Regional systems of entrepreneurship in 2017–2018: An empirical study in selected regions of South America

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Even with the progress in the understanding of regional entrepreneurial systems in developed economies, very little is known about how they function in South America. This study aims to address this research gap by examining the features of entrepreneurial systems in 22 regions in Colombia, Ecuador, and Uruguay using an adapted Global Entrepreneurship Index (GEI) methodology. The results of the present study reveal that, put together, the selected South American regions show higher average scores in entrepreneurial attitudes compared to countries at similar stages of economic development. Looking at the pillar level, South American regions are weak in ‚process innovation', ‚internationalization', and ‚technology absorption', which have been identified as the regions' most critical bottlenecks. Moreover, relevant differences in individual entrepreneurial attitudes, abilities, and aspirations among urban and rural populations within the studied regions are also identified. The contribution from the empirical work presented here is twofold. First, this study validates the suitability of the GEI methodology for the analysis of regional entrepreneurial systems in a developing-country context. Second, it provides one of the first empirical investigations into regional entrepreneurial ecosystems in South America. This study's findings could be utilised as the basis for more context-sensitive regional entrepreneurship policy approaches in the studied regions.

Keywords:
entrepreneurship,
regional entrepreneurship system,
entrepreneurship policy,
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Introduction

Entrepreneurial ecosystems (EEs) are a crucial area of interest within the entrepreneurship research field (Cavallo et al. 2019). Entrepreneurship is a complex phenomenon that requires multidimensional approaches to be fully understood. The EE approach arises as a distinctive and systemic view of entrepreneurship that proposes that the creation, discovery, and exploitation of entrepreneurial opportunities are interactively influenced by economic, social, institutional, and other important factors (Qian et al. 2013). The EE concept has been attracting attention from both scholars and policymakers. The number of published articles on the topic of EEs is rapidly increasing; meanwhile, the EE concept is increasingly being adopted as a regional policy strategy to foster sustainable entrepreneurship (Alvedalen–Boschma 2017, Bischoff–Volkmann 2018, Cavallo et al. 2019, Spigel–Harrison 2018). Nevertheless, despite the advances in EE research, many fundamental questions about the optimal ecosystem structure, systemic nature of EEs, and metrics for ecosystems remain unanswered (Alvedalen–Boschma 2017, Kuckertz 2019, Kuratko et al. 2017, Malecki 2018, Roundy et al. 2018, Stam–van de Ven 2021).

Though still evolving, the EE concept has been used as the basis for the design of several frameworks and tools for measuring the performance of entrepreneurial systems in practice (e.g., Kauffman Foundation model (Stangler–Bell-Masterson 2015), the Global Entrepreneurship Index (GEI) [1], the Global Entrepreneurship Monitor's National Entrepreneurship Context Index (GEM NECI) [2], and the Regional Entrepreneurship and Development Index (REDI) [3]). Among the most well-established indices for measuring the quality of national- and regional-level EEs are the GEI and the REDI. The GEI provides yearly data of the EEs in 137 countries, while the REDI has been computed two times, in 2013 and 2017, using data from 125 regions in the EU (Szerb et al. 2017). The adoption of the GEI and REDI theoretical framework and empirical outputs by researchers (see Ács et al. 2018, Audretsch–Belitski 2017, Komlósi–Páger 2015, Szerb et al. 2019) and institutions, such as the European Commission, have legitimised the validity of these indicators in theory and practice. One of the foremost features of the GEI and REDI methodologies is that they reflect the multidimensional character of entrepreneurship as these indices are calculated by combining both individual (entrepreneurs, population) and institutional data. Moreover, the GEI and REDI ensure the systemic nature of EEs by employing the so-called penalty for bottleneck (PFB) methodology in their models.

The continued publication of the GEI has significantly advanced the knowledge on the functioning of national-level entrepreneurial systems worldwide. Similarly, the publication of the REDI has contributed to a clear understanding of the

dynamics of EEs within the EU regions. However, no similar index has been developed and applied in South America. Since the REDI has been successfully calculated for EU regions, a potential gap, and an opportunity to employ this methodology have existed for measuring EEs in other regions, such as in South America. Nevertheless, despite the apparent potential for applying the REDI methodology elsewhere, there are several constraints vis-à-vis its broader application. The REDI employs complex indicators that require specific regionalised data, which are scarcely available for developing countries. Thus, as the REDI is the regional adaptation of the GEI (Szerb et al. 2017), modifying the GEI methodology rather than employing the original complex REDI variable structure may be a more robust approach when aiming to measure regional EEs in regions where regionalised data are not entirely available. However, this approach is not novel. Earlier studies have attempted to measure regional entrepreneurial systems in Hungary and Spain by modifying the GEI methodology (Ács et al. 2012, Szerb et al. 2013). Based on this background and aiming to advance knowledge on the functioning of regional ecosystems in South American regions, this study provides an adaptation and application of the GEI methodology from Ács et al. (2014) to measure regional-level entrepreneurship across 22 regions in three South American countries: Colombia, Ecuador, and Uruguay.

In the present study, the GEI index structure is adapted and modified, and the values for a ‚regional GEI' for 22 South American regions are calculated. The work presented here provides one of the first empirical investigations into how selected regional EEs in South America function and also shows how the GEI methodology can be adapted for the study of regional entrepreneurial systems in a developing-country context. Moreover, the methodological and practical insights gained from this study may also assist subnational policymakers in developing strategies to create supportive environments that foster productive entrepreneurship. This paper presents an overview of the advancement in the research on regional EE measurement. It summarises the details of the regional adaptation of the GEI methodology, the data characteristics, and a summary of the features of the selected regions to provide context. Presents and discusses the results at three levels of aggregation: the overall regional GEI score, sub-indices, and pillar level. Features the policy discussion and the conclusions.

Advancement in regional entrepreneurial ecosystems' conceptualisation and measuring

It is now well established from various studies in the stream of entrepreneurial systems that entrepreneurship occurs in localities. Specific conditions within regions of the same country can influence entrepreneurial decisions differently, and therefore, the local scale is the most appropriate for studying EEs (Malecki 2018).

