$, an ordinal probit model is used:

$$\begin{aligned} y_{ij}^* &= \lambda_{ij} \eta_j + \varepsilon_{ij}, \varepsilon_{ij} \sim \mathcal{N}(0, \theta_{ij}), \\ y_{ij} &= c \text{ si } \tau_{ij,c-1} < y_{ij}^* \leq \tau_{ij,c}, c = 1, \dots, 8, \end{aligned}$$

where y_{ij}^* is the underlying continuous latent response, λ_{ij} is the factor loading, θ_{ij} is the error variance, and $\tau_{ij,1}, \dots, \tau_{ij,7}$ are the thresholds. The observed probabilities are obtained using the normal CDF $\Phi(\cdot)$. The correlation matrix γ^* is approximated using polychoric correlations ($\hat{R}_{poly}$), and the thresholds $\hat{\tau}$ are estimated using a two-stage maximum likelihood method (Olsson, 1979).

Mapping the indicator and latent variables in their simple structure yields:

$$\begin{aligned} \eta_{rna} &= rna1 + rna2 + rna3 \\ \eta_{rep} &= rep1 + rep2 + rep3 + rep4 \\ \eta_{dmt} &= dmt1 + dmt2 + dmt3 \\ \eta_{ies} &= ies1 + ies2 + ies3 + ies4 + ies5 + ies6 + ies7 + ies8 \\ \eta_{rsc} &= rsc1 + rsc2 + rsc3 + rsc4 \\ \eta_{aoi} &= aoi1 + aoi2 + aoi3 + aoi4 \\ \eta_{idt} &= idt1 + idt2 + idt3 + idt4 + idt5 \end{aligned}$$

Once the endogenous block η_{idt} and the exogenous vector

$$\xi = (\eta_{rna}, \eta_{rep}, \eta_{dmt}, \eta_{ies}, \eta_{rsc}, \eta_{aoi})^T.$$

The structural model is formulated as

$$\eta_{idt} = \gamma^T \xi + \zeta, \text{ with } \gamma = (\gamma_{rna}, \gamma_{rep}, \gamma_{dmt}, \gamma_{ies}, \gamma_{rsc}, \gamma_{aoi})^T, \zeta \sim \mathcal{N}(0, \psi).$$

A priori, we expect $\gamma_{rep}, \gamma_{ies}, \gamma_{aoi}, \gamma_{dmt}, \gamma_{rna} > 0$ (enablers and resources) and $\gamma_{rsc} \geq 0$ (possible predominant indirect effect).

The estimation was performed using the Weighted Least Squares Method with Mean and Variance Correction (WLSMV). This estimator is used because the data consist of ordinal items and it performs well with 6 or more scales, offering less bias in loadings than other estimators (Rhemtulla et al., 2012; Flora and Curran, 2004). The software used was JAMOVl (2025) with its SEM module.

The research was conducted in the Milagro canton, which has a population of 195,943 inhabitants. Sampling was purposive in the parishes of Camilo Andrade Manrique, Chirijos, Coronel Enrique Valdez, and Ernesto Seminario Hans, with a total of 215 interviews. This sample exceeds the threshold of 200 respondents required to use a Structural Equation Modeling technique; this is due to the complexity of the model, and saturation serves as the mechanism for determining sample adequacy, as measured by the factor loadings of all variables (Flora and Curran, 2004; Li, 2016; Wolf et al., 2013).

The Milagro canton is located in the central-eastern part of the province of Guayas, in the southeastern coastal region of Ecuador. It has an area of approximately 404.96 km². The cantonal seat covers approximately 34 km². The cantonal capitals, together with the urban areas of the rural parishes, account for 7.67% of the canton's total area; thus, 92.32% is rural, where hamlets and crops are located. Additionally, the productive area includes industries, infrastructure, and commercial and service corridors (Geoportal, 2011).

The canton extends to the east of the province of Guayas and is located 45.5 km from the city of Guayaquil via Route E40. It lies at an elevation of 13 meters above sea level; the climate is classified as tropical, with distinct dry and wet (rainy) seasons. It has an average annual temperature of 23.9°C and approximately 4,283 mm of precipitation (Climate-Data, 2025).

The overall model fit is assessed using the RMSEA, SRMR, CFI, and TLI indices. Low RMSEA/SRMR values (target RMSEA < 0.05, SRMR < 0.05) and high CFI/TLI values (≥0.95) are considered evidence of good model fit.

Internal reliability will be measured using Cronbach's alpha and McDonald's omega for each construct. For convergent validity, the average variance extracted (AVE) will be used with the following formula.

$$AVE_j = \frac{\sum_i \lambda_{ij}^2}{\sum_i \lambda_{ij}^2 + \sum_i \theta_{ij}}$$

An AVE of ≥ 0.50 is considered adequate evidence.

3. Results

The data were processed for the structural equation model, and both the measurement and structural models exhibit acceptable overall fit, as the standardized mean squared residual and mean squared error of approximation are below 0.05 even within the confidence intervals (see Table 1). This model converges well, and the estimated values can be used to understand the issue at hand.