Regional approaches for measuring EEs can be more precise because data at the national level may potentially hide a great deal of variation between and within city-regions and complicate the comprehension of the reality of the situation at the subnational, city, city-region, or regional scale where ecosystems predominantly function (Spigel et al. 2020). Within this framework, various models for measuring entrepreneurship systems have been developed and applied in subnational regions within the United States, Australia, or Europe (de Villiers Scheepers et al. 2018, Qian et al. 2013). In this context, perhaps the most well-known index for measuring regional entrepreneurship is the REDI. Since its first publication in 2013, the REDI reports have contributed to a better understanding and measurement of regional entrepreneurship systems in the EU. However, despite the increasing interest in developing measures for regional EEs, studies have been restricted to developed economies' contexts.

The functioning of regional entrepreneurship systems in developing regions remains unknown. In a South American context, ecosystems are well studied at the national level. The GEI provides continuous data for Chile, Colombia, Uruguay, Peru, Argentina, Bolivia, Ecuador, Paraguay, Brazil, Suriname, and Venezuela. Nevertheless, to date, there are no EE measurements designed for or applied to explore the functioning of EEs at the subnational level. Exceptionally, a growing academic interest has been observed in the theoretical examination of EEs in Chile; researchers have been exploring the characteristics and mechanisms of Chilean national and regional ecosystems from different perspectives (Amorós–Mandakovic 2017, Kuschel 2019, Villegas-Mateos 2021).

Perhaps one of the soundest reasons why no known empirical research has focussed on exploring the dynamics of regional EEs in South America is the lack of robust regional statistics. In South America, there are no regional statistical agencies responsible for collecting consistent regional data from various countries as does Eurostat in the EU. Nevertheless, possibilities for empirically measuring regional EEs in South America still exist because there are sufficient subnational data available for each country, and these can be aggregated to different levels to reflect regional conditions.

Method

The Global Entrepreneurship Index methodology

The GEI is a composite indicator that measures both the quality of entrepreneurship and the attributes of the supporting EE in a country. The GEI views entrepreneurship as ‚the dynamic, institutionally embedded interaction between entrepreneurial attitudes (ATT), entrepreneurial abilities (ABT), and entrepreneurial aspirations (ASP) by individuals, which drives the allocation of resources through the creation and operation of new ventures' (Ács et al. 2018,

p. 21). As shown in Table 1, the GEI is a complex four-level index that combines 14 pillars, each of which contains an individual and an institutional variable corresponding to the micro- and macro-level aspects of entrepreneurship.

Table 1

Structure of the Global Entrepreneurship Index (GEI)

Sub-indices	Pillars	Variables (indicators/institutions)
Attitudes sub-index	Opportunity perception	Opportunity recognition
		Freedom (economic freedom and property rights)
	Start-up skills	Skill perception
		Education (tertiary education and quality of education)
	Risk acceptance	Risk perception
		Country risk
	Networking	Know entrepreneurs
		Agglomeration (urbanization and infrastructure)
	Cultural support	Career status
		Corruption
Abilities sub-index	Opportunity start-up	Opportunity motivation
		Governance (taxation and good governance)
	Technology absorption	Technology level
		Technology absorption
	Human capital	Educational level
		Labour market (staff training and labour freedom)
	Competition	Competitors
		Competitiveness (market dominance and regulation)
Aspirations sub-index	Product innovation	New product
		Technology transfer
	Process innovation	New technology
		Science (GERD[a]) and [average quality of scientific institutions + availability of scientists and engineers])
	High growth	Gazelle
		Finance and strategy (venture capital and business sophistication)
	Internationalization	Export
		Economic complexity
	Risk capital	Informal investment
		Depth of capital market

a) Gross Domestic Expenditure on Research and Development.
Note: Individual variables are marked in white whereas institutional ones are marked in grey background.
Source: Ács et al. (2018b).

The GEI scores are calculated following an eight-stage process, which starts with the selection of variables, construction and normalisation of pillars, capping, average pillar adjustment, penalising, as well as the calculation of sub-index and GEI super-index (The Global Entrepreneurship and Development Institute 2018). Pillar values

range from 0 to 1 as these are first normalised. Thereafter, the pillars are allocated into three building blocks or sub-indices, namely, ATT, ABT, and ASP. The value of a sub-index is the arithmetic average of its adjusted pillars for that sub-index multiplied by 100. Finally, the average of the three sub-indices constitutes the entrepreneurship super-index (Ács et al. 2018a). The index scale ranges between 0 and 100, with 100 as the maximum value and 0 as the potential minimum. Moreover, to capture the complex characteristics of the National Systems of Entrepreneurship concept (Ács et al. 2014), the GEI is built following the guidelines of the Organisation for Economic Co-operation and Development (OECD) *Handbook on constructing composite indicators* (Giovannini et al. 2008).

Furthermore, in line with the systems of entrepreneurship theory, the GEI index calculation includes the PFB method to account for the interconnectedness of the pillars. This method implies that the highest performance enhancement will be achieved when additional resources are allocated to alleviate the most constraining bottleneck in the system. The key idea is to account for the relationships and complementarity across the systems and subsystems and highlight the importance of the bottleneck factors. The concept of complementarity simply refers to the interaction of two variables. Traditional index methods, based on the cumulative addition of independent index components, effectively assume the full substitution of elements, and, therefore, cannot recognize or handle bottleneck effects. By including this methodology in the calculation of the index, the GEI overcomes the shortcomings regarding the lack of consideration of the systemic nature of the entrepreneurial activity and the interconnectedness of elements of EEs that have been noted in the current literature (Alvedalen–Boschma 2017, Cavallo et al. 2019).

The regional adaptation of the GEI

For employing the national GEI methodology to analyse regional entrepreneurship systems, data and structures need to be modified to reflect the regional conditions. The optimal scenario would be to have the access to and use regional data on the same variables used at the national level. Nonetheless, acquiring the same original GEI data type is challenging in the context of South America, where no strong regional institutions are responsible for collecting and sharing regional data. In the present study, this issue is solved by employing regional data obtained from disaggregated data available at national-level institutions, such as national statistics institutes.

The individual GEI variables for all 22 regions are calculated in the same way as the original index structure owing to the availability of a large, pooled data set of more than 75,000 observations from the Global Entrepreneurship Monitor (GEM) Adult Population Survey 2010–2018. The details of the individual variables employed can be found in Table A1 (see Internet Appendix). In contrast, the calculation of institutional variables is more complicated because of the lack of

regional institutional-level data. Two approaches are used alternately to overcome this issue. First, for the unavailable variables, closely correlated proxy variables are employed to substitute for the missing data. When specific variables cannot be replaced efficiently by similar proxies, the national-level values are employed for all the regions. In this case, the pillar-level value would correspond entirely to variations in the individual-level variable used. The details and sources of institutional variables and indicators employed can be found in Table A2 (see Internet Appendix). Out of the 14 institutional variables for the entrepreneurship index construction, seven employ national-level values: (1) Freedom, (2) Country Risk, (3) Corruption, (4) Governance, (5) Competitiveness, (6) Economic Complexity, and (7) Depth of Capital Market, while the remaining seven variables employ a combination of regional and national-level data.

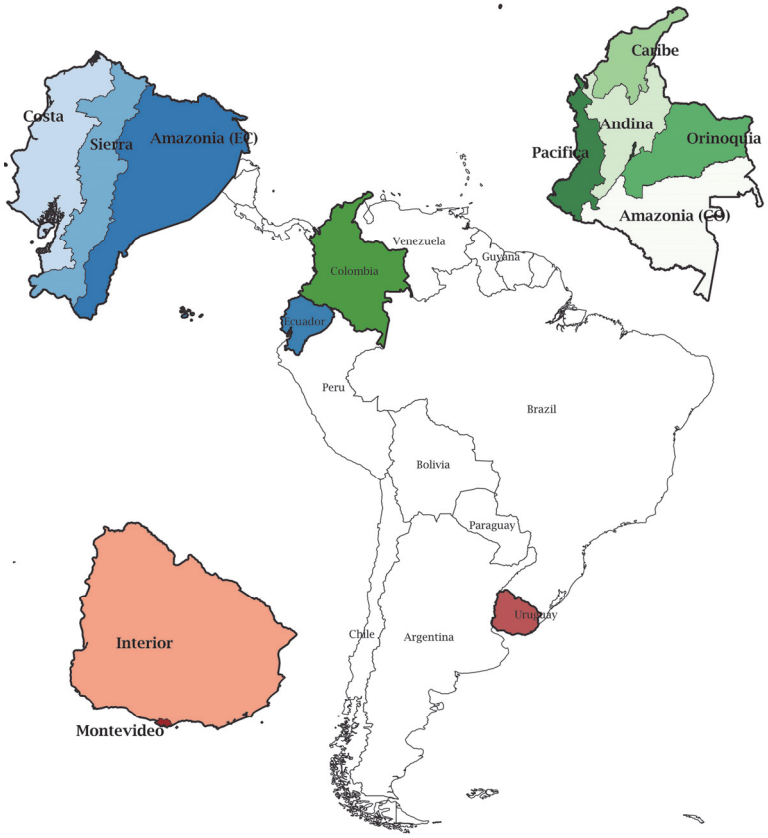
The unit of analysis in the present study is the ‚great subnational region'. Great regions are composed of various smaller administrative units, namely, departments or provinces within a country. Great subnational regions are smaller than a country but bigger than the country administrative units; therefore, they are rather similar to the Nomenclature of Territorial Units for Statistics (NUTS 2) level regions of the EU classification. As shown in Figure 1, a total of 10 great regions in Colombia (5), Ecuador (3), and Uruguay (2) are studied. Six of these ten regions are subdivided into urban and rural subregions in order to analyse them separately and identify possible differences between these two configurations.

The basic characteristics of the selected South American regions

Colombia is an upper-middle-income and efficiency-driven country consisting of 32 administrative departments grouped in 5 major natural regions: Caribe, Andina, Pacífica, Orinoquía, and Amazonía (Figure 1). The Caribe region is in the north, composed of eight departments. The region covers a total land area of 132,288 km^2. The Andina natural region is in central Colombia and is the country's most populated region. It contains the majority of the country's urban centres, including the capital city of Bogota. The region includes 10 departments. The total land area of the Andina region is 282,540 km^2. The Pacífica region covers an area of 83,170 km^2 along Colombia's Pacific coast. This region includes four departments. The Orinoquía region is located on the eastern side of Colombia and covers an area of 285,437 km^2. The Orinoquía region covers most of the area of four departments. The Amazonía is the largest Colombian region. It covers an area of 483,000 km^2 or 35% of Colombia's total territory. The region includes six departments. The official language in Colombia is Spanish, and the currency is the Colombian Peso.

Figure 1

Colombian, Ecuadorian, and Uruguayan natural regions



Ecuador is an upper-middle-income and efficiency-driven country consisting of 24 provinces divided into 3 continental natural regions, namely, Costa, Sierra, and Amazonía, and one isolated region, the Galápagos Islands. The Costa region includes 7 provinces. Guayaquil, the most populated city in Ecuador, is part of this region. The region's total area is 70,611 km^2. The Costa region is located along the coastal area of the Pacific Ocean. This region, therefore, is the most relevant for maritime trade and transportation. The Sierra region is in the Central part of the country and contains 10 provinces. Its territory is 60,361 km^2. The Sierra region includes Ecuador's national capital, Quito. The Amazonía region, also known as Oriental, includes six provinces. Amazonía is the largest region in Ecuador and has an area of 116,604 km^2. It is also the most sparsely populated region in the country. Ecuador is a ‚decentralised state', a term that refers to the decentralised administrative, political, and fiscal character of governance. Since 2000, the currency in Ecuador has been the USD.