Table 1.
Model Tests

	SRMR	RMSEA	95% Confidence Interval		RMSEA-p
			Lower	Upper	
Model	0.04	0.03	0.01	0.05	0.98

Source: Author's own work (2025).

Overall, the model exhibits acceptable incremental fit, which is analyzed in conjunction with the parsimony fit in Table 1. The index values must exceed 0.95 as a threshold (see Table 2). This validates the conceptual model, which posits that natural-environmental, economic-productive, demographic-labor, economic-social infrastructure, socio-cultural, and organizational-institutional resources influence innovation, technology transfer, and development.

Table 2.
Fit Indices

	Model
Comparative Fit Index (CFI)	0.98
Tucker-Lewis Index (TLI)	0.99
Bentler-Bonett Non-normed Fit Index (NNFI)	0.99
Relative Noncentrality Index (RNI)	0.98
Bollen's Incremental Fit Index	0.95
Goodness-of-Fit Index (GFI)	0.95

Source: Author's own work (2025).

Table 3 shows a good fit in terms of the model's internal consistency, as the Cronbach's alpha values exceed 0.7. Likewise, convergent validity is acceptable across the constructs, although the organizational-institutional aspects are borderline. Although this limit is set at a reasonable threshold of 0.50, a high level of validity can be inferred because, when viewing the dataset as a whole, Cronbach's alpha and McDonald's alpha are found to be higher, indicating a marginally convergent validity analysis.

Table 3.
Reliability Index

Variable	α	ω_1	ω_2	ω_3	AVE
Natural and Environmental Resources	0.822	0.821	0.821	0.824	0.628
Economic and productive resources	0.847	0.843	0.843	0.827	0.599
Demographics and Labor Market	0.824	0.824	0.824	0.825	0.635
Economic and Social Infrastructure	0.890	0.891	0.891	0.889	0.526
Socio-Cultural Resources	0.814	0.811	0.811	0.807	0.539
Organizational and Institutional Aspects	0.784	0.785	0.785	0.789	0.499
Innovation, Technology Transfer, and Development	0.912	0.915	0.915	0.921	0.706

Source: Author's own work (2025).

The factor loadings indicate an acceptable measurement model with good convergence. Natural and environmental resources, demographics, and the labor market have high and consistent loadings (see Table 4). Likewise, economic and productive resources and socio-cultural resources maintain moderate loadings. Economic-social infrastructure and organizational-institutional aspects exhibit certain heterogeneous loadings. This indicates a robust model whose variables are designed to explain the phenomenon under study and effectively address the article's objective.

Among the heterogeneous loadings for economic-social infrastructure, the factors that most represent this dimension are territorial specialization and the transportation system, together with water supply, with the provision of basic services being particularly important.

The planning carried out by territorial institutions and private institutions plays a significant role in the organizational and institutional aspects related to the territory, particularly in terms of their capacity to coordinate research, innovation, and technology transfer initiatives.

Table 4.
Measurement Model

Latent	Observed	Estimated	p-value
Natural and Environmental Resources	Geographic location	0.74	
	Climate	0.81	<.001
	Soils	0.81	<.001
Economic and productive resources	Production organization	0.83	
	Business Networks	0.91	<.001
	Business association	0.67	<.001
	Cooperation among companies	0.64	<.001

Latent	Observed	Estimated	p-value
Demographics and the labor market	Demographics and population dynamics	0.83	
	Unemployment	0.75	<.001
	Underemployment	0.80	<.001
Economic and social infrastructure	Transportation	0.79	
	Telecommunications	0.73	<.001
	Energy Sources and Uses	0.70	<.001
	Water supply	0.77	<.001
	Basic sanitation	0.72	<.001
	Housing	0.57	<.001
	Specialized services	0.81	<.001
	Consulting services	0.65	<.001
Socio-cultural resources	Formal education	0.72	
	Non-formal education	0.83	<.001
	Tangible assets	0.68	<.001
	Intangible assets	0.68	<.001
Organizational and institutional aspects	Municipal Government	0.73	
	Local Authority	0.64	<.001
	Institutional Planning	0.77	<.001
	Private institutions	0.66	<.001
Innovation, technology transfer, and development	Innovation	0.85	
	Research	0.82	<.001
	Technology Transfer	0.82	<.001
	University-Industry Collaboration	0.87	<.001
	Regional Development	0.81	<.001

Source: Author's own work (2025).

Table 5 shows the structural model in which economic and productive resources have the greatest effect on innovation, technology transfer, and development. Likewise, economic and social infrastructure, as well as organizational and institutional factors, continue to influence innovation. Additionally, demographics, the labor market, and natural and environmental resources have a lesser effect on innovation. However, sociocultural resources have no influence on innovation and development in the Milagro canton (not significant).

Table 5.
Measurement Model

Dep	Pred	Estimate	p-value
Innovation, Transfer, and Development	Natural and environmental resources	0.17	0.003
	Economic and productive resources	0.37	<.001

Dep	Pred	Estimate	p-value
	Demographics and labor market	0.18	0.007
	Economic and social infrastructure	0.20	0.002
	Socio-Cultural Resources	0.00	0.935
	Organizational and Institutional Aspects	0.19	0.008

Source: Author's own work (2025).