Table 2

Economic characteristics of South American regions, 2017–2018

Region	Country	Regional population[a]	Urbani-sation, %[b]	Active population rate, %[c]	Regional GDP in current billion USD[d]	GDP per capita in current USD[e]	Poverty, %[f]	Main economic sector[g]	Tertiary education, %[h]
	population data			economic data					
Andina	Colombia	27,322,316	81.00	63.89	202.00	7393.10	9.79	Manufacturing, wholesale, and retail	75.01
Caribe	Colombia	10,725,455	71.97	61.31	48.11	4485.20	27.54	Manufacturing, wholesale, and retail	48.3
Pacífica	Colombia	8,409,994	65.57	61.92	42.20	5017.50	28.14	Manufacturing, wholesale, and retail	48.81
Orinoquía	Colombia	1,710,579	70.43	68.2	16.38	9577.60	32.44	Agriculture, livestock, hunting, forestry, and fishing	25.9
Amazonía (CO)	Colombia	1,123,581	54.94	68.2	3.24	2879.90	39.02	Mining, public administration, and defence	57.47
Sierra	Ecuador	7,504,942	56.0	72.38	45.92[i]	6118.60	25.01	Construction, public administration, and defence	55.61
Costa	Ecuador	8,303,168	73.0	64.86	43.57[i]	5248.25	23.20	Construction, public administration, and defence	35.69
Amazonía (EC)	Ecuador	898,547	42.0	78.75	7.34[i]	8170.35[i]	42.34	Oil and natural gas extraction and related services	24.33
Montevideo	Uruguay	1324920	98.94	64.50	29.01	21049.55	10.00	Commerce and services (tertiary sector)	97.39
Interior	Uruguay	2075080	91.79	59.86	28.45	14789.05	6.01	Commerce and services (tertiary sector), and manufacturing industry	40.16

a) *Source:* [4–6].
b) Percentage of the population living in urban areas. Data are from 2011 for Uruguay.
c) Economically active population calculated from province and department level labour data. *Source:* [7–9].
d) Own calculation based on [10–12].
e) GDP/population for Ecuador and Colombia. [13].
f) Colombia, poverty by unsatisfied basic needs (NBI). Ecuador and Uruguay, poverty by poverty line. *Source:* [14–16].
g) *Source:* [17–19].
h) Regional Gross enrolment ratio in tertiary education. *Source:* [20].
i) GVA per province and región year 2017.

Uruguay is a high-income and a ‚transition from efficiency-driven to innovation-driven' country. Its total land area is 176,215 km². The official language is Spanish, and the local currency is the Uruguayan Peso. The country is divided into 19 administrative departments grouped into two major regions: Montevideo and Interior. The Montevideo region covers an area of 530 km², a mere 0.3% of the total national territory, but holds approximately 40% of the total population. The Interior region covers the remaining area of 175,685 km². Montevideo, therefore, is a particularly densely populated region. The Montevideo region includes the capital city, Montevideo. The Interior region includes the remaining 18 departments. Uruguay has typically been a unitary state with its main political institutions and fiscal power centralised in Montevideo. Nevertheless, Article 50 of the National Constitution of Uruguay recognizes that the State will support decentralisation policies to promote regional development and general wellbeing. Table 2 summarises the key indicators of Colombia, Ecuador, and Uruguay's regional populations and economies.

Results and discussion

First, the regional GEI super-index scores of the South American regions are compared to 33 worldwide ‚efficiency-driven' or ‚transition from efficiency- to innovation-driven' economies according to the World Economic Forum (2018) classification. In this study, regions are conceptually treated as small nations that have specific individual and institutional dynamics. Moreover, recognizing that different forms of entrepreneurial activities can exist at different stages of development (Ács–Naudé 2013), the performance of the study's selected regions are compared with the performance of similar economies.

As seen in Table 3, the South American regions' performance is relatively heterogeneous, with scores distributed from 40.11 for the Colombian Andina Urban region at the high end to 14.25 for the Ecuadorian Amazonía region at the low end. Comparatively, Colombia ranks at the level of Hungary. Uruguay performs at the level of China or Malaysia, while Ecuador's performance is more akin to Indonesia's. Interestingly, certain regions have significantly higher rankings than their home country, as is the case with Colombia's Urban Andina region, which ranked 7th, while Colombia is ranked 9th. Similarly, Uruguay is ranked 14th, but the Montevideo region is ranked 10th. In Ecuador, the Sierra Urban region is ranked 42nd, whereas the country is ranked 44th. This observation is critical as it demonstrates the differences in the characteristics among subnational ecosystems. Overall, Chile has the best-performing entrepreneurship system among the compared economies, while the Ecuadorian Amazon region has the weakest ecosystem.

Table 3

GEI 2017 scores: Countries and South American regions compared

Rank	Country/region	GDP	GEI score[a)]	Rank	Country/region	GDP	GEI score[a)]
1	Chile	14,999	58.8	29	Lebanon	7,801	28.8
2	Saudi Arabia	20,804	47.2	30	Interior Rural	14,789	28.69
3	Poland	13,865	46.6	31	Thailand	6,593	27.1
4	Slovakia	17,557	44.1	32	Peru	6,711	26.8
5	Turkey	10,895	43.7	33	Panama	15,150	26.2
6	Latvia	15,682	43	34	Morocco	3,036	25.7
7	Andina Urban	7,393	40.11	35	Mexico	9,288	25.7
8	Andina	7,393	39.7	36	Russia	8,705	25.4
9	Colombia	6,377	37.3	37	Georgia	4,062	24
10	Montevideo	21,050	36.81	38	Bulgaria	8,334	22.7
11	Andina Rural	7,393	36.32	39	Egypt	2,444	22.7
12	Hungary	14,606	36.3	40	Argentina	14,613	22.2
13	China	8,879	36.3	41	Iran	5,520	22.1
14	Uruguay	17,322	34.6	42	Sierra Urban	6,119	21.43
15	Pacífica	5,018	34.16	43	Indonesia	3,838	21.2
16	Malaysia	10,259	33.4	44	Ecuador	6,214	21.1
17	Pacífica Urban	5,018	32.72	45	Jamaica	4,843	21
18	South Africa	6,132	32.6	46	Sierra	6,119	20.3
19	Caribe Urban	4,485	32.52	47	Brazil	9,925	20.1
20	Jordan	4,177	31.7	48	Bosnia and Herzegovina	5,395	19.9
21	Interior Urban	14,789	31.44	49	El Salvador	3,806	19.8
22	Caribe	4,485	30.88	50	Costa Urban	5,248	19.23
23	Croatia	13,452	30.8	51	Costa	5,248	18.97
24	Interior	14,789	30.67	52	Sierra Rural	6,119	18.19
25	Amazonía (CO)	2,880	30.24	53	Guatemala	4,451	17.9
26	Orinoquía	9,578	29.68	54	Costa Rural	5,248	17.48
27	Caribe Rural	4,485	29.39	55	Amazonía (EC)	8,170	14.25
28	Pacífica Rural	5,018	29.02				

a) Global Entrepreneurship Index (GEI) values for Uruguayan regions are from 2018.
Notes: GDP per capita (current USD). Colombian, Ecuadorian, and Uruguayan regions are highlighted.
Source: Countries' GEI scores are from The Global Entrepreneurship and Development Institute (2017).

Relative positions of South American regions at the sub-index level

This subsection analyses the regional scores of the 22 South American regions according to the three GEI sub-indices of ATT, ABT, and ASP. Analysis at the sub-indice level allows for observations of specific issues around entrepreneurship development, and simultaneously, it enables more specific regional differences to be identified. As shown in Table 4, the regional scores for ATT rank between 18.90 and 47.19, ASP range between 15.58 and 37.84, while the range for entrepreneurial aspirations is relatively wider – the regional scores range between 8.28 and 43.65.

For both sub-indices, ATT and ABT, Montevideo receives the highest values, while for ASP, Andina Urban attains the highest scores. Amazonía (Ecuador) scores the lowest regional values for the three sub-indices.

Table 4

Entrepreneurial attitudes (ATT), Entrepreneurial Abilities (ABT) and Entrepreneurial Aspirations (ASP) values and ranks of 22 South American regions, 2017

Country/region	Attitudes		Abilities		Aspirations		GEI	
	rank	ATT	rank	ABT	rank	ASP	rank	GEI
Colombia								
Andina	4	43.17	3	33.68	3	42.27	2	39.7
Caribe	13	36.55	12	25.86	8	30.22	10	30.88
Pacífica	8	41.24	8	29.69	6	31.54	5	34.16
Orinoquía	15	35.79	15	24.93	11	28.32	14	29.68
Amazonía (Colombia)	16	35.71	17	24.24	7	30.76	12	30.24
Andina Urban	5	42.65	2	34.03	2	43.65	1	40.11
Andina Rural	3	44.12	5	31.24	5	33.59	4	36.32
Caribe Urban	9	40.62	10	27.51	9	29.42	8	32.52
Caribe Rural	11	39.62	14	25.47	14	23.08	15	29.39
Pacífica Urban	12	37.04	11	26.89	4	34.24	7	32.72
Pacífica Rural	14	36.41	13	25.8	13	24.83	16	29.02
Ecuador								
Sierra	21	26.4	20	19.48	20	15.03	19	20.3
Costa	20	26.52	23	17.58	22	12.81	21	18.97
Amazonía (Ecuador)	25	18.9	25	15.58	25	8.28	25	14.25
Sierra Urban	19	27.19	19	20.39	19	16.7	18	21.43
Sierra Rural	22	25.21	22	17.79	24	11.57	23	18.19
Costa Urban	18	27.47	21	18.05	23	12.18	20	19.23
Costa Rural	23	23.91	24	15.7	21	12.82	24	17.48
Uruguay								
Montevideo	1	47.19	1	37.84	12	25.39	3	36.81
Interior	7	41.31	9	28.63	16	22.08	11	30.67
Interior Urban	6	41.58	7	30.34	15	22.39	9	31.44
Interior Rural	10	40.42	16	24.46	17	21.2	17	28.69
National GEI								
Colombia 2017	17	34.22	4	31.28	1	46.52	6	37.34
Ecuador 2017	24	23.78	18	21.23	18	18.20	22	21.07
Uruguay 2017	2	44.52	6	30.54	10	28.67	13	34.58
South American regions average	35.41		25.24		24.20		28.28	
Efficiency and transition from efficiency- to innovation-driven economies average	30.30		28.4		31.8		30.1	

Note: Data for National Global Entrepreneurship Index (GEI) scores and averages are from the Global Entrepreneurship and Development Institute (GEDI) (2017).

From the table presented above, two cluster groups can be identified: first, the leading entrepreneurial regions, that is, those that perform relatively strongly for most of the three sub-indices and the overall GEI score, such as the Colombian regions of Andina, Andina Urban, and Andina Rural, and the Uruguayan region of Montevideo. These regions also show some common characteristics: both Andina and Montevideo are highly urbanised (81% and 98.94%), and they have the highest rates of tertiary education and the lowest levels of poverty of the 22 regions (Table 2). Second, the lagging entrepreneurial regions can also be identified. The Ecuadorian regions of Costa, Amazonía, Sierra Rural, Costa Urban, and Costa Rural have the lowest values in most of the three sub-indices and overall GEI score. Altogether, in the South American regions, ATT (35.41) is the strongest sub-index, meaning that the population and institutions in these regions enable an optimistic view and positive attitude towards entrepreneurship. The ATT score for the South American regions is 5.11 points higher than the efficiency, and the transition from efficiency- to innovation-driven economies is average. Conversely, the ABT and ASP have significantly lower average scores in the South American regions.