The overall results indicate that innovation, technology transfer, and development depend on productive coordination, the availability of infrastructure, and governance, with ecosystem services serving as a complementary factor. However, the business network and the capacity for productive organization are the primary factors a region has to foster innovation, technology transfer, and development.

Basic services and the specialization of services that complement productive activity serve as the second incentive for innovation, technology transfer, and development. Furthermore, the way in which the territory's institutions are planned and the autonomous government's governance model constitute a third pillar that drives an increase in innovation, technology transfer, and development within the territory.

4. Discussion

The empirical findings provide key insights for the discussion on models of territorial development and regional innovation. The strong association observed between economic-productive resources and innovation ($\hat{\gamma} = 0.370$) supports the literature on Regional Innovation Systems and clusters, which posits that the density of business-to-business interactions and cooperation within networks constitutes the main determinant of territorial absorption capacity (Cooke, 2001; Pinto et al., 2023; Volberda et al., 2010). In Milagro, business collaboration and collaborative networks act as the driving force behind the adoption of technologies and process innovation (Pinto et al., 2023).

Physical, digital, and specialized service infrastructure ($\hat{\gamma} = 0.200$) serves as a fundamental enabling condition (Gorain, 2021; Koul, 2025). Road connectivity and telecommunications networks reduce transaction barriers and enable local firms to access information flows and external markets (Hambly and Rajabiun, 2021). However, infrastructure alone does not automatically generate innovation if it is not linked to local institutions and human capital (Dansou and Carrier, 2023; Lawal et al., 2024). The significance of the organizational-institutional block ($\hat{\gamma} = 0.190$) is consistent with the findings of Fagerberg and Srholec (2023), who argue that effective local governance and planning capacity are indispensable for transforming intentions into sustainable development projects (Hambly and Rajabiun, 2021).

Likewise, demographic and labor market variables ($\hat{\gamma} = 0.180$) reflect the importance of skilled human capital and the absorption of skilled employment for retaining value within the canton (Audretsch et al., 2021; Gao et al., 2022). Natural resources ($\hat{\gamma} = 0.170$) make a positive, complementary contribution, which must be integrated into agro-industrial value chains and sustainable technological solutions to avoid reprimarization traps (Chacua et al., 2024; Ma et al., 2022). The fourth discussion shows that the combination of human capital, employment, and mobility shapes regional innovation capacity, since improved skill endowments and dynamic labor markets capture returns on knowledge (Audretsch et al., 2021).

The non-significant result for sociocultural resources (H5 not supported) warrants special analytical consideration. Far from suggesting that culture or education lack relevance, the absence of a direct effect indicates that cultural heritage and non-formal education do not automatically translate into innovative products or processes unless they are mediated by social capital, associative trust, and

institutional intermediation mechanisms (Challoumis, 2025). Sociocultural assets constitute an enabling contextual foundation that fosters social cohesion and indirectly strengthens productive networks and local institutions (Chen et al., 2025; O'Dwyer et al., 2023).

According to the results, sociocultural resources do not have a direct effect on innovation, but they may do so indirectly. For example, social capital—measured by trust, norms, and civic networks—can be aligned with economic-productive, infrastructural, or institutional resources through a mediating mechanism, thereby creating an enabling context (Challoumis, 2025).

5. Conclusions

This study demonstrates that the consolidation of anchoring environments for innovation, technology transfer, and development in the Milagro canton depends primarily on the coordination of its productive fabric, the quality of its infrastructure, institutional effectiveness, and local human capital. Natural endowments act as complementary assets that gain strategic value when integrated into knowledge networks and complex value chains.

From an applied perspective, the following implications emerge for strengthening anchoring environments:

Cluster governance and institutional framework: Create public-private-academic collaboration platforms that professionalize territorial planning and incentivize university-business partnerships and pro-innovation public procurement.

Closing infrastructure gaps: Prioritize the expansion of high-speed digital connectivity (broadband) and logistics infrastructure to optimize agro-industrial and service chains.

Aligning Skills with the Labor Market: Adapt technical and higher education programs to the demands of local productive sectors, strengthening the capacity to attract and retain qualified talent.

Limitations: The study employs a cross-sectional design, which limits the ability to infer dynamic causal relationships over time. Furthermore, as it is based on perceptions of key stakeholders collected through a single source, there is a possibility of common method bias or unobserved endogeneity. Finally, the findings pertain specifically to the territorial context of the Milagro canton; therefore, their generalization to other areas should be approached with analytical caution.

Future research directions: It is suggested that this methodology be replicated in other municipalities and intermediate administrative districts across the country to conduct comparative analyses and support the formulation of a national strategy for anchoring environments. Likewise, it is recommended to employ spatial econometric models (such as spatial dependency or lag models) to examine the regional transmission of knowledge and spillover effects toward neighboring parishes and cantons.

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