South American regions compared at the GEI's pillar level

Pillar-level data (Table B1 – see Internet Appendix) provide a more detailed and precise picture of the entrepreneurial profile of each of the regions. To identify the specific regional strengths and weaknesses, the pillar scores for leading and lagging regions within each country are compared, and their performance relative to the country GEI score is measured. As discussed in the methodological chapter, each pillar consists of an individual and an institutional variable. In this study, the individual indicators for each pillar are calculated using entirely regionalised data. However, owing to the lack of institutional regionalised data, six pillars utilise the same aggregate institutional variable score for the countries to which the regions belong (those pillars are indicated by an asterisk in Table B1). Consequently, the least variance can be seen where the institutional variables are the same for all regions. Variations in opportunity perception, risk acceptance, cultural support, competition, risk capital are due purely to the individual variables.

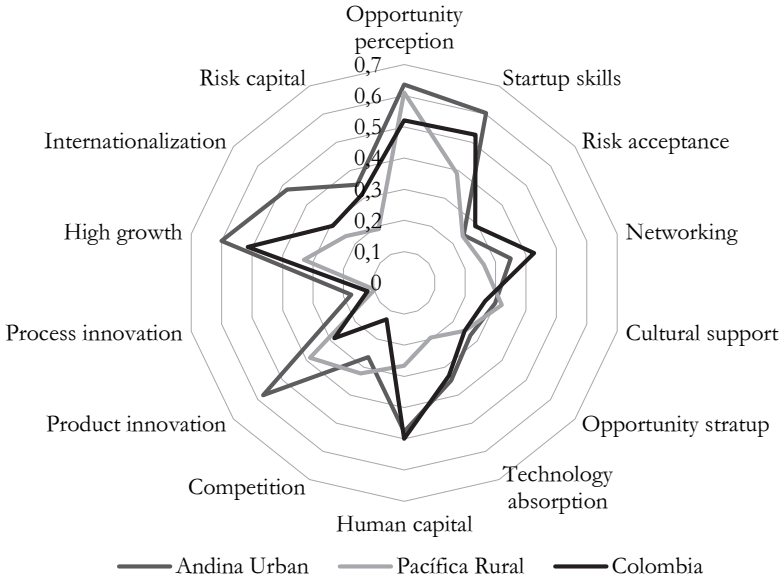
Colombia's regions compared at the GEI's pillar level

As seen in Figure 2, the Andina Urban region (GEI 40.11) is the best-performing region within Colombia, while the Pacífica Rural region (GEI 29.02) ranks in the lowest position. A variation of 11.09 points can be observed between these two regions. Overall, the Andina Urban region performs better than Colombia as a whole (GEI 37.34). The strengths of the Andina Urban region compared to Colombia are in networking and human capital. Overall, the Pacífica Rural region underperforms compared to the national scores; the most significant differences are evident in the high growth and internationalization pillars. Interestingly, the Pacífica

Rural region scores higher in the cultural support and networking pillars than Andina Rural and Colombia.

Figure 2

Colombian leading and lagging region, GEI pillar level, 2017

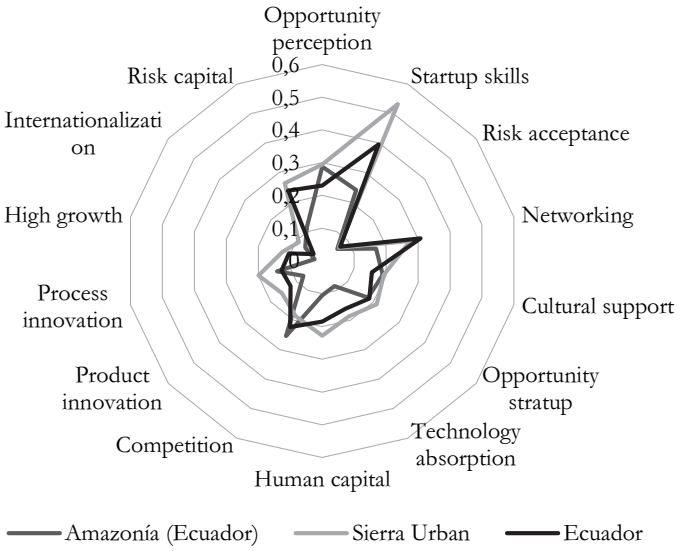


Ecuador's regions compared at the GEI's pillar level

Sierra Urban (GEI 21.43) is the best-performing region, while Amazonía (GEI 14.25) ranks the lowest. A difference of 7.18 points can be observed between these two regions. The most significant differences are in the start-up skills and risk capital pillars, where the Amazonía region significantly underperforms compared to Sierra Urban (Figure 3). The Sierra Urban region performs better than the country overall. The region's scores indicate strong opportunity perception and capacity for technology absorption compared to the national scores. Sierra Urban scores are lower for the networking and product innovation pillars compared to the national scores. The weakest pillars for the Sierra Urban region are risk acceptance (0.06) and internationalization (0.09).

Figure 3

Ecuadorian leading and lagging region, GEI pillar level, 2017

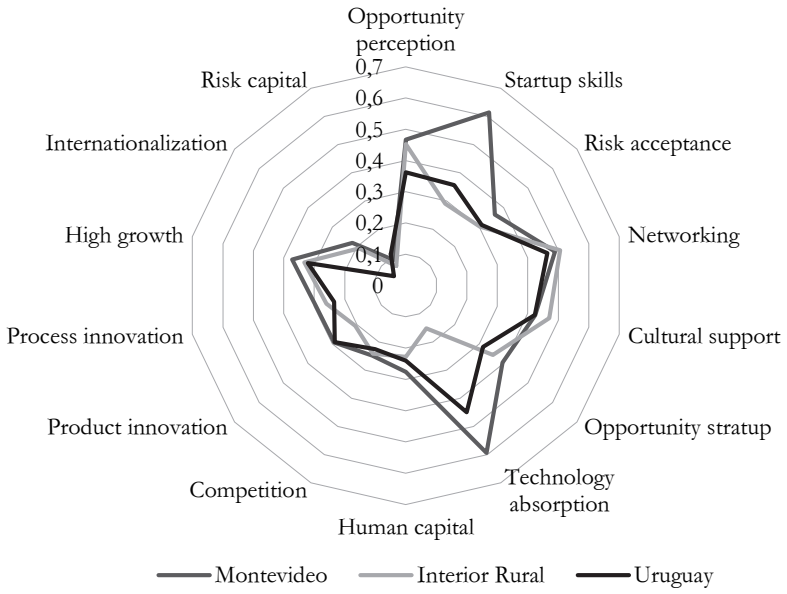


Uruguay's regions compared at the GEI's pillar level

The Montevideo region (GEI 36.81) is the best-performing region, while Interior Rural (GEI 28.69) ranks in the lowest position. A difference of 8.12 points can be observed between these two regions. The most significant differences are evident in the start-up skills and technology absorption, where the Interior Rural region underperforms significantly compared to Montevideo. Interestingly, the Interior Rural region performs better than Montevideo in the networking and cultural support pillars (Figure 4). Overall, Montevideo performs significantly better than Uruguay (GEI 34.58), while Interior Urban slightly underperforms compared to the national scores. Montevideo's weakest pillars are internationalization and risk capital.

Figure 4

Uruguayan leading and lagging regions, GEI pillar level, 2018



The main 'bottlenecks' for the selected regions' ecosystems

Table 5 shows the ‚top three' most constraining bottlenecks for each region. Overall, process innovation is the weakest pillar for 10 of the 22 regions. Process innovation aims to measure the ability to use new technologies by start-ups. This pillar is calculated by combining a measurement of the percentage of businesses using new technology that is less than five years old and the product of the Gross Domestic Expenditure on Research and Development (GERD) by the average of the level of availability of scientific institutions and availability of scientists and engineers in the country. The low scores in this pillar indicate that businesses do not generally use new technology as they have limited access to high-quality human capital in Science, Technology, Engineering, Mathematics (STEM) fields. internationalization and technology absorption are also among the top least favourable pillars for South American regions. Internationalization is the second most constraining pillar for 7 of the 22 regions, while technology absorption is the second most relevant bottleneck in 6 regions. Interestingly, networking is a challenge only in the Colombian Amazonía region, and competition is a challenge prevalent in mainly urban regions.

Table 5

Least favourable pillars for South American main, urban, and rural regions

Urban, rural region	1st	2nd	3rd
	pillar		
	Great regions		
Andina	Process innovation	Risk acceptance	Opportunity start-up
Caribe	Process innovation	Technology absorption	Competition
Pacífica	Process innovation	Technology absorption	Risk capital
Orinoquía	Process innovation	Technology absorption	Product innovation
Amazonía (CO)	Technology absorption	Product innovation	Networking
Sierra	Risk acceptance	Internationalization	High growth
Costa	Internationalization	High growth	Risk acceptance
Amazonía (EC)	High growth	Risk acceptance	Internationalization
Interior	Risk capital	Internationalization	Product innovation
	Urban regions		
Andina Urban	Process innovation	Risk acceptance	Competition
Montevideo	Risk capital	Internationalization	Competition
Caribe Urban	Process innovation	Technology absorption	Risk capital
Pacífica Urban	Process innovation	Competition	Technology absorption
Interior Urban	Risk capital	Internationalization	Product innovation
Sierra Urban	Risk acceptance	Internationalization	High growth
Costa Urban	Internationalization	Risk acceptance	High growth
	Rural regions		
Andina Rural	Process innovation	Opportunity start-up	Risk acceptance
Caribe Rural	Process innovation	Technology absorption	Internationalization
Pacífica Rural	Process innovation	Risk capital	Technology absorption
Interior Rural	Risk capital	Technology absorption	Internationalization
Sierra Rural	Risk acceptance	Internationalization	High growth
Costa Rural	High growth	Internationalization	Risk acceptance

Policy discussion

Taken together, the result from the GEI scores form the basis for developing a framework for an entrepreneurship policy approach at two policy levels: national and subnational.

National-level policy

The aggregated GEI score (Table 3) shows that Colombia is among the best performers within South American countries (surpassed only by Chile). Process innovation is the most constrictive bottleneck for all Colombian regions, except for the Amazonía region (Table 5). In this context, national policies centred on

improving the capacity of entrepreneurs to create new products and to enhance the innovation linkages between university and industry (Dutta et al. 2018, Sebestyén et al. 2021) could have a significant impact on business innovation. Conversely, the most favourable pillar for Colombia is high growth. As shown in Table 5, internationalization is among the ‚top three' least favourable pillars for most Ecuadorian and Uruguayan regions. Therefore, national-level policies centred on facilitating the internationalization of entrepreneurs by improving the country's export potential and increasing productivity are required to boost entrepreneurship in both countries. These policies are crucial for Uruguay, as they could also help overcome the country's sharp contraction (–12%) of export volumes experienced in 2018 (Giordano et al. 2019). For Ecuador, the most favourable pillar is start-up skills. A possible explanation for this might be that since 2007, Ecuador has experienced steady improvement in its tertiary education enrolment rate, increased internet access in schools, and the local availability of specialised training services (World Economic Forum 2018).

Subnational level policy

Certainly, regional and national GEI scores are similar because of the use of national-level values in the calculation of some institutional variables. However, as the individual data are entirely regional, variations can be observed to reveal valuable insights for regional policy. First, sub-index regional averages (Table 4) denote that the regional entrepreneurial attitudes average is higher than that of similar economies. Therefore, it is evident that the South American population's attitudes, perceptions, and behaviour towards entrepreneurship, coupled with regional institutional conditions, are particularly favourable for entrepreneurship across the region. This is a noteworthy feature of the South American context in contrast to similar economies in other parts of the world. This finding is in line with previous research that shows that for most of the high Total Entrepreneurial Activity (TEA) countries, the levels of entrepreneurship are related to attitude-inclined aspects, such as entrepreneurial capacity (skills), low fear of failure, and perceived entrepreneurial opportunity (Beynon et al. 2016). However, ABT and ASP for South American regions are lower than the global average.

The underperformance of ABT and ASP has different causes within each country. In Ecuador, policies for improving abilities require immense effort to enhance technology absorption (values for all Ecuadorian regions are under 0.20 in this pillar). Technology absorption, as measured in this study, depends on the level of access to communication and information technology (internet). In this regard, research highlights the importance of understanding territorial inequalities in the information society as these may create differences in a similar way as economic development does (Páger–Zsibók 2014). Therefore, policies aiming to bridge gaps in access to technology could have a significant impact. Similarly, technology

absorption is also the most constraining pillar for the Colombian ABT sub-index. Low firm-level technology absorption capacity and decreasing foreign direct investment for technology transfer are persistent issues for competitiveness both in Ecuador and Colombia (World Economic Forum 2018). For Uruguay, efforts to improve ABT are required in the human capital and competition pillars. In the case of ASP for Ecuador, the internationalization and high growth pillars are the most constraining ones within the sub-index. The scores for internationalization in Ecuador are critically low (all the Ecuadorian regional scores are lower than 0.10 in this pillar). For Colombia, the process innovation pillar is the most constraining for this sub-index (all the Colombian regional scores are lower than 0.25 in this pillar).

In Uruguay, the risk capital and internationalization pillars are the main limitations for the aspirations sub-index. Mainly, policy efforts are required to improve risk capital, which is extremely low in all the Uruguayan regions (scores lower than 0.10). One explanation for such low values is the low level of informal investment. Therefore, centring regional policy on tackling the underlying individual (Honjo–Nakamura, 2020) and environmental (Szerb et al. 2007) causes of low formal investment rates among the Uruguayan population could have a great impact. Finally, specific differences in the scores at the urban-rural regional levels (Table 5) are found. First, it can be observed that although similar pillars are constraining regional systems of entrepreneurship, the relevance (position on the 1-to-3 categorisation of the least favourable pillars) of each one is different in urban and rural regions. In other words, the same elements are performing at different levels in the urban and rural areas within the same main region. Second, specific bottleneck pillars for urban-rural regions are evident. In Colombia, internationalization is a unique bottleneck for the Caribe Rural region. These types of differences are also observed among Uruguayan regions. product innovation is a specific weakness in the Interior Urban region, while for the Interior Rural region, technology absorption is a particular weakness. Similarly, competition is a bottleneck only for urban Uruguayan regions. Summarily, these results suggest that attention should be paid to designing policies that address specific aspects of urban and rural entrepreneurial systems.

Conclusions

This study aimed to adapt and apply the GEI methodology in order to measure regional-level entrepreneurship across 22 regions in Colombia, Ecuador, and Uruguay. It is of great significance because it marks the first attempt to examine regional entrepreneurial systems in the context of South American regions. One of the more valuable findings emerging from the present study is that the GEI methodology is suitable for studying regional entrepreneurial systems in the developing countries. Although they do not ensue from a centralised regional

database, most of the indicators required for the GEI calculations are available at the disaggregated level for South American countries.

Herein, the selected regions are conceptually treated as small nations. Therefore, the GEI regional values are calculated in the same way as they would be for countries. In comparing the aggregated GEI scores of our regions within a set of 33 countries at the same level of development, it is observable that South American regions rank heterogeneously, ranging from Colombia's Andina Urban region, which ranks among the top-ten best global performers, to the Ecuadorian Amazonía region, which ranks at the bottom of the group. The South American regions are also investigated at the GEI sub-index and pillar levels. As a big region, the selected regions together show higher average scores in ATT than the ‚efficiency-driven' and ‚transitioning from efficiency- to innovation-driven' economies on average. This implies an overall high acceptance and recognition of the role of entrepreneurship in South America. At the sub-index level, the Colombian Andina, Andina Urban, and Andina Rural regions have a relatively better position among the 22 studied regions. Conversely, the Ecuadorian regions of Amazonía, Sierra Rural, and Costa Rural are at the lowest position in the group. The selected South American regions are particularly weak in ATT and ASP, with the ‚process innovation', ‚internationalization', and ‚technology absorption' pillars being their most critical bottlenecks.

Specific configurations of weaknesses and strengths for urban and rural subregions are also identified. At the pillar level, the constraining pillars are mostly the same for both urban and rural regions within a country, but the severity of the bottleneck pillars is different among urban and rural settings. ‚Competition' has been identified as a bottleneck pillar specific to urban regions. These findings are consistent with those of Henderson (2002) and Müller– Korsgaard (2017), who suggest that spatial context is significant in the rural entrepreneurial process. An implication of the variation in scores within urban and rural regions is the possibility that the rural populations' ATT, ABT, and ASP are different from those of their urban counterparts. Therefore, these findings suggest that the urban-rural nature of regions should be carefully considered, as each might require customised policy strategies to alleviate specific bottlenecks of urban and rural regions within a single main region.

Finally, national- and subnational-level policy approaches are outlined based on national and regional ecosystem priorities. At the national level, policy efforts to foster ‚process innovation' are of paramount importance for Colombia. In Ecuador and Uruguay, national policy efforts are required to increase 'internationalization'. At the subnational level, regional policy efforts to improve abilities should focus on boosting ‚technology absorption' in the three Ecuadorian regions. However, policies aimed at improving aspirations among the Ecuadorian regions will require specific efforts in the ‚internationalization' and ‚high growth' pillars. In the case of

Colombia, ‚technology absorption' is the most constraining pillar for ABT, while ‚process innovation' is the most constraining aspect for ASP. For Uruguay, major efforts to improve entrepreneurial aspirations are required in the ‚internationalization' and ‚risk capital' pillars.

The insights gained from this study may be of assistance to researchers interested in developing empirical tools for measuring regional EEs in locations where regionalised data are limited. Given that only three countries are covered in the present study, in the future, it is crucial to explore the potential use of the proposed GEI adaptation approach to examine entrepreneurship in regions of other South American countries.

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INTERNET APPENDIX

Appendix A

Table A1 Definitions of regional-level individual variable sets used for the GEI calculation

Table A2 Regional-level institutional variable sets employed for the GEI calculation

Appendix B

Table B1 South American regions relative position at the pillar level, 2017

